United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2013-CPA-0020

OCT - 5 2015

Alicia E. Kirchner
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Ms. Kirchner:

The U.S. Army Corps of Engineers' (Corps) has requested coordination under the Fish and Wildlife Coordination Act (FWCA) for the American River Common Features General Re-evaluation Report (GRR) project. The proposed flood risk management construction would occur along the lower American River and the Sacramento River in Sacramento County, California. The enclosed report constitutes the U.S. Fish and Wildlife Service's draft FWCA report for the proposed project. A draft FWCA report was provided to the Corps and other state and federal resource agencies on September 20, 2013. We did not receive any comments on the draft FWCA report.

If you have any questions regarding this report on the proposed project, please contact Jennifer Hobbs, Fish and Wildlife Biologist, at (916) 414-6541.

Sincerely,

for Jennifer M. Norris
Field Supervisor

Enclosure:

cc:
Anne Baker, COE, Sacramento, CA
Amy Kennedy, CDFW, Rancho Cordova, CA
Howard Brown, NOAA Fisheries, Sacramento, CA
Steve Schoenberg, Bay Delta Fish and Wildlife Office, Sacramento, CA

FISH AND WILDLIFE COORDINATION ACT REPORT
AMERICAN RIVER COMMON FEATURES
GENERAL RE-EVALUATION REPORT PROJECT

OCTOBER 2015

BACKGROUND

In February 1986, major storms in northern California caused record flows along the American River. Water releases from Folsom Reservoir into the American River, in combination with high flows on the Sacramento River, almost caused catastrophic flooding to the city of Sacramento and surrounding areas. The result of the February 1986 storms raised concerns over the adequacy of the existing flood control system, which led to a series of investigations to provide additional flood protection to the Sacramento area.

The U.S. Army Corps of Engineers (Corps) completed an initial feasibility study in December 1991 for the American River and Natomas Basin areas. The feasibility report recommended the construction of a concrete gravity flood detention dam just downstream of the confluence of the North and Middle Forks of the American River, and for levee improvements downstream of Folsom Dam. Due to environmental and cost concerns, Congress chose not to authorize the proposed detention dam and instead directed the Corps to supplement the analysis of flood control options considered in the 1991 study.

A supplemental study was completed and presented in the *Supplemental Information Report American River Watershed Project, California*, dated March 1996. The report presented three possible flood control plans: (1) the construction of the concrete gravity flood detention dam recommended in the 1991 report; (2) Folsom Dam improvements; and (3) a stepped release plan for Folsom Dam releases. The report also concluded that levee improvements downstream of Folsom Dam were needed and that these levee improvements were "common" to all three plans. Under the Water Resources Development Act of 1996 (WRDA 96), Congress authorized the American River Common Features Project (Common Features Project), which included levee modifications on both banks of the American River, levee modifications along the east bank of the Sacramento River downstream from the Natomas Cross Canal, installation of streamflow gauges upstream from Folsom Reservoir, modification of the flood warning system along the lower American River, and continued interim reoperation of Folsom Reservoir for flood control.

In 1999, Congress decided to authorize improvements to Folsom Dam to control a 200-year flood event with a peak release of 160,000 cubic feet per second (cfs) from the dam. By doing this, improvements to levees downstream of Folsom Dam could be fine-tuned to work closely with the Folsom Dam improvements being discussed by Congress. Subsequently, the Common Features Project was modified by the Water Resources Development Act of 1999 (WRDA 99) to include additional features so the American River could safely convey an emergency release of 160,000 cfs. Also authorized under WRDA 99 was the Folsom Dam Modification project, which would allow for larger releases from Folsom Dam earlier in a flood event. At the same time, Congress also directed the Corps to review additional modifications to the flood storage of Folsom Dam to maximize the use of the dam for flood damage reduction prior to consideration of any additional storage on the American River. The Folsom Dam Raise project was subsequently authorized by Congress in 2004.

Major construction components for the Common Features Project under the WRDA 96 authorization include construction of seepage remediation along about 22 miles of the American River levees. Under the WRDA 99 authorization, the major construction components include construction of seepage remediation and levee raises along four stretches of the American River. All Common Features Project features authorized under WRDA 96 and WRDA 99 have been constructed or are in design analysis for construction, and the U.S. Fish and Wildlife Service (Service) has previously coordinated with the Corps on the various aspects of the Common Features Project.

Deep under-seepage became a significant concern along the American River levees following a flood event in 1997. Since the levee improvements along the American River were still in the design phase, remediation of deep under-seepage needed to be included in the design plans. This additional effort led to considerable cost increases over what was originally authorized by Congress for the Common Features Project, including the WRDA 99 improvements that had already increased the cost of the original WRDA 96 authorization.

The Folsom Dam Post Authorization Change Report and the Economic Re-evaluation Report for Folsom Dam Improvements revealed that additional levee improvements were needed on the American and Sacramento Rivers in order to truly capture the benefits of the Folsom Dam projects. These levee deficiencies consisted primarily of erosion concerns on the American River, and seepage, stability, erosion, and height deficiencies on the Sacramento River downstream of its confluence with the American River. However, the full extent of these levee deficiencies was not known and additional re-evaluation studies were needed for the flood basins that comprise the city of Sacramento.

The purpose of the Common Features Project is to reduce the flood risk for the city of Sacramento. The following problems were identified within the Sacramento levee system:

- seepage and underseepage;
- levee erosion;
- levee stability;
- levee overtopping;
- access for maintenance and flood fighting;
- vegetation and encroachments;
- releases from Folsom Dam;
- floodplain management; and
- additional upstream storage from existing reservoirs.

DESCRIPTION OF PROJECT AREA

The project area is located along the Sacramento and American River watersheds. The Sacramento River watershed covers 26,000 square miles in central and northern California. Major tributaries of the Sacramento River include the Feather, Yuba, and American Rivers. The American River watershed covers about 2,100 square miles northeast of Sacramento and includes portions of Placer, El Dorado, Alpine, and Sacramento counties. The American River watershed includes Folsom Dam and Folsom Reservoir; inflowing rivers and streams, including the North, South and Middle forks of the American River; and the American River downstream to its confluence with the Sacramento

River in the city of Sacramento. The Sacramento and American rivers form a floodplain covering roughly 110,000 acres at their confluence. This floodplain includes most of the developed portions of the city of Sacramento.

The American River Common Features GRR study area includes: about 12 miles of the north and south banks of the American River immediately upstream of its confluence with the Sacramento River; the east bank of the Natomas East Main Drainage Canal (NEMDC), Dry Creek, Robla Creek, Arcade Creek, and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); the east bank of the Sacramento River downstream from the American River to the town of Freeport, where the levee ties into the Beach Lake levee; and the Sacramento Weir and Bypass, which is located along the north edge of the city of West Sacramento.

Within the greater project area, there are four distinct flood basins: the American River North Basin, the American River South Basin, the Sacramento Bypass and the Natomas Basin. These basins are described in further detail below.

The American River North Basin is located north of the American River and east of the city of Natomas, and includes the North Sacramento and Arden Arcade communities. Project construction in this basin includes the levees on the north bank of the American River, levees on the east bank of NEMDC, and levees along Arcade Creek, Dry/Robla Creek, and the Magpie Creek Diversion Channel.

The American River South Basin is located south of the American River and east of the Sacramento River. Communities protected by these project levees include Downtown Sacramento, Land Park, Pocket-Meadowview, East Sacramento, South Sacramento and Rancho Cordova. Project construction in this basin would be limited to the south bank of the American River and the east bank of the Sacramento River.

The Sacramento Bypass is located in Yolo County, about 4 miles west of the city of Sacramento and along the northern edge of the city of West Sacramento. The Sacramento Weir runs along the west bank of the Sacramento River and connects the river to the Bypass. The Bypass is located in a rural area owned by the State of California and operated as the Sacramento Bypass Wildlife Area.

The Natomas Basin is located in the northern portion of the study area and is located east of the Sacramento River, west of NEMDC, and north of the American River. The Natomas Basin is considered to be a part of the study area, as described by the GRR; however, the proposed measures to raise the height of the Natomas Basin levees were previously analyzed in the Natomas Levee Improvement Program, Phase 4b Landside Improvements Project (NLIP Phase 4b Project) in 2010. Therefore, the Natomas Basin will not be analyzed in this document.

PROJECT DESCRIPTION

The purpose of the Common Features GRR is to determine if there is a Federal interest in modifying the authorized Common Features Project for flood risk management in the greater Sacramento area. National Environmental Policy Act (NEPA) evaluation is required when a major Federal action is under consideration and may have impacts on the quality of the natural and human environment. The Corps has determined that the proposed project may have significant effects on the environment and therefore, an EIS is required.

The Common Features GRR has identified a number of problems associated with the flood risk management system protecting the city of Sacramento and surrounding areas. There is a high probability that flows in the American and Sacramento Rivers would stress the network of levees protecting Sacramento to the point that levees could fail. The consequences of such a levee failure would be catastrophic since the area inundated by flood water is highly urbanized and the flooding could be up to 20 feet deep.

A wide variety of management measures were developed and then evaluated and screened to address the planning objectives to remedy the Sacramento area levee problems. Formulation strategies were then developed to address various combinations of the planning objectives and planning constraints. The formulation strategies used to address the objectives and constraints included measures to reduce flood stages, address seepage and underseepage, address stability, address erosion, address maintenance/emergency response access, and achieve the urban levee level of protection. Based upon these strategies, various combinations of the measures were assembled to form an array of preliminary plans. The preliminary plans were then evaluated, screened, and reformulated, resulting in a final array of alternatives. From this final array of alternatives, a tentatively selected plan was identified.

No Action Alternative

The Corps is required to consider a No Action Alternative as one of the alternatives for selection in order to comply with the requirements of NEPA. With the No Action Alternative, it is assumed that no additional features would be implemented by the Corps or by local interests to achieve the planning objectives over and above those elements of the previously authorized Common Features Project.

Under the No Action Alternative the Corps would not conduct any additional work to address seepage, slope stability, overtopping, or erosion concerns in the Sacramento metropolitan area. As a result, if a high flow event were to occur, the Sacramento area would remain at risk of a possible levee failure.

The urban development within the project area would continue to be at risk of flooding and lives would continue to be threatened. The levees within the study area could fail and result in a catastrophic disaster. If a levee failure were to occur, major government facilities would be impacted until the flood waters recede. Within the study area are many transportation corridors that could be flooded as well if the levees were to fail.

Alternative 1: Fix Levees in Place

Alternative 1 involves the construction of fix-in-place levee remediation measures to address seepage, stability, erosion, and overtopping concerns identified for the American and Sacramento river levees, and the East Side Tributaries. In addition, Alternative 1 would include levee raises for the Natomas Basin, which were analyzed under NEPA in the NLIP Phase 4b Project EIS/EIR in 2010. As a result, this FWCA report incorporates the analysis of the levee raise by reference, but is not discussed within this report.
Due to the urban nature and proximity of existing development within the American River North and South Basins, Alternative 1 proposes fix in place remediation. The purpose of this alternative would be to improve the flood damage reduction system to safely convey flows to a level that

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The urban development within the project area would continue to be at risk of flooding and lives would continue to be threatened. The levees within the study area could fail and result in a catastrophic disaster. If a levee failure were to occur, major government facilities would be impacted until the flood waters recede. Within the study area are many transportation corridors that could be flooded as well if the levees were to fail.

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Due to the urban nature and proximity of existing development within the American River North and South Basins, Alternative 1 proposes fix in place remediation. The purpose of this alternative would be to improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 1 summarizes the levee problems discussed above and the proposed remediation measure for each waterway.

Table 1. Alternative 1 Proposed Levee Improvement Measures by Waterway

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	–	–	Bank Protection, Launchable Rock Trench	–
Sacramento River	Cutoff Wall	Cutoff Wall	Bank Protection, Launchable Rock Trench	Levee Raise
NEMDC	Cutoff Wall	Cutoff Wall	–	Floodwall
Arcade Creek	Cutoff Wall	Cutoff Wall	–	Floodwall
Dry and Robla Creeks	–	–	–	Floodwall
Magpie Creek	–	–	–	Floodwall

In addition to the proposed levee improvement measures shown in Table 1, the following measures and policies would be addressed during construction.

- The Corps' standard levee footprint would be established during construction of structural improvements on all levees that are out of compliance. The standard levee footprint consists of a 20 foot crown width, a 3H:1V waterside slope, and a 2H:1V landside slope, when possible. If the 3H:1V waterside slope is not possible, than a minimum 2H:1V waterside slope would be established instead.

- A 10 foot landside maintenance access would be established, when possible.

- Compliance with Corps levee vegetation requirements would be established. The vegetation requirements include a 15 foot waterside, landside and vertical vegetation-free zone. When possible, a variance would be sought to allow vegetation to remain. If granted, the variance would allow for vegetation to remain on the lower waterside slope and within the waterside 15 foot vegetation-free zone. No vegetation would be permitted on the landside slope.

    - A vegetation variance would be requested to provide compliance for the Sacramento River portion of this project.

    - The erosion measures on the American River is not considered a structural fix, as these measures do not impact the structure of the levee, therefore the vegetation in this portion of the project would not be addressed under the Common Features GRR project. American River vegetation compliance would occur under a System-

1 Seepage, stability, and overtopping measures were addressed in the American River Common Features WRDA 96 and WRDA 99 construction projects.

Wide Improvement Framework by the local sponsors.

  - The East Side Tributaries would be brought into vegetation compliance during construction in those levee reaches.

- Utility encroachments would be brought into compliance with Corps policy. Utilities that penetrate the levee would be removed and replaced with one of two fixes: a surface line over the levee prism or a through-levee line equipped with positive closure devices.

- Private encroachments would be removed by the non-Federal local sponsor or property owner prior to construction.

There would be no proposed measures under Alternative 1 for the Sacramento Bypass. The following sections contain more detailed information on the specific measures proposed by waterway under Alternative 1.

American River

Levees along the American River under Alternative 1 require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed to address erosion on the American River levees: bank protection and a launchable rock trench. Both of these measures are described in detail in the subsections below. These measures would be implemented for all of the proposed alternatives discussed in this document.

Bank Protection

This measure consists of placing rock protection on the river's bank, and in some locations, on the levee slope to prevent erosion. The location of rock placement would be based on site-specific analysis. When necessary, the eroded portion of the bank would be filled and compacted prior to the rock placement. The sites would be prepared by clearing and stripping the site prior to construction. Small vegetation and deleterious materials would be removed. In most cases large vegetation would be permitted to remain at these sites. Temporary access ramps would be constructed, if needed, using imported borrow material that would be trucked to the site.

Revetment would be imported from an offsite location via haul trucks and temporarily stored at a staging area located in the immediate vicinity of the construction site. A loader would be used to move revetment from the staging area to the excavator that would be placing material. The revetment would be placed at a slope varying from 2V:1H to 3V:1H, depending on the site specific conditions. A large rock berm would be placed in the water up to an elevation slightly above the mean summer water surface and a planting trench would be established on the rock berm surface for re-vegetation purposes. An excavator would either be working from the top of bank placing revetment on the bank and in the water, or from on top of the rock berm that is established.

Launchable Rock Trench

The launchable rock filled trench is designed to deploy once erosion has removed the bank material beneath it. All launchable rock trenches would be constructed outside of the natural river channel. The vegetation would be removed from the footprint of the trench and the levee slope prior to excavation. The trench configuration would include a 2H:1V landslide slope and a 1H:1V waterside slope, and would be excavated at the toe of the existing levee. All soil removed during trench excavation would be stockpiled for reuse or disposed of. The bottom of the trench would be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and the amount of rock required.

After excavation, the trench would be filled with revetment that would be imported from an off-site location via haul trucks. After rock placement, the trench would be covered with a minimum of 3 feet of stockpiled soil for a planting berm. Rock placed on the levee slope would be covered with 2 feet of stockpiled soil. All disturbed areas would be reseeded with native grasses and small shrubs where appropriate. Trees would be permitted on the berm if planted outside the specified vegetation free zone.

<u>Sacramento River</u>

Levees along the Sacramento River require improvements to address seepage, stability, and erosion. In addition, these levees require height improvements in order to convey additional flows that exceed the current design levels. To provide access for levee construction, inspection, maintenance, monitoring, and flood-fighting, some properties would need to be acquired.

Where the existing levee does not meet the levee design requirements, slope flattening, crown widening, and/or a levee raise is required. This improvement measure addresses problems with slope stability, geometry, overtopping, and levee access. To begin levee embankment grading, the area would be cleared, grubbed, stripped, and where necessary, portions of the existing embankment would be excavated to allow for bench cuts and keyways to tie in additional embankment fill. Excavated and borrow material from nearby borrow sites would be stockpiled at staging areas. Haul trucks and front end loaders would bring borrow materials to the site, which would then be spread evenly and compacted according to levee design plans.

The existing levee centerline would be shifted landward, where necessary, in order to meet the Corps' current levee footprint requirements; or, in order to construct the levee to the existing footprint, a retaining wall may be constructed at the landside levee toe. This measure would raise the levee landward of the existing levee without reducing the levee crown width or disturbing the waterside slope. Retaining walls would range from 4 to 6 feet high and would require landside slope benching to establish the additional fill into the levee section. The levee crown patrol road would be re-established and a new road at the levee toe would be added 10 feet landward of the retaining wall.

Cutoff Walls

To address seepage concerns, a cutoff wall would be constructed through the levee crown. The cutoff wall would be installed by one of two methods: conventional open trench cutoff walls or deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach would depend on the depth of the cutoff wall needed to address seepage. The open trench method can be used to install a cutoff wall to a depth of about 85 feet. For cutoff walls of greater depth, the DSM method would be utilized.

Prior to construction of the cutoff wall, the construction site and staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded to about half of the levee height to create a large enough working platform (about 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids.

Open Trench Cutoff Walls

Under the open trench method, a trench 3 feet wide would be excavated at the top of levee centerline and into the subsurface materials up to 85 feet deep with a long boom excavator. As the trench is excavated, it is filled with low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench is mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture is backfilled into the trench, displacing the temporary slurry. Once the slurry has hardened, it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

DSM Cutoff Wall

The DSM method involves the use of a crane that supports a set of two to four mixing augers used to drill through the levee crown and subsurface to a maximum depth of about 140 feet. As the augers are inserted and withdrawn, a cement bentonite grout would be injected through the augers and mixed with native soils. An overlapping series of mixed columns would be drilled to create a continuous seepage cutoff barrier. Once the slurry has hardened, it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

Bank Protection

Bank protection on the Sacramento River would be addressed by construction of the launchable rock trench method described for the American River above, or by standard bank protection, which consists of placing rock protection on the bank to prevent erosion. This measure entails filling the eroded portion of the bank, when necessary, and installing revetment along the waterside levee slope and streambank, from the streambed to a height determined by site-specific analysis. The sites would be prepared by removing vegetation along the levee slopes at either end of the site for construction of a temporary access ramp if needed. The ramp would then be constructed using imported borrow material that would be trucked onsite.

The placement of rock onto the levee slope would occur from atop the levee and/or from the waterside by means of barges. Rock required within the channel, both below and slightly above the water line at the time of placement, would be placed by an excavator located on a barge. Construction would require two barges: one barge would carry the excavator, while the other barge would hold the stockpile of rock to be placed on the channel slopes. Rock required on the upper portions of the slopes would be placed by an excavator located on top of the levee. Rock placement from atop the levee would require one excavator and one loader for each potential placement site. The loader brings the rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the waterside of the levee.

The revetment would be placed via the methods discussed above on existing banks at a slope varying from 2V:1H to 3V:1H, depending on site specific conditions. After revetment placement has been completed, a small planting berm would be constructed in the rock, when feasible, to allow for some re-vegetation of the site.

NEMDC

The east levee of the NEMDC requires improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A conventional open trench cutoff wall would be constructed at these locations to address these problems. The open trench cutoff walls would be constructed as described for the Sacramento River levee described above.

The NEMDC east levee also has height issues which would be addressed by construction of a floodwall. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown construction. The heights of the floodwalls vary from 1 to 4 feet, as required by water surface elevations. Constructing the floodwall raise would require doweling into the existing concrete floodwall and adding reinforced concrete to the floodwall section. The waterside slope would be re-established to its existing slope and the levee crown would grade away from the wall and be surfaced with aggregate base.

Arcade Creek

The Arcade Creek levees require improvements to address seepage, slope stability, and overtopping when the flood event exceeds the current design. A cutoff wall would also be constructed to address seepage for portions of the creek. There is a ditch adjacent to the north levee at the landside toe which provides a shortened seepage path and could affect the stability of the levee. The ditch would be replaced with a conduit or box culvert and then backfilled. This would lengthen the seepage path and improve the stability of the levee.

The majority of the levees on Arcade Creek have existing floodwalls; however, there remains a height issue in this reach. A 1 to 4 foot floodwall raise would allow the levees to pass flood events greater than the current design level. Construction of the floodwall would be consistent with the description for NEMDC above.

Dry and Robla Creeks

The Dry Creek and Robla Creek levees require improvements to address overtopping for when flood events exceed the design level. Height improvements would be made with a floodwall raise. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown construction. The height of the floodwalls would vary from 1 to 4 feet as required by water surface elevations. Construction of the floodwall would be consistent with the description for NEMDC above. The waterside slope would be re-established to its existing slope and the levee crown would be graded away from the wall and be surfaced with aggregate base.

Magpie Creek Diversion Channel

A number of features are proposed for the Magpie Creek Diversion Channel under Alternative 1. These features include the following:

- Strengthening the existing project levee;
- Construction of a 3 to 4 foot tall floodwall along the top of the existing levee for a distance of about 2,100 feet. Construction of the floodwall would be consistent with the description for NEMDC above;
- Construction of a new 1,000-foot-long levee along Raley Boulevard, south of the Magpie Creek bridge;
- Construction of a 79 acre flood detention basin on both sides of Raley Boulevard, primarily through the purchase of properties to preserve the existing floodplain; and
- Raley Boulevard improvements, including widening the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

Alternative 2: Fix Levees in Place and Widen the Sacramento Weir and Bypass

Alternative 2 would include all of the levee improvements discussed in Alternative 1 above, except for the levee raises along the Sacramento River. Instead of the levee raises, the Sacramento Weir and Bypass would be widened to divert more flows into the Yolo Bypass. The levees along the American River, NEMDC, Arcade Creek, Dry Creek, Robla Creek, and the Magpie Creek Diversion Channel would be improved to address identified seepage, stability, erosion, and height concerns through methods described under Alternative 1 above. The levees along the Sacramento River would be improved to address identified seepage, stability, and erosion concerns through the measures described under Alternative 1 above. Due to the urban nature of the project area and proximity of development to the levees, the majority of the levee repairs would be fixed in place.

In addition, Alternative 2 would include levee raises for the Natomas Basin. The Natomas Basin levee raises are proposed under the Common Features Project GRR for authorization; however, these measures were analyzed under NEPA for the NLIP Phase 4b Project EIS/EIR in 2010.

The following sections contain more detailed information on the specific features and reaches included in this alternative. Table 2 summarizes the levee problems discussed above and the proposed measure for each waterway.

Table 2. Alternative 2 Proposed Remediation Measures by Waterway

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[2]	—	—	Bank Protection, Launchable Rock Trench	—
Sacramento River	Cutoff Wall	Cutoff Wall	Bank Protection, Launchable Rock Trench	Sacramento Bypass and Weir Widening
NEMDC	Cutoff Wall	Cutoff Wall	—	Floodwall
Arcade Creek	Cutoff Wall	Cutoff Wall	—	Floodwall
Dry and Robla Creeks	—	—	—	Floodwall
Magpie Creek	—	—	—	Floodwall, Levee Raise

Sacramento Weir and Bypass

The existing Sacramento Weir and Bypass, which allow high flows in the Sacramento River to be diverted into the Yolo Bypass, would be expanded to roughly twice the current width to accommodate increased bypass flows. The existing north levee of the Sacramento Bypass would be degraded and a new levee would be constructed about 1,500 feet to the north. The existing Sacramento Weir would be expanded to match the wider bypass. The new north levee of the bypass would include a 300-foot-wide seepage berm on the landside, with a system of relief wells. An existing high tide relief well site near the existing north levee would be remediated by the non-Federal sponsor prior to construction.

American River

Measures for the American River levees under Alternative 2 would address erosion. These measures were identified and described under Alternative 1 and would also be included in Alternative 2. Implementation of these measures under Alternative 2 would be consistent with the description in Alternative 1.

East Side Tributaries

Measures for NEMDC, Arcade Creek, Dry Creek, Robla Creek, and the Magpie Creek Diversion Channel under Alternative 2 would address seepage, slope stability, and erosion control. These measures were identified and described in Alternative 1 and would also be included in Alternative 2. Implementation of these measures under Alternative 2 would be consistent with the description in Alternative 1.

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2 Seepage, stability, and overtopping measures were addressed in the American River Common Features WRDA 96 and WRDA 99 construction projects.

Sacramento River

The measures for the Sacramento River levees under Alternative 2 would be consistent with Alternative 1, with one exception. Under Alternative 1, Sacramento River levee remediation measures were proposed to address seepage, stability, erosion control, and levee height problems. Under Alternative 2, there would be no need to address the levee height problems. Therefore, the measures from Alternative 1 that would be implemented under Alternative 2 for the Sacramento River levees would include: (1) installation of cutoff walls to address seepage concerns; (2) slope reshaping to address stability concerns; and (3) bank protection or launchable rock trench measures to address erosion. The description of these measures can be found above under Alternative 1 for the Sacramento River.

BIOLOGICAL RESOURCES

American River

The American River Parkway (Parkway) contains many vegetation types including riparian scrub, riparian forest, oak woodland, open water, grasslands, and some agriculture. Along the river channel, vegetation is primarily considered shaded riverine aquatic (SRA) cover. Trees adjacent to the channel are mainly oaks and cottonwoods with a thick understory of vines, shrubs, and herbaceous vegetation.

The levee slopes along the American River are primarily covered with grasses and a few scattered trees within the levee structure. Several areas within the Parkway have been used as mitigation sites for the Corps and other agency projects for valley elderberry longhorn beetle. There are also some areas within the Parkway that have been used to compensate for loss of riparian habitat or oak woodlands from projects. Vegetation on the landside of the levee is mostly non-native ornamentals and landscape plantings that were planted beyond the legal property and fence lines of residents.

Habitats in the project area around the American River support various wildlife species. Mammal species include mule deer, coyote, black-tailed jackrabbit, striped skunk, and a variety of rodents. Common bird species include American robin, spotted towhee, dark-eyed junco, black phoebe, California towhee, ash-throated flycatcher, northern flicker, mourning dove, California quail, house finch, American and lesser goldfinches, Bewick's and house wrens, northern mockingbird, yellow-billed magpie, red-winged and Brewer's blackbirds, oak titmouse, and Anna's hummingbird. Common raptors include red-tailed hawk, Cooper's hawk, red-shouldered hawk, American kestrel, and great horned owl. Reptile and amphibian species found within the project area include western fence lizard, gopher snake, western rattlesnake, common kingsnake, Pacific treefrog, and western toad.

The river and small backwater areas provide habitat for many water associated species such as raccoon, beaver, Canada goose, wood duck, common merganser, mallard, black phoebe, great blue heron, belted kingfisher, and common yellowthroat. The levee slopes, which are dominated by annual grassland, provide foraging habitat and cover for California ground squirrel, pocket gopher, and western meadowlark.

The lower American River supports a diverse and abundant fish community; altogether, at least 41 species of fish are known to inhabit the river (USFWS 1986). In recognition of its "outstanding and remarkable" fishery resources, the entire lower American River was included in the Wild and Scenic Rivers System in 1981, which provides some protection for these resources (USFWS 1991). Four anadromous species are important from a commercial and recreational perspective. The lower river supports a large run of fall-run Chinook salmon, a species with both commercial and recreational values. The salmon run is sustained by natural reproduction in the river, and by hatchery production at the Nimbus Salmon and Steelhead Hatchery, operated by the California Department of Fish and Wildlife (CDFW). The average annual production of fall-run Chinook salmon in the American River from 1992-2009 is 109,574 (USFWS 2013).

Steelhead, a popular sport fish, are largely sustained in the river by production from the Nimbus Hatchery, because summer water temperatures often exceed the tolerances of juvenile steelhead, which typically spend about 1 year in the river. American shad and striped bass enter the river to spawn; these two species, introduced into the Sacramento River system in the late 1800s, now support popular sport fisheries. In addition to species of economic interest, the lower American River supports many nongame species, including Sacramento pikeminnow, Sacramento sucker, tule perch, and hardhead (USFWS 1994).

NEMDC

This canal is a narrow channel with many trees in the lower portion. As the canal heads north the channel widens and has less woody vegetation. The levee slopes on the east side of the canal are clear of vegetation due to maintenance practices. The west side of this canal is not part of this project as it is part of the NLIP Phase 4b Project.

Arcade Creek

The levees along Arcade Creek are maintained vegetation free; however, the channel does have some trees and understory. Between Norwood Avenue and Rio Linda Boulevard the channel contains a thick riparian area but vegetation becomes sparse once it passes Rio Linda Boulevard. Due to the urban conditions in this area, wildlife is limited to those similar to the Parkway but in smaller numbers.

Dry and Robla Creeks

The Dry and Robla Creeks area is a wide open space floodplain, with both creeks being contained between the two levees. The creeks maintain sufficient water throughout the year for trees to survive along the channel. There are scattered wetlands located in the floodplain with a higher concentration at the confluence with the NEMDC. The actual levee slopes in this floodplain contain very little vegetation due to maintenance practices. Wildlife in the floodplain is similar to that in the Parkway.

Magpie Creek Diversion Channel

The project area of Magpie Creek Diversion Channel begins in an industrial area where the channel contains primary grasses. Upstream, the area becomes open space before it intersects with Raley Boulevard and additional industrial development. Seasonal wetlands in the area include natural vernal pools and other areas with standing water that provide a similar biological function as natural vernal pools. Wildlife in this area includes jack rabbits, skunks, beavers, and coyotes that also use the surrounding undeveloped area. Avian species that utilize this habitat include herons and waterfowl. Amphibian and reptile species include treefrog and common garter snake.

Sacramento River

Vegetation along the Sacramento River is mostly SRA cover consisting of oaks and cottonwoods with shrub understory. There are intermittent locations along the waterline with no trees due to revetment. The Sacramento River Bank Protection Project has repaired some erosion sites along this section of the river using rock revetment on the slope and creating small vegetated benches. These sites have been planted with riparian vegetation and woody material has been placed in the rock to provide in water habitat for fish species.

Due to the urban development adjacent to the levees in this area, wildlife is limited to small mammals and various avian species. Domestic animals from residents are also often seen along the levees in this basin of the project. Though a narrow riparian corridor, this area does function as a migratory corridor for wildlife as the area to the east is completely developed with housing. It is important to maintain a corridor to provide connectivity along the Sacramento River.

The Sacramento River contains a variety of habitat characteristics that are important to many fish species. Streamside vegetation provides SRA cover and aids in temperature control, streambank stability, and habitat complexity. Cover is used by all life stages of anadromous fish for shelter and provides habitat for salmonids, Sacramento splittail, delta smelt, black bass and sunfish.

Root structures of riparian vegetation can provide bank stability and shelter for juvenile fish. Woody debris can provide shelter from predation and refugia from stream flow. Riparian vegetation also influences the food chain of a stream, providing organic detritus and terrestrial insects. Terrestrial organisms falling from overhanging branches contribute to the food base of the aquatic community. Salmonids in particular are primarily insectivores and feed mainly on drifting food organisms.

In general, the Sacramento River channel provides a migratory pathway to many anadromous fish and provides seasonal rearing habitat to many other native fish species. Native anadromous fish species include Chinook salmon, green and white sturgeon, Pacific and river lamprey, and steelhead. Native resident fish species include delta smelt, hardhead, hitch, prickly sculpin, Sacramento blackfish, Sacramento pikeminnow, Sacramento splittail, Sacramento sucker, threespine stickleback and tule perch. Non-native anadromous species, such as American shad and striped bass, provide recreational sport fishing opportunities. Non-native resident fish species include several species of catfish, black bass, sunfish and minnows. Some non-native species may provide recreational fishing opportunities, such as largemouth, smallmouth, and striped bass, yet these species also prey upon native juvenile species that use nearshore habitats.

Sacramento Bypass and Weir

The Sacramento Bypass is a 360 acre area that is an important cover and feeding area for wildlife during the late fall, winter and early spring. Vegetation varies from scattered trees, such as mature cottonwoods, willows and valley oaks, to a sparsely covered sand soil area on the eastern end. There are also wetlands within the bypass. Game birds, raptors, songbirds, and native mammals are all present in this area.

The footprint of the expanded weir contains 8 acres of scattered trees along the road, railroad tracks, and levee slope. Primary wildlife use this area is avian species, beavers, skunks, and rabbits. The trees along the river provide shade for many native and non-native species. These trees are also used by various avian species for nesting.

Threatened and Endangered Species

Potentially affected federally-listed species within the project area include the valley elderberry longhorn beetle, giant garter snake, delta smelt, Central Valley steelhead, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and green sturgeon. The valley elderberry longhorn beetle, giant garter snake, delta smelt, yellow-billed cuckoo, and least Bell's vireo fall under the jurisdiction of the Service. The National Marine Fisheries Service (NMFS) is responsible for the listed salmonids and green sturgeon.

The riverbank and associated nearshore aquatic area that would be affected by the proposed action constitute portions of the designated critical habitat of the delta smelt. Indirect effects of the proposed action may also extend to other portions of this critical habitat. The Corps completed section 7 consultation with the Service. The consultation is included as Appendix 1.

In addition, the bank protection action area constitutes elements of essential fish habitat (EFH). EFH is the aquatic habitat (water and substrate) necessary to fish for spawning, breeding, feeding and or growth to maturity that will allow a level of production needed to support a long-term, sustainable commercial fishery and contribute to a health ecosystem. Consultation with NMFS regarding EFH is required for all commercially-harvested runs of salmon, including all runs of salmon in the project's action area.

Future Conditions Without the Project (No Action Alternative)

American River

Under the No Action Alternative, the Corps would not participate in construction of the proposed project. There would be no construction related effects to the vegetation and wildlife. However, looking over the past several decades the largest and most frequent flows come down the American River system, some of the floodplain in the Parkway has eroded away. During the 50 year life span of the project it is expected that larger flows would be released from Folsom Dam and sustained for longer periods, leading to potential loss of floodplain and the vegetation on it within the Parkway. While erosion and accretion within the riverine system is a normal and healthy process, Folsom Dam has cutoff sediment supply to the lower American River which creates a sediment starved section of the river. Sediment starvation means that accretion would not occur and the loss of floodplain and its ability to support habitat would be lost. This loss would also cause any wildlife in the area to relocate to other areas where the habitat they need is present. Because we cannot predict when and how large events would occur, it is not possible to determine when the floodplain would erode. The loss of the Parkway vegetation and wildlife habitat would be considered a significant impact.

East Side Tributaries

Under the No Action Alternative, the Corps would not participate in construction of the proposed project. There would be no construction related effects to the vegetation and wildlife. The riparian habitat on Arcade Creek between Norwood Avenue and Rio Linda Boulevard would remain. The other creeks do not contain much vegetation; however, the little vegetation that does exist would not be removed. Wildlife in these creek areas would not be disturbed due to construction activities.

Sacramento River

Under the No Action Alternative, the Corps would not participate in construction of the proposed project. There would be no construction related effects to the vegetation and wildlife. The banks along the Sacramento River are very erosive and without some kind of erosion control measures, the banks would continue to erode during high flows. As the banks of the river erode, vegetation would be lost and the levees could fail. It is likely that in order to save the levee structures, flood fighting activities would occur during a high flow emergency response. Flood fighting is usually performed by placing large rock along the levee slope to stop erosion and prevent levee failure and loss of lives. The placement of the rock could prevent and/or impede future growth of trees and vegetation on the levee slopes.

In the event that flood fighting activities are not successful and a levee failure occurs, all vegetation could be lost and wildlife could be swept away in the flood waters. The loss of vegetation that could occur in a large flood event and the placement of rock along the banks could have significant impacts to vegetation and wildlife, particularly to the functioning of a migratory corridor.

While this area of the project does not provide large patches of habitat, it does serve as a migratory corridor for wildlife from further south in the Sacramento-San Joaquin Delta to areas further north along the Sacramento River, such as the Parkway. Riparian corridors can be especially important for reptiles, amphibians, and small mammals.

Future Conditions With the Project

Impacts to vegetation and wildlife within the project area are evaluated based on data collected from tree surveys conducted in 2011, site visits, Google Earth, and the American River Parkway Plan (Parkway Plan). The goals and objectives of the Parkway Plan and how construction of the project would impact those goals and objectives were considered in the impact analysis. Table 3 summarizes the impacts to vegetation by basin and reach.

Alternative 1: Fix Levees in Place

American River

The construction of rock trenches along the American River would result in the removal of about 65 acres of riparian habitat within the Parkway. This acreage was determined by overlaying the largest possible footprint onto an aerial photograph and calculating the riparian habitat within the footprint. Much of this riparian habitat contains trees that have been in the Parkway for 50 to 100 years or more. The Parkway is the largest remaining riparian corridor in the city of Sacramento. In addition, construction would also impact 135 acres of grassland, which include the levees, patrol roads, and open lands. Project construction along the American River would be intermittent and would occur over a 7 year period. Trees would not be removed all at one time, they would be removed at each trench site as the trench is constructed.

Table 3. Potential Impacts by Flood Basin and Reach

Waterway	Impacts
American River	65 acres of riparian habitat
	135 acres of grassland habitat
East Side Tributaries	2 acres oak woodland
	4 acres of grassland
	10.5 acres riparian
Sacramento River	70 acres of riparian
Sacramento Bypass	300 acres of agricultural fields and drainage canals
	8 acres of riparian vegetation

Most of the 65 acres of riparian habitat is located on land designated by the Parkway Plan as Protected Areas or Nature Study Area. However, the Parkway Plan also allows for flood control activities to be conducted in order to pass 160,000 cfs through the system. Section 4.10 of the Parkway Plan states:

> *Flood control project, including levee protection projects and vegetation removal for flood control purposes, shall be designed to avoid or minimize adverse impacts on the Parkway, including impacts to wildlife and wildlife corridors. To the extent that adverse impacts are unavoidable, appropriate feasible compensatory mitigation shall be part of the project. Such mitigation should be close to the site of the adverse impact, unless such mitigation creates other undesirable impacts.*

Any trees planted would take many years to mature to the level where they provide the same value as those removed. Because there would be many years between when the trees are planted and when they mature to a value of those removed, this impact is considered significant. Construction would likely occur from May through October when birds are nesting. Once the project is authorized and funded, surveys of the project areas would occur to determine if migratory birds are nesting in areas which may be impacted during construction.

East Side Tributaries

Riparain and oak woodland along Arcade Creek and the NEMDC would need to be removed to construct the project. These trees are suitable nesting habitat for many avian species in the area. Surveys would be conducted to determine if any nesting birds are present prior to construction. If nesting birds are located adjacent to the project area, coordination with the resource agencies would occur. Any trees where nesting birds are located would not be removed while they are actively nesting. However, once the young have fledged, the trees may be removed to construct the project. The loss of trees in this area would be considered significant because new plantings would take many years to grow to the value of those removed.

This alternative would result in temporary impacts to about 4 acres of grasses along the creek channels and levee slopes. Once construction is complete, the areas would be planted with a native grass seed mix to prevent erosion and replace the grasses removed for construction. The grasslands are likely to grow back in a single season.

Sacramento River

Under this alternative the existing levee structure would be degraded by one half to create a working platform for slurry wall installation. As the levee is degraded, all vegetation on the top one half would be removed. Levee degradation will result in the loss of 70 acres of riparian habitat. These trees are located on the top half of the levee, so they provide a small amount of SRA cover and habitat for many avian species. They also contribute to the width of the riparian corridor. On average the current width of the riparian corridor along the Sacramento River is 100 feet. Riparian loss will remove about 60 feet of those 100 feet. The construction and planting of the berm as part of the erosion repair will create an additional 25 feet to the width of the riparian corridor. There will still be a net loss of 35 feet from the riparian corridor. The loss of this 35 feet from the width of the riparian habitat can cause increased predation because the narrower corridor will increase edge effects. Additionally, smaller widths of habitat make it more likely that stochastic events will affect the habitat and loss of the vegetation could result in complete removal of the riparian corridor diminishing connectivity. It will be important for the Corps and the non-federal and local sponsors to ensure that the remaining riparian habitat remains, regeneration occurs (it may need to be helped through active planting), and non-native vegetation does not become established within the corridor.

On the waterside of the levee, 930 large trees would be left in place on the lower one-third and rock would be placed around the base of the trees. The trees that would remain in place are scattered over 31,130 linear feet (50 acres). The rock protection around the trees would reduce the potential for erosion and anchor the trees in place to lower the risk of uprooting in high water events. The understory vegetation would be removed to provide a clean surface to place the rock. Excluding the large trees, vegetation in this area is primarily small shrubs, low growing plants of various species, and grasses. Once the rock protection is in place and a planting berm is constructed, the area would be planted with small shrubs. Appropriate plants would be selected to maximize wildlife habitat.

On the landside of the levee all trees would be removed on the levee slope and within 15 feet of the levee toe to comply with the Corps vegetation policy. Within this 15 feet compliance area, a 10-foot wide landside operations, maintenance, and emergency access corridor would be established. There are 670 trees of various species and size within this landside area that would be removed and not be replaced on-site. The removal of these trees is considered significant because it would take many years for the replacement trees to establish to the value of those removed.

The landside slopes are primarily covered with ornamental groundcovers installed by adjacent private property owners. In some places landscaping has been extended beyond the fence or property lines and up the levee slopes. Degrading of the levee would include removal of all vegetation on the upper half of the landside slope. All disturbed areas, including the levee slopes, would be planted with native grasses to prevent erosion. The 15 foot landside vegetation free zone would be maintained vegetation free, except for the native grasses.

The loss of woody vegetation would affect avian species. Surveys would be conducted to determine if any nesting birds are present prior to construction. If nesting birds are located adjacent to the project area, coordination with the resource agencies would occur. Trees where nesting birds are located would not be removed while they are actively nesting.

Alternative 2 – Fix Levees and Widen the Sacramento Weir and Bypass

The footprints of all features in this alternative are the same as Alternative 1 with the added feature of widening the Sacramento Weir and Bypass. Areas that no longer require a raise would still maintain the same footprint since the purpose of the raise would instead be accomplished via the installation of a retaining wall at the toe of the levee. Therefore, the effects to vegetation and wildlife are the same as those for Alternative 1, with the addition of those associated with the Sacramento Weir and Bypass.

Sacramento Weir and Bypass

Habitat within the existing Bypass would remain the same as the existing conditions. The Bypass would be expanded by about 300 acres, which would become open space and would likely become similar habitat for wildlife as the existing Bypass. Operations of the new weir and bypass would be determined after construction is complete. No grading or altering of the lands within the existing bypass would occur as part of this alternative. Since the southern side of the bypass is lowest in elevation, water would naturally flow to the existing area and continue to support existing vegetation and wildlife. Due to the natural flow of water in the Bypass, existing wetlands are not expected to be impacted by construction of the project. There is a potential for additional wetlands to actually develop in the added 300 acres of bypass since the land would no longer be farmed. Conversion of this land back to its natural state would have benefits to other wildlife and could become an expansion of the Sacramento Bypass Wildlife Area.

There are 8 acres of riparian vegetation that would be removed to construct the weir structure. The 8 acre area contains both the Old River Road and Union Pacific Railroad train tracks. Avian species are the primary wildlife in this area with some small animals like fox and coyotes, which pass through the area to access the river. Included within the 8 acres are 1,500 linear feet of vegetation along the Sacramento River which may be removed to allow the river to flow freely into the weir. Both native and non-native fish species use this area of the river. During construction there would be direct effects to wildlife as the human activities associated with the construction would likely cause any wildlife to relocate to other open space lands to avoid the disturbance; however, the expansion of the Sacramento Weir and Bypass would have a positive effect on vegetation and wildlife once construction is complete and lands are converted from farming activities to open space.

DISCUSSION

Service Mitigation Policy

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register 46:15; January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. However, the Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several criteria, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value." To achieve this goal, any unavoidable losses would need to be replaced in-kind. "In-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost. The planning goal of Resource Category 3 is "no net loss of habitat while minimizing loss of in-kind value." To achieve this goal any unavoidable losses will be replaced in-kind or if it is not desirable or possible out-of-kind mitigation would be allowed. The planning goal of Resource Category 4 is "minimize loss of habitat value." To achieve this goal the Service will recommend ways to rectify, reduce, or minimize loss of habitat value.

In addition to mitigation planning goals based on habitat values, Region 8 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage and value for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to fish and wildlife habitat, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectifying, reducing or eliminating impacts over time, and compensation.

Ten fish and/or wildlife habitats were identified in the project area which had potential for impacts from the project: oak woodland, riparian forest, riparian scrub-shrub, SRA cover, shallow open water, emergent wetland, annual grassland, agriculture (non-rice cultivation), ornamental landscape, and other. The resource categories, evaluation species, and mitigation planning goal for the habitats impacted by the project are summarized in Table 4.

The evaluation species selected for the oak woodland that would be impacted are acorn woodpecker, turkey, and mule deer. Acorn woodpeckers utilize oak woodlands for nearly all their life requisites; 50-60 percent of the acorn woodpecker's annual diet consists of acorns. Acorn woodpeckers can also represent impacts to other canopy-dwelling species. Turkeys forage and breed in oak woodlands and are abundant in the project area. Mule deer also heavily depend on acorns as a dietary item in the fall and spring; the abundance of acorns and other browse influence the seasonal pattern of habitat use by deer. These latter species represent species which utilize the ground component of the habitat and both have important non-consumptive human uses (i.e., wildlife viewing and bird watching). Based on the high value of oak woodlands to the evaluation species, and their declining abundance, the Service has determined oak woodlands which would be affected by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value or acreage."

The evaluation species selected for the riparian forest that would be impacted by the project are Swainson's hawks, wood ducks, and Bullock's orioles. Riparian forest vegetation provides important cover, and roosting, foraging, and nesting habitat for these species. Large diameter trees also provide nesting sites for species such as wood ducks and Swainson's hawks. Riparian woodland cover-types are of generally high value to the evaluation species, and are overall, extremely scare (less than 2% remaining from pre-development conditions). Therefore, the Service finds that any riparian forest cover-type that would be impacted by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value or acreage." In addition, the Service's regional goal of no net loss of wetland acreage or habitat values, whichever is greater, would apply to this habitat type.

The evaluation species selected for the riparian scrub-shrub vegetation that would be impacted by the project is the yellow warbler. Riparian scrub-shrub vegetation provides important cover, and roosting, foraging, and nesting habitat for this species. Riparian cover-types are generally of high value to the evaluation species, and are overall extremely scarce (less than 2% remaining from pre-development conditions). Therefore, the Service finds that any riparian scrub-shrub cover-type that would be impacted by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value or acreage." In addition, the Service's regional goal of no net loss of wetland acreage or habitat values, whichever is greater, would apply to this habitat type.

The evaluation species selected for SRA cover that would be affected by the project are juvenile salmonids (salmon and steelhead) and the heron and egret family (family Ardeidae). Salmonids were selected because large declines in their numbers are among the most important resource issues in the region, and because of their very high commercial and sport fishing values. Herons and egrets were selected because of the Service's responsibilities for their management under the Migratory Bird Treaty Act, their relatively high value for non-consumptive human uses, such as bird watching, and their value as indicator species for the many birds which use SRA cover.

Table 4. Resource categories, evaluation species, and mitigation planning goal for the habitats possibly impacted by the proposed American River Common Features General Re-evaluation Report, Sacramento County, California.

COVER-TYPE	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Oak Woodland	Acorn woodpecker Turkey Deer	2	No net loss of in-kind habitat value or acreage.
Riparian Forest	Swainson's hawk Wood duck Bullock's oriole	2	No net loss of in-kind habitat value or acreage.
Riparian Scrub-Shrub	Yellow warbler	2	No net loss of in-kind habitat value or acreage.
SRA Cover	Juvenile salmonids Herons and Egrets	1	No loss of existing habitat value.
Emergent Wetland	Marsh Wren	2	No net loss of in-kind habitat value or acreage.
Shallow Open Water	Egret Sunfish	2	No net loss of in-kind habitat value or acreage.
Annual Grassland	Red-tailed hawk	3	No net loss of habitat value while minimizing loss of in-kind habitat value.
Agriculture (non-rice cultivation)	White-tailed kite California vole	4	Minimize loss of habitat value.
Ornamental Landscape	None	4	Minimize loss of habitat value.
Other	None	4	Minimize loss of habitat value.

In 1992, the Service designated SRA cover that is impacted by bank protection activities within the Sacramento Bank Protection Project action area as Resource Category 1 (USFWS 1992). Under Resource Category 1, habitat to be impacted is high value, unique, and irreplaceable on a national basis or in the eco-region, and the Service's mitigation planning goal is for no loss of existing habitat value.

The evaluation species selected for the emergent wetland cover-type is the marsh wren. Drainage wetland habitat provides important cover, foraging, nesting, and roosting habitat for such water associated birds as well as some amphibians and aquatic mammals. Insects and spiders are taken from vegetation, the wetland floor, and while in flight (Gutzwiller and Anderson 1987). For protection from predators, the marsh wren usually constructs nests in reedy vegetation about 15 inches above water that is 2 to 3 feet deep (Gutzwiller and Anderson 1987). Because of the medium to high value of this habitat to the evaluation species, and its relative scarcity, the Service designates any emergent wetland habitat within the project area as Resource Category 2, with its associated mitigation planning goal of "no net loss of in-kind habitat value or acreage."

The evaluation species selected for the shallow open water cover-type is the egret and sunfish. Shallow, open water is important to a number of regionally important fish and wildlife. For example, wading birds (e.g., herons and egrets) use it for feeding, as do a number of gamefish, including sunfish, catfish and striped bass. It is also part of the critical habitat designated for federally listed delta smelt and Sacramento River winter-run Chinook salmon. Such shallow water is generally removed when typical bank protection is done, especially when the bank is reshaped. The result is likely to be higher velocities and deeper water along the new shoreline. Compounding the problem is the large amount of riprap that has already been placed in the vicinity of the proposed action, thus effectively removing many miles of shallow, open water. In concert with past Sacramento River Bank Protection Project planning, the Service is designating such habitat that would be impacted as Resource Category 2, with an associated planning goal of "no net loss of in-kind habitat value or acreage."

The evaluation species selected for the annual grassland cover-type is the red-tailed hawk, which utilizes these areas for foraging. This species was selected because of the Service's responsibility for their protection and management under the Migratory Bird Treaty Act, and their overall high non-consumptive values to humans. Annual grassland areas potentially impacted by the project vary in their relative values to the evaluation species, depending on the degree of human disturbance, plant species composition, and juxtaposition to other foraging and nesting areas. Therefore, the Service designates the annual grassland cover-type in the project area as Resource Category 3. Our associated mitigation planning goal for these areas is "no net loss of habitat value while minimizing loss of in-kind habitat value."

The evaluation species selected for the agriculture, non-rice cultivation, cover-type is the white-tailed kite (formerly black-shouldered kite) and the California vole. The white-tailed kite in California is a common species of open and cultivated bottomland and is an obligate predator on diurnal small mammals (Faanes and Howard 1987). Movements and nesting of the white-tailed kite is largely governed by concentrations of mice and voles (Faanes and Howard 1987). The California vole is a widespread and common herbivore in California (Brylski 1990), and its abundance and distribution, along with daytime activity, make it an important prey species. Because this habitat is not native, and is managed for crop production unless fallowed, the Service designates the agriculture cover-type in the project area as Resource Category 4. Our associated mitigation planning goal for these areas is "minimize loss of habitat value."

No evaluation species were identified for the ornamental landscape or "other" cover-types. The ornamental landscape is typically vegetation which occurs along the fence line of adjacent private properties and is maintained by individual landowners. The "other" cover-type encompasses those areas which do not fall within the other cover-types such as gravel and paved roads, parking areas, buildings, bare ground, riprap, etc. Generally these cover-types would not provide any significant habitat value for wildlife species. Therefore, the Service designates the ornamental landscape and "other" cover-types in the project area as Resource Category 4. Our associated mitigation planning goal for these areas is "minimize loss of habitat value."

The recommendations below are based on preliminary construction designs provided by the Corps for the Common Features GRR. Once the specific project designs are developed, the Service's recommendations will be refined.

RECOMMENDATIONS

The Service recommends:

1. Avoid the loss of SRA cover by planting native woody vegetation within the bank protection areas. Work with the Service, NMFS, and California Department of Fish and Wildlife (CDFW) to develop planting and monitoring plans, and with DWR and SAFCA to develop a variance to allow vegetation within the Corps' vegetation free zone to remain in place, especially in areas designed for rock slope protection.

2. Woody vegetation that needs to be removed within the construction footprint should be removed during the non-nesting season to avoid affecting active bird nests.

3. Avoid impacts to migratory birds nesting in trees along the access routes and adjacent to the proposed repair sites by conducting pre-construction surveys for active nests along proposed haul roads, staging areas, and construction sites. This would especially apply if construction begins in spring or early summer. Work activity around active nests should be avoided until the young have fledged. The following protocol from the CDFW for Swainson's hawk would suffice for the pre-construction survey for raptors.

   A focused survey for Swainson's hawk nests will be conducted by a qualified biologist during the nesting season (February 1 to August 31) to identify active nests within 0.25 mile of the project area. The survey will be conducted no less than 14 days and no more than 30 days prior to the beginning of construction. If nesting Swainson's hawks are found within 0.25 mile of the project area, no construction will occur during the active nesting season of February 1 to August 31, or until the young have fledged (as determined by a qualified biologist), unless otherwise negotiated with the California Department of Fish and Wildlife. If work is begun and completed between September 1 and February 28, a survey is not required.

4. Avoid future impacts to the site by ensuring all fill material is free of contaminants.

5. Minimize project impacts by reseeding all disturbed areas, including staging areas, at the completion of construction with native forbs and grasses. Reseeding should be conducted just prior to the rainy season to enhance germination and plant establishment. The reseeding mix should include species used by and beneficial for native pollinators. The Service can work with you in developing this seed mix.

6. Minimize the impact of removal and trimming of all trees and shrubs by having these activities supervised and/or completed by a certified arborist.

7. Compensate the loss of oak woodland, riparian forest, riparian scrub-scrub, and emergent wetland at a ratio of at least 2:1. The Corps should work with the Service and other resource agencies on the development of a riparian plan that will evaluate locations for riparian vegetation planting based on land use in the lower American River Parkway, effects from known future projects, such as the reoperation of Folsom Dam, where existing riparian and

valley elderberry longhorn beetle habitat exists, creating and maintaining connectivity between large riparian patches, and coordination with Sacramento County Parks. For the loss of other cover-types, the Corps should work with the Service and other resource agencies on the development of compensation success benchmarks to ensure that goals are achieved.

8. All bank protection areas should be planted with a diverse mix of woody and herbaceous riparian vegetation. Sites should be diverse (a mix of riparian forest and scrub-shrub) and fit into the surrounding landscape. The planting plan should take into account what is missing from the surrounding vegetation and attempt to create heterogeneous habitats. The Corps should develop a baseline map of existing vegetation communities. Given the amount of rock already placed and the amount proposed for placement, this can serve to create diverse and heterogeneous habitats.

9. Include within the planting contract a provision for the contractor to plant understory species after some of the woody canopy has established. Studies have shown that planting late successional understory species after woody species canopy cover has been established provides better success for establishing these understory plants. Incorporating these species within the planting mix provides more diverse habitat for wildlife species (Johnston 2009).

10. Contact the California Department of Fish and Wildlife regarding possible effects of the project on State listed species.

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APPENDIX 1

U.S. FISH AND WILDLIFE ENDANGERED SPECIES CONSULTATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2014-F-0518

SEP 1 1 2015

Ms. Alicia E Kirchner
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Formal Consultation on the American River Common Features (AFRC) Project, Sacramento County, California

Dear Ms. Kirchner:

This letter is in response to the U.S. Army Corps of Engineers (Corps) April 3, 2015, request for consultation with the U.S. Fish and Wildlife Service (Service) on the proposed American River Common Features General Reevaluation Report (ARCF GRR) project in Sacramento County, California. You request was received by the Service on April 7, 2015. The Corps originally initiated consultation on June 30, 2014; however, the Service responded on July 23, 2014, with a request for additional information regarding the project description and the effects analysis the Corps had completed. The April 3, 2015, letter and biological assessment began the formal consultation period. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

The Federal action on which we are consulting is the ARCF GRR, which includes levee improvements and bank protection along the Sacramento River, levee improvements along Arcade, Magpie, and Dry/Robla Creeks, widening the Sacramento Bypass and Weir, and bank protection along the lower American River. Pursuant to 50 CFR 402.12(j), you submitted a biological assessment for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project may affect and is not likely to adversely affect the vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardi*); may affect likely to adversely affect the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), delta smelt (*Hypomesus transpacificus)* (smelt) and its critical habitat; the giant garter snake (*Thamnophis gigas*); and the yellow-billed cuckoo (*Coccyzus americanus occidentalis*). The project is outside of critical habitat designated for the valley elderberry longhorn beetle and critical habitat proposed for the yellow-billed cuckoo.

The Corps previously consulted with the Service on the Magpie Creek Flood Control Project and on September 15, 2004 a biological opinion regarding effects to the vernal pool fairy shrimp, vernal pool tadpole shrimp, and giant garter snake (File # 1-1-04-F-0132) was provided. The project described in the 2004 biological opinion is exactly the same as the Magpie Creek portion of the project description in the Common Features biological assessment. Because the environmental baseline for vernal pool fairy shrimp and vernal pool tadpole shrimp has not changed from the baseline that was analyzed in the 2004 biological opinion and the project description remains the same, effects to and take of vernal pool fairy shrimp and vernal pool tadpole shrimp are addressed i the September 15, 2004, biological opinion. More recent information regarding the status of the habitat along Magpie Creek for giant garter snake has changed from the 2004 biological opinion. This opinion addresses those changes and any potential effects to the giant garter snake.

Seasonal wetlands, which may provide suitable habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp, occur in the vicinity of the Robla Creek woodland mitigation site A, however any vernal pools in this area would be avoided by these activities. The Corps will implement a 250-foot buffer between vernal pools and vegetation planting. Planting activities will be done in the fall when the wetlands are dry and will use best management practices to ensure that sediment does not enter the seasonal wetlands. The Service concurs that with your determination of may affect, not likely to adversely affect vernal pool fairy shrimp and vernal pool tadpole shrimp at the Robla Creek woodland mitigation site A.

This biological opinion is based on information provided in the Corps' letter requesting consultation and the biological assessment. A complete administrative record is on file at the Service's Sacramento Fish and Wildlife Office.

CONSULTATION HISTORY

September 4, 2013: The Service commented on the April 2013 draft biological assessment.

April 8, 2014: The Service commented on the October 2013 draft biological assessment.

June 30, 2014: The Corps initiated section 7 consultation with the Service.

July 23, 2014: The Service sent a letter in response to the Corps initiation requesting additional information.

April 3, 2015: The Corps provided an updated biological assessment with responses to the Service's July 23, 2014, request for additional information.

August 31, 2015: The Corps provided a revised biological assessment that addressed questions the Service had regarding the project description.

BIOLOGICAL OPINION

Description of the Action

Congress directed the Corps to investigate the feasibility of reducing flood risk of the city of Sacramento. The Corps completed feasibility studies in 1991 and 1996, recommending a concrete gravity flood detention dam on the north fork of the American River at the Auburn site along with levee improvements downstream of Folsom Dam. Other plans evaluated in the report were Folsom Dam improvements and a stepped release plan for Folsom Dam releases. These additional plans also included levee improvements downstream of Folsom Dam. Congress recognized that levee improvements were "common" to all candidate plans in the report and that there was a Federal interest in participating in these "common features." Thus, the ARCF Project was authorized in the Water Resources Development Act (WRDA) of 1996 and a decision on Auburn Dam was deferred to a later date. Major construction components of ARCF in the WRDA 1996 authorization included construction of seepage remediation along about 22 miles of American River levees and construction of levee strengthening and raising of 12 miles of Sacramento River levee in Natomas.

Following the 1986 flood, significant seepage was experienced on the Sacramento River from Verona (upstream end of Natomas) at River Mile (RM) 79 to Freeport at RM 45.5. In addition, both the north and south bank of the American River from RM 0 to about RM 11.4 experienced seepage. Seepage on the Sacramento River was so extensive that Congress, soon after the 1986 flood event, funded remediation in the Sacramento Urban Levee Improvement Project (Sac Urban). The Sac Urban Project constructed shallow seepage cutoff walls from Powerline Road in Natomas at approximately RM 64 down to Freeport.

Shortly thereafter, the Sacramento Valley experienced a flood event in 1997. Considerable seepage occurred on the Sacramento River as well as on the American River. Seepage on the American River was expected because remediation measures had yet to be constructed, but the occurrence of significant seepage on the Sacramento River in the reach remediated as part of the Sac Urban Project was alarming and confirmed that deep underseepage was also of significant concern. As a result, seepage remediation on the American River (then in the late 1990s in the design phase) would need to be designed to remediate both through- and deep underseepage.

In 1999, Congress decided not to authorize Auburn Dam, but instead authorized improvements for Folsom Dam. By doing this, improvements to levees downstream of Folsom Dam could be fine-tuned to work closely with the Folsom improvements being discussed by Congress. Therefore, the ARCF project was modified by WRDA 1999 to include additional necessary features for the American River so that it could safely convey the proposed emergency release of 160,000 cubic feet per second (cfs) from Folsom Dam. Major construction components for the ARCF project in the WRDA 1999 authorization include construction of seepage remediation and levee raise along four stretches of the American River, and construction of levee strengthening and raising of 5.5 miles of Natomas Cross Canal levee in Natomas. All American River features authorized in WRDA 1996 and 1999 have been constructed or are in design analysis for construction within a year or two.

The purpose of the ARCF project is to reduce the flood risk for the city of Sacramento. The following problems were identified within the Sacramento levee system:

- Seepage and underseepage;
- Levee erosion;
- Levee stability;
- Levee overtopping;
- Access for maintenance and flood fighting;
- Vegetation and encroachments;
- Releases from Folsom Dam;
- Floodplain management; and
- Additional upstream storage from existing reservoirs.

In order to evaluate the effects to listed species, the Corps looked at the largest foreseeable footprint. As the Corps moves into the design phase of the project, footprint changes will likely reduce the effects to listed species.

The project is designed to allow for the release of 160,000 cubic feet per second (cfs) from Folsom Dam. The levees along the American River are unable to withstand these maximum flows for extended periods of time without increased risk of erosion and potential failure. The exact location where erosion will occur and to what extent erosion will occur during any given event is unknown. Erosion within the American River Parkway will be addressed as part of the Folsom Dam Water Control Manual Update currently under evaluation and a biological assessment is being prepared to initiate section 7 consultation with both the Service and National Marine Fisheries Service (NMFS). Therefore, the effects of erosion along the lower American River and effects of increased Yolo Bypass flooding frequency due to changes in operations from Folsom Dam are not analyzed in this project description. This is because construction of the American River and Sacramento Bypass measures, which are dependent on releases from Folsom Dam, will not occur until after a biological opinion is received for the Water Control Manual Update. Sacramento River and East Side Tributaries measures are necessary to improve the flood risk management system in the Sacramento area regardless of the change in operation at Folsom Dam and are not dependent on Folsom Dam operations for their implementation. As a result, construction in these areas could occur regardless of the Folsom Dam Water Control Manual Update schedule.

The Corps' project involves the construction of fix-in-place levee remediation measures to address seepage, stability, erosion, and height concerns identified for the Sacramento River and American River levees, Natomas East Main Drainage Canal (NEMDC), Arcade, Dry/Robla, and Magpie Creeks (Figure 1). Most height concerns along the Sacramento River will be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass. Due to the urban nature and proximity of existing development within the American River North and South basins the Corps is planning fix in place remediation. This would improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 1 summarizes the levee problems discussed above and the proposed measure for each waterway.

Sacramento Area Flood Control Agency (SAFCA), the project's local sponsor, will complete some portions of the Federal project. SAFCA is seeking permission from the Corps pursuant to 33 USC §408 (Section 408) for alteration of the Federal levees along the NEMDC and Arcade Creek.

In addition to the proposed levee improvements measures shown in Table 1, the following measures and policies would be addressed during construction:

- The non-Federal (Department of Water Resources (DWR)) will bring the levees into compliance with the Corps' standard levee footprint using a System Wide Implementation Framework (SWIF) process. A SWIF is a plan developed by the levee sponsor(s) and accepted by the Corps to implement system-wide improvements to a levee system (or multiple levee systems within a watershed) to address system-wide issues, including correction of unacceptable inspection items, in a prioritized way to optimize flood risk reduction. The standard levee footprint consists of a 20 foot crown width, 3:1 waterside

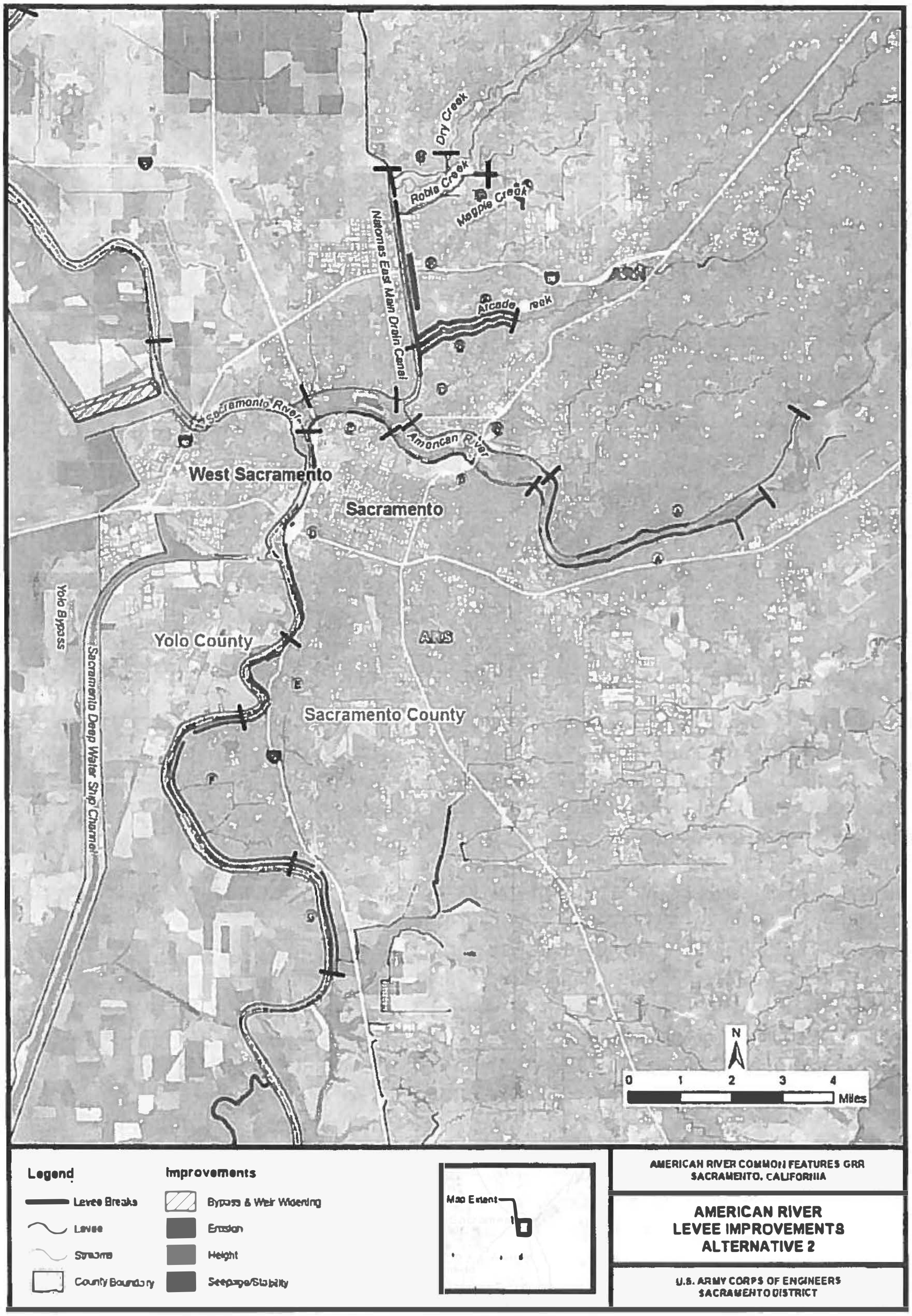

Figure 1. American River Common Features Project Area

Table 1. Remediation by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench (31,000 linear feet)	---
Sacramento River	Cutoff Wall (50,300 linear feet)	Cutoff Wall (50,300 linear feet)	Bank Protection (50,300 linear feet)	Sacramento Bypass and Weir Widening, Levee Raise (1,500 feet)
NEMDC	Cutoff Wall (6,000 linear feet)	Cutoff Wall	---	Floodwall (15,600 linear feet)
Arcade Creek	Cutoff Wall (22,000 linear feet)	Cutoff Wall	---	Floodwall (22,000 linear feet)
Dry/Robla Creeks	---	---	---	Floodwall (2,500 linear feet)
Magpie Creek[2]	---	---	---	Floodwall, Levee Raise

[1]American River seepage, stability, and overtopping measures were addressed in a previous construction project.
[2]In addition to the floodwall, Magpie Creek will include construction of a new levee (3,100 linear feet) along Raley Boulevard south of the creek, and construction of a detention basin on both sides of Raley Boulevard (79 acres). In addition, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

slope and 2:1 landside slope, when possible. If the 3:1 waterside slope is not possible, then a minimum 2:1 waterside slope would be established instead.

- Engineering Technical Letter 1110-2-583 (ETL) vegetation compliance would occur under a SWIF by the local maintaining agency (LMA). The intent of the SWIF is to collaboratively work with the resource agencies and levee sponsors to transition existing levees to Corps standards while maintaining Public Law (PL) 84-99 rehabilitation assistance and adhering to the Act and other environmental laws. The SWIF is a two-step process completed by the applicant that is composed of a letter of intent, which is followed by submission of a SWIF plan. The SWIF process allows eligible local sponsors to implement levee improvements in a prioritized "worst first" way to optimize the achievement of risk reduction. The Corps acknowledges that implementing system-wide improvements will need to be done within a collaborative intergovernmental framework and that it will take time to develop and implement improvements in complex situations. Challenges including ensuring that both environmental and levee safety considerations are adequately served.
- The vegetation requirements for the SWIF include a 15-foot waterside, landside, and vertical vegetation-free zone. Trees that pose an unacceptable risk to levee integrity will be removed and the root balls and roots will be remediated. Trees that do not pose a threat will not be removed. Vegetation on the landside slope would only be removed within the construction

footprint (up to ½ levee degrade) and the remaining vegetation would be dealt with under the SWIF process.

- Utility encroachments will be brought into compliance with Corps policy. Utilities that penetrate the levee would be removed and replaced with one of two fixes: (1) a surface line over the levee prism, or (2) a through-levee line equipped with positive closure devices.
- Private encroachments shall be removed by the non-Federal sponsor prior to construction.
- The Sacramento District of the Corps will pursue a vegetation variance which will allow vegetation on the lower ½ of the levee slope to 15 feet waterward of the waterside levee toe to remain in place. The Sacramento District has conducted an evaluation which examined the safety, structural integrity, and functionality of the levees that will be retained and not compromised if a tree were to fall and result in scouring of the root ball area. The results show that the tree fall and scour did not significantly affect levee performance, and the levee meets Corps seepage and slope stability criteria assuming the entire project is constructed.

American River

Levees along the American River require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed for the American River levees: (1) a maximum of 31,000 linear feet (LF) of bank protection, and (2) a maximum of 65 acres/45,000 LF of launchable rock trench. Both of these measures are described in detail in the subsections below. These numbers are maximized because there is some overlap identified to account for the uncertainty of site-specific conditions. For example, for some reaches both bank protection and launchable rock trench impacts were estimated even though both measures will not be constructed in the same reach.

<u>Bank Protection</u>

This measure consists of placing rock revetment on the river's bank to prevent erosion. It entails installing revetment along the stream bank based on site-specific analysis (Figure 2). When necessary, the eroded portion of the bank will be filled and compacted prior to the rock placement. The sites will be prepared by clearing and stripping of loose material and understory growth prior to construction. In most cases, large vegetation will be permitted to remain at these sites. Temporary access ramps will be constructed, if needed, using imported borrow material that would be trucked on site.

The placement of rock onto the bank will occur from a land based staging area using long reach excavators and loader. The loader brings rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the waterside of the levee.

The revetment will be placed on the existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a planting berm will be constructed in the rock to allow for revegetation of the site. The planting berm varies in width from 5 to 15 feet. In all cases the planting will occur outside the vegetation free zone as required by the ETL.

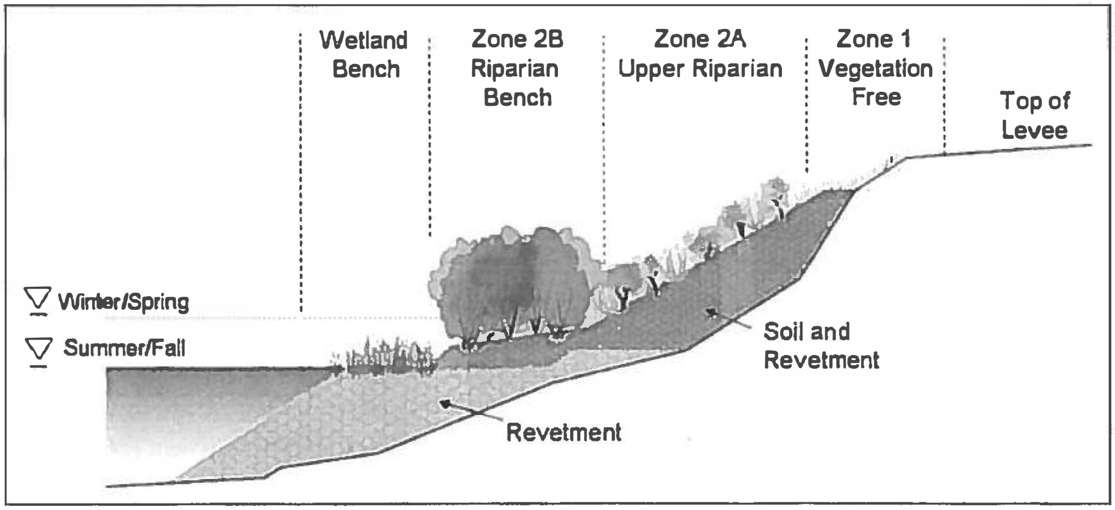

Figure 2. Bank Protection with Planting Bench.

Launchable Rock Trench

For the purposes of this project description, it is assumed that 65 acres of the lower American River will have a launchable rock trench fix. The remainder will be the bank protection described above. This measure includes construction of a launchable rock filled trench, designed to deploy once erosion has removed the bank material beneath it (Figure 3). All launchable rock trenches will be constructed outside of the natural river channel. The vegetation will be removed from the footprint of the trench and the levee slope prior to excavation of the trench. The trench configuration will include a 2:1 landside slope and 1:1 waterside slope and will be excavated at the toe of the existing levee. All soil removed during trench excavation will be stockpiled for potential reuse. The bottom of the trench will be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and amount of rock required.

After excavation, the trench will be filled with revetment that will be imported from an offsite commercial location. After rock placement the trench will be covered with a minimum of 3 feet of the stockpiled soil for a planting berm. Rock placed on the levee slope will be covered with 2 feet of stockpiled soil. All disturbed areas will be reseeded with native grasses and small shrubs where appropriate. Trees and shrubs could be permitted on the trench if planted outside the specified vegetation free zone as required by the ETL.

Sacramento River

Levees along the Sacramento River require improvements to address seepage, stability, and erosion. About 50,300 LF of bank protection and cutoff wall or slope stability work is proposed for the Sacramento River. In addition, these levees require a total of one mile of intermittent height improvements in order to convey additional flows that exceed current design levels.

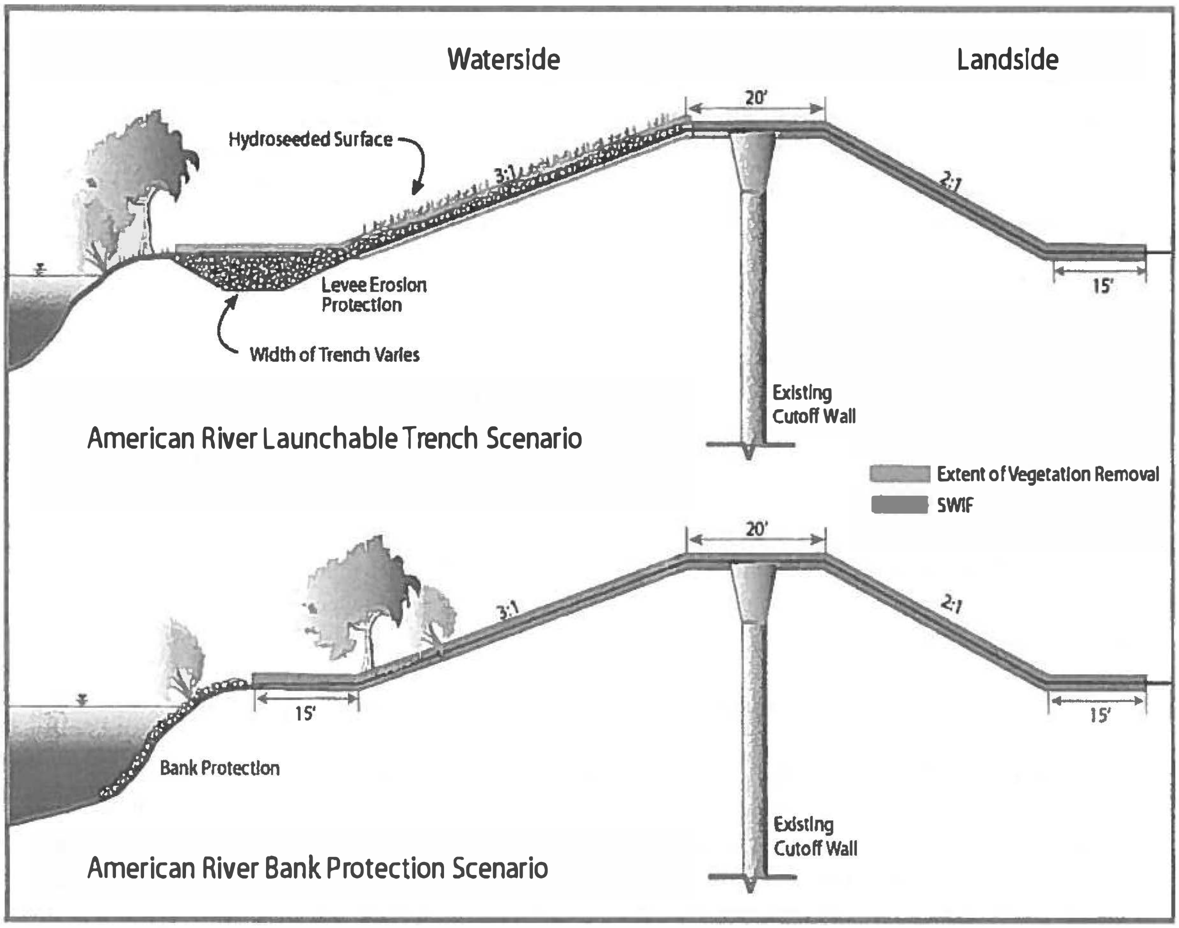

Figure 3. Launchable Rock Trench and Bank Protection.

Where the existing levee does not meet the levee design requirements, as discussed above, slope flattening, crown widening, and/or a minimal amount of levee raise is required. This improvement measure addresses problems with slope stability, geometry, height and levee crest access and maintenance. To begin levee embankment grading, loose material and vegetation understory will be cleared, grubbed, stripped, and where necessary, portions of the existing embankment will be excavated to allow for bench cuts and keyways to tie in additional embankment fill. Excavated and borrow material (from nearby borrow sites) will be stockpiled at staging areas. Haul trucks and front end loaders will bring borrow materials to the site, which will then be spread evenly and compacted according to levee design plans.

The levee will be raised about 1 to 2 feet resulting in the levee footprint extending out a maximum of 5 feet on the landside from the existing levee. The levee crown patrol road will be re-established at the completion of construction.

Cutoff Walls

To address seepage concerns, a cutoff wall will be constructed through the levee crown. The cutoff wall will be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach will depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of about 85 feet. For cutoff walls of greater depth the DSM method will be utilized.

Prior to any cutoff wall construction method, the construction site and any staging areas will be cleared, grubbed, and stripped. The levee crown will be degraded up to half the levee height to create a large enough working platform (about 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids. This method of slurry wall installation will also reduce the risk of slurry mixture following seepage paths and leaking into the river or into landside properties.

Open Trench Cutoff Wall

Under the open trench method, a trench about 3 feet wide will be excavated at the top of levee centerline and into the subsurface materials up to 85 feet deep with a long boom excavator. As the trench is excavated, it is filled with low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench is mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture is backfilled into the trench, displacing the temporary slurry. Once the slurry was hardened, it will be capped and the levee embankment will be reconstructed with impervious or semi-impervious soil.

DSM Cutoff Wall

The DSM method involves a crane supported set of two to four mixing augers used to drill through the levee crown and subsurface to a maximum depth of about 140 feet. As the augers are inserted and withdrawn, a cement bentonite grout will be injected through the augers and mixed with the native soils. An overlapping series of mixed columns will be drilled to create a continuous seepage cutoff barrier. A degrade of up to one half the levee height will be required for construction of the DSM wall. For both methods, once the slurry has hardened it will be capped and the levee embankment will be reconstructed with impervious or semi-impervious soil.

Bank Protection

Proposed bank protection along the Sacramento River will address erosion concerns. Studies have shown that the Sacramento River levees have a medium to high risk of breach due to erosion. Bank protection will be addressed by standard bank protection with planting berm. The standard bank protection measure for the Sacramento River consists of placing rock protection on the bank to prevent erosion. This measure entails filling the eroded portion of the bank, where necessary, and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. Large trees on the lower half of the waterside slope will be protected in place to retain shaded riverine aquatic (SRA) habitat. The sites will be prepared by removing vegetation along the levee slopes at either end of the site for construction of a temporary access ramp, if needed. The ramp will then be constructed using imported commercial borrow material that will be trucked on site.

The placement of rock onto the levee slope will occur from atop the levee and/or from the waterside by means of barges. Rock required within the channel, both below and slightly above the water line at the time of placement, will be placed by an excavator located on a barge. Construction will require two barges: one barge would carry the excavator, while the other barge will hold the stockpile of rock to be placed on the channel slopes. Rock required on the upper portions of the slopes will be placed by an excavator located on top of the levee. Rock placement from atop the levee will require one excavator and one loader for each potential placement site. The loader brings the rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the waterside of the levee.

The revetment will be placed via the methods discussed above on existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a small planting berm will be constructed in the rock to allow for some revegetation of the site.

Natomas East Main Drain Canal

The east levee of the NEMDC requires 6,000 LF of improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A cutoff wall will be constructed at this location to address the seepage and stability problems. The cutoff wall will be constructed by one of the methods described in the Sacramento River section above. SAFCA is proposing to construct 1,700 LF of cutoff wall beginning just south of the confluence of Arcade Creek and extending south along the NEMDC. The Corps will construct the remaining 4,300 LF of cutoff wall.

Arcade Creek

The Arcade Creek levees require improvements to address seepage, slope stability, and overtopping when the event exceeds the current design. A centerline cutoff wall will be constructed to address seepage along 22,000 LF of the Arcade Creek levees. Levees from Rio Linda Boulevard to Marysville Boulevard will have a cutoff wall constructed at the waterside toe of the levee. Construction of the waterside toe cutoff wall will require constructing a work bench along the toe of the levee. Excavation for the bench will extend deep enough below existing grade to remove organic material and soft, unsuitable foundation soils. Bench excavation will also extend into the existing waterside slope of the levee as needed. Riprap will be placed on the waterside benches after construction of the waterside toe cutoff wall. Some portions of the Arcade Creek north levee will require more substantial excavation and reconstruction of the waterside slope to provide a low permeable seepage levee slope barrier. Bench fill material will be integrated with the slope reconstruction fill to provide an integral seepage barrier with the cutoff wall over the full height of the levee slope. A small section of levee will have a sheet pile cutoff wall at the centerline of the levee, rather than the waterside toe cutoff wall.

There is a ditch adjacent to the north levee at the landside toe which provides a shortened seepage path, and could affect the stability of the levee. The ditch will be replaced with a conduit or box culvert and then backfilled. This will lengthen the seepage path and improve the stability of the levee. Additionally, pressure relief wells will be installed along the landside toe of the levee along the north levee west of Norwood Avenue.

The majority of the Arcade Creek levees have existing floodwalls, however there remains a height issue in this reach. A 1 to 4-foot floodwall will allow the levees to pass flood events greater than the current design level. The floodwall will be placed on the waterside hinge point of the levee and will be designed to disturb a minimal amount of waterside slope and levee crown for construction. The waterside slope will be re-established to its existing slope and the levee crown will grade away from the wall and be surfaced with aggregate base.

Dry and Robla Creeks

The Dry and Robla Creeks levees require improvements to address overtopping when flood events exceed the design level. Height improvements will be made with a new floodwall constructed to a height of 4 to 6 feet along 2,500 LF of the south levee. The floodwall will be placed at the waterside hinge point of the levee and will be designed to disturb a minimal amount of waterside slope and levee crown for construction. Construction of the floodwall will be consistent with the description for Arcade Creek above. The waterside slope will be re-established to its existing slope and the levee crown will grade away from the wall and be surfaced with aggregate base.

Magpie Creek Diversion Canal

The Magpie Creek Diversion Canal project description is the same as was described in the September 15, 2004 biological opinion.

Sacramento Weir and Bypass

The Sacramento Weir was completed in 1916. It is the only weir in the Sacramento River Flood Control Project that is manually operated; all others overflow by gravity on their own. It is located along the right bank of the Sacramento River about 4 miles upstream of the Tower Bridge, and about 2 miles upstream from the confluence with the American River. Its primary purpose is to protect the city of Sacramento from excessive flood stages in the Sacramento River channel downstream of the American River. The weir limits flood stages (water surface elevations) in the Sacramento River to project design levels through the Sacramento/West Sacramento area. Downstream of the Sacramento Weir, the design flood capacity of the American River is 5,000 cfs higher than that of the Sacramento River. Flows from the American River channel during a major flood event often exceed the capacity of the Sacramento River downstream of the confluence. When this occurs, floodwaters flow upstream from the mouth of the American River to the Sacramento Weir.

The project design capacity of the weir is 112,000 cfs. It is currently 1,920 feet long and consists of 48 gates to divert floodwaters to the west through the mile-long Sacramento Bypass to the Yolo Bypass. Each gate has 38 vertical wooden plank "needles" (4 inches thick by 1 foot wide by 6 feet long).

Though the weir crest elevation is 24.75 feet, the weir gates are not opened until the river reaches 27.5 feet at the I Street gage with a forecast to continue rising. This gage is about 1,000 feet upstream from the I Street Bridge and about 3,500 feet upstream from the mouth of the American River. The number of gates to be opened is determined by the National Weather Service/DWR river forecasting team to meet either of two criteria: (1) to prevent the stage at the I Street gage from exceeding 29 feet, or (2) to hold the stage at the downstream end of the weir to 27.5 feet (DWR 2010). The weir gates are then closed as rapidly as practicable once the stage at the weir drops below 25 feet. This provides "flushing" flows to re-suspend sediment deposited in the Sacramento River between the Sacramento Weir and the American River during the low flow periods when the weir is open during the peak of the flood event (DWR 2010).

The Sacramento Weir and Bypass will be expanded to roughly twice their current width to accommodate increased bypass flows. The existing north levee of the Sacramento Bypass will be degraded and a new levee would be constructed 1,500 feet to the north. The existing Sacramento Weir will be expanded to match the wider bypass. At this time, it is not known whether the new segment of weir will be constructed consistent with the 1916 design described above, or whether it will be designed to be a gravity-type weir. The new north levee of the bypass will be designed to be consistent with the existing Sacramento Bypass north levee; however, it will also include a 300-foot-wide seepage berm on the landside with a system of relief wells. A hazardous, toxic, and radiological waste site near the existing north levee will be remediated by the non-Federal sponsor prior to construction.

Operation of the new segment of the Sacramento Weir will occur during high water situations only, when the American River flows exceed 115,000 cfs. The existing Sacramento Weir will be operating at the pre-existing conditions described above. There are not expected to be any water quality impacts, though this has not been specifically modeled. The approximate change in water diversions, which are shown in Table 2, will vary based on the size of the flood event. The frequency of water diversion is expected to be the same, dependent on the stream gage at the I Street Bridge reaching 27.5 feet.

The widened portion of the Sacramento Weir will only be operated when the release from Folsom Dam is above 115,000 cfs. With the Folsom Dam improvements in place, releases from Folsom Dam will be above 115,000 cfs for flood events greater than the 100-year event. Therefore, for events up to and including the 100-year event, only the existing weir will be operated per the criteria previously established. For events greater than the 100-year event, when the release from Folsom Dam will go above 115,000 cfs, the new weir will be opened. Therefore, for events up to the 100-year event there will be no change in flow conditions in the Sacramento and Yolo Bypasses.

Table 2. Comparison of 10-, 100-, and 200-year Frequency Flows under Various Conditions

10-Year Event	Existing Condition	Future Without Project Condition	Future With Project Condition
American River	43,000 cfs	72,000 cfs	72,000 cfs
Sacramento Bypass	50,000 cfs	66,000 cfs	66,000 cfs
Yolo Bypass below Sacramento Bypass	270,000 cfs	296,000 cfs	296,000 cfs
100-Year Event	Existing Condition	Future Without Project Condition	Future With Project Condition
American River	145,000 cfs	115,000 cfs	115,000 cfs
Sacramento Bypass	131,000 cfs	115,000 cfs	115,000 cfs
Yolo Bypass below Sacramento Bypass	555,000 cfs	535,000 cfs	535,000 cfs
200-Year Event	Existing Condition	Future Without Project Condition	Future With Project Condition
American River	320,000 cfs	160,000 cfs	160,000 cfs
Sacramento Bypass	183,000 cfs	149,000 cfs	164,000 cfs
Yolo Bypass below Sacramento Bypass	656,000 cfs	631,000 cfs	643,000 cfs

For the 200-year event, there will be an increase in flows in the Sacramento Bypass of about 15,000 cfs. In the Yolo Bypass, this equates to an increase of about 0.10-foot of water surface elevation. During the 200-year event, the Yolo Bypass is already flooded from levee to levee. The addition of these flows will equate to about 0.5-foot of additional width on the Yolo Bypass levee slopes.

High Hazard Levee Encroachment and Vegetation Removal

The National Flood Insurance Program (NFIP) standards for levee accreditation and the State's ULDC both require removal or modification of encroachments that pose an unacceptably high risk to the performance and safety of a levee either by undermining its structural integrity or by interfering with necessary inspection, operation, and maintenance activities. To address this requirement, SAFCA has identified and evaluated all of the encroachments in the NEMDC, Robla Creek, and Arcade Creek area. Each of these encroachments has been evaluated and based on this evaluation the encroachments have been classified as either:

- High-risk – poses a threat to levee integrity, removable prior to the levee being accredited;
- High-risk – impedes operation, maintenance, and inspection, removable within 3 years after the levee is accredited; or
- Low-risk – not identified as high hazard.

High-risk encroachments to be removed are limited to residential landscaping located at 10 locations along the landside of the south and north levees of Arcade Creek and along the Robla Creek south levee.

Vegetation on levees must be modified or removed if it presents an unacceptable risk to the structural integrity or impedes operation and maintenance of the levee. Eight high-risk trees along Arcade Creek have been identified for removal. All of the trees are either nonnative (7) or snags (1). Five are located on the waterside of the levees. These trees are in addition to any trees that will be removed as a result of implementation of levee improvements in the Arcade Creek area.

Utility Relocation

Existing encroachments and penetrations within the NEMDC and Arcade Creek have been inventoried by SAFCA. Many utilities will be avoided, however some utilities may need to be temporarily removed or relocated prior to construction. Temporary bypass pumping may be required for sanitary sewers. SAFCA and the construction contractors will coordinate with utility owners to manage the utilities in advance of construction. Disturbed utilities will be restored after construction consistent with Central Valley Flood Protection Board requirements.

Stormwater Pollution Prevention

Temporary erosion/runoff best management control measures would be implemented during construction to minimize stormwater pollution resulting from erosion and sediment migration from the construction, borrow, and staging areas. These temporary control measures may include implementing construction staging in a manner that minimizes the amount of area disturbed at any one time; secondary containment for storage of fuel and oil; and the management of stockpiles and disturbed areas by means of earth berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures will be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and included in a Stormwater Pollution Prevention Plan (SWPPP).

After completion of construction activities, the temporary facilities (construction trailers and batch plants) will be removed and the site would be restored to pre-project conditions. Site restoration activities for areas disturbed by construction activities, including borrow areas and staging areas, will include a combination of regrading, reseeding, constructing permanent diversion ditches, using straw wattles and bales, and applying straw mulch and other measures deemed appropriate.

Borrow Sites, Haul Routes, and Staging Areas

Borrow Sites - It is estimated that a maximum of 1 million cubic yards (cy) of borrow material will be needed to construct the project. Detailed studies of the borrow needs have not been completed. Actual volumes exported from any single borrow site will be adjusted to match demands for fill. Borrow sites will be selected that avoid effects to endangered species or their habitat.

To identify potential locations for borrow material soil maps and land use maps were obtained for a 20-mile radius surrounding the project area. Except as discussed below for Arcade Creek and NEMDC, eventual borrow site selection will include the following criteria: avoid threatened and endangered species effects and habitat, current land use patterns, and soil types.

Excavation limits on the borrow sites will provide a minimum buffer of 50 feet from the edge of the borrow site boundary. From this setback, the slope from existing grade down to the bottom of the excavation will be no steeper than 3:1. Excavation depths from the borrow sites will be determined based on available suitable material. The borrow sites will be stripped of top material and excavated to appropriate depths. Once material is extracted, borrow sites will be returned to their existing use whenever possible, or these lands could be used to mitigate for project effects, if appropriate.

Because SAFCA has completed more detailed design and studies for work along NEMDC and Arcade Creek the borrow site has been selected. Borrow site 2 is located along the east side of the NEMDC north of where the levee repairs will occur. About 27,000 cubic yards of material will be excavated from the 5.5-acre borrow site in order to construct levee improvements along the NEMDC and Arcade Creek. Following borrow activities the site will be contoured to create about 0.5 acre of tule bench, set an elevation the will provide aquatic habitat all year, 1.0 acre of higher bench with seasonal wetlands, that will flood in the winter and spring, and 3.5 acres of native grassland.

Clean rock will be commercially acquired in order to construct the American and Sacramento River bank protection sites. For the Sacramento River, rock will be acquired from a commercial source in the Bay Area and barged up the Sacramento River to the construction sites. Rock for the American river sites will be acquired from a commercial source within a 50-mile radius and will be hauled in trucks to the construction sites.

Haul Routes – Haul routes will be determined during the design phase and will depend on what borrow sites and staging areas are selected. Haul routes will be selected based on existing commercial routes and levee roads. Haul routes will be selected that avoid effects to federally listed species.

For Arcade Creek and NEMDC, haul trucks will leave borrow site 2 and use East Levee Road from the borrow site down to a point just north of the existing Del Paso/Main Avenue Bridge over NEMDC. Temporary bridges crossing the NEMDC and Arcade Creek will be used to allow haul trucks to reach repair sites. Railroad car undercarriages on temporary abutment supports will be one option for temporary bridge crossings.

Staging Areas – Staging areas will be selected that do not require the removal of vegetation or habitat that is used by threatened or endangered species or effect threatened or endangered species. Four potential staging areas have been identified for improvements along Arcade Creek. All four areas will require little preparation other than surface striping and temporary connection roads and ramps to the levee crown. The primary use of staging areas will be for temporary trailers, parking, and material staging. Additionally, there will need to be space to process material and an area where excavated soils and imported soils will be spread out and processed material. Importing, processing, and exporting material for levee reconstruction will be continuous activities once the work flow is established during the start of the construction season. Staging areas will be returned to pre-project conditions following construction activities unless the owner agrees to some grade raising to help dispose of excess construction soils.

Operation and Maintenance

Operation and maintenance (O&M) of the levees in the Sacramento area are the responsibility of the local maintaining agencies, including the American River Flood Control District, the DWR, and the City of Sacramento. The applicable O&M Manual for the Sacramento area levees is the Standard Operation and Maintenance Manual for the Sacramento Flood Control Project. Typical levee O&M in the Sacramento in the Sacramento area currently includes the following actions:

- Vegetation maintenance up to four times a year by mowing or applying herbicide.
- Control of burrowing rodent activity monthly by baiting with pesticide.
- Slope repair, site-specific and as needed, by re-sloping and compacting.
- Patrol road reconditioning up to once a year by placing, spreading, grading, and compacting aggregate base or substrate.
- Visual inspection at least monthly, by driving on the patrol road on the crown and maintenance roads at the base of the levee.
- Post-construction, groundwater levels will be monitored using the piezometers.

The Corps will work with local maintaining agencies to develop the maintenance activities necessary for long-term operations and maintenance. This will occur during the preconstruction engineering and design phase of the project. The Corps will evaluate if these maintenance activities will affect any Federally-listed species and reinitiate section 7 consultation if there will be adverse effects to listed species. Currently, the Corps only has a project description for activities that will affect valley elderberry longhorn beetle habitat. This is included below.

Following construction, the O&M manual for these reaches will be adjusted to reflect the vegetation variance and the SWIF plan. Under the adjusted O&M manual, large trees that are protected in place under the variance will be allowed to remain on the waterside slopes and additional vegetation will be planted on the planting benches.

Vegetation maintenance includes keeping maintenance roads clear of overhanging branches. Some of the vegetation along the levees includes elderberry shrubs. As part of long-term O&M, elderberry shrubs will be trimmed by the three levee maintenance districts. Table 3 describes the maximum amount of elderberry acreage that will be trimmed each year as a result of O&M. Trimming consists of cutting overhanging branches along the levee slopes on both the landside and waterside. Some shrubs may be located adjacent to the levee with branches hanging over the levee maintenance road. Up to a third of a shrub will be trimmed in a single season. Trimming will occur between November 1 and March 15. Loss of habitat will be offset through the development of a conservation area as described in the conservation measures below. Each year the local maintaining agency will document the amount of valley elderberry longhorn beetle habitat that they have trimmed and report that number to the Corps to ensure compliance with this biological opinion. If the local maintaining agency has a need to exceed the amount of valley elderberry longhorn beetle habitat which needs to be trimmed or affected due to routine maintenance, then they will request the Corps reinitiate consultation on this biological opinion for those actions.

Table 3. O&M by Maintaining Agency

Local Maintaining Agency	Levee Systems Covered	Annual Acreage of Trimmed Elderberry Shrubs*	Total Acreage of Elderberry Shrubs Trimmed over the 50 Year Life of the Project
American River Flood Control District	Lower American River, Dry/Robla Creek, Arcade Creek, NEMDC	0.5	25
Maintenance Area 9	Sacramento River east levee between Sutterville Road and the Beach Lake Levee	0.2	10
City of Sacramento	Sacramento River East Levee between the confluence of the American River and Sutterville Road	0.1	5

*acreage based on an estimated average shrub of 0.027 acre and no more than 1/3 of a shrub trimmed any given year.

Valley Elderberry Longhorn Beetle Habitat

Valley elderberry longhorn beetles are closely associated with elderberry shrubs. In 2011, the Corps conducted surveys and mapped all of the elderberry shrubs on the levees and 15 feet on either side of the levee. Elderberry shrubs were located along the American River and Sacramento River. The Corps counted shrub clusters and used elderberry stem counts from previous projects in the area to estimate a standard number and size of elderberry stems per shrub cluster. Tables 4 and 5 list the stem counts for shrubs along the American River and Sacramento River respectively. While shrubs exist along Arcade Creek or Magpie Creek, the Corps and SAFCA will avoid effects to the beetle by following the conservation measures below.

Table 4. American River Elderberry Shrub Effects and Compensation

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios	Elderberry Plantings	Associated Native Planting	Associated Native Ratios
riparian	> or = 1" & < or = 3"	no	1,998	2	3,996	3,996	1
		yes	0	4	0	0	2
riparian	> 3" & < 5"	no	790	3	2,370	2,370	1
		yes	16	6	96	192	2
Riparian	> or = 5"	no	312	4	1,248	1,248	1
		yes	23	8	184	368	2
TOTAL			**3,139**		**7,894**	**8,174**	
				total basins or credits=	1,606.8		
				total acres for compensation	66.40		

Table 5. Sacramento River Elderberry Shrub Effects and Compensation

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios	Elderberry Plantings	Associated Native Plantings	Associated Native Ratios
riparian	> or = 1" & < or = 3"	no	104	2	208	208	1
		yes	0	4	0	0	2
riparian	> 3" & < 5"	no	40	3	120	120	1
		yes	1	6	6	12	2
riparian	> or = 5"	no	16	4	64	64	1
		yes	2	8	16	32	2
TOTAL			**163**		**414**	**436**	
				total basins or credits=	85		
				total acres need for compensation	3.51		

Delta Smelt Habitat

The American River lacks suitable turbidity making it unsuitable for delta smelt. Due to the higher temperatures within Arcade Creek, Magpie Creek, and NEMDC it is also unlikely that delta smelt will use these tributaries. Therefore, suitable delta smelt habitat occurs within the Sacramento River in the reach where erosion protection will occur. The Corps has calculated that there will be a complete loss of 14 acres of shallow water habitat due to the placement of riprap and a change of substrate from natural soil to riprap on 32 acres.

Giant Garter Snake Habitat

Giant garter snakes are not known to use large rivers such as the American and Sacramento Rivers. Given the close proximity to urban development, high level of human disturbance, presence of riparian vegetation along the banks of most channel reaches, and lack of extensive marsh or rice to the east, giant garter snakes are unlikely to occur in Arcade Creek, Dry Creek, Robla Creek, Magpie Creek, or the southern section of the NEMDC (south of where Dry Creek enters). North of Dry Creek, the NEMDC has less woody vegetation, less urban development, and large areas of open grassland along the landside of the levee with rice farming occurring to the west of the grasslands. Therefore, there is potential for the snake to occur either in the upland or within the NEMDC north of where Dry Creek enters. Work in this location will involve removal of borrow material at borrow site 2 (5.5 acres of upland habitat).

Habitat for the giant garter snake also exists north of the existing Sacramento Bypass north levee. The land north of the Sacramento Bypass is currently agricultural fields producing row crops and nut orchards. Existing giant garter snake aquatic habitat occurs in drainage ditches and farm canals and the surrounding upland habitat. About 15 acres of aquatic habitat will be filled making it and the associated 30 acres of upland habitat unavailable to the giant garter snake. The Sacramento Bypass also has a toe drain along the levee with 25 acres of aquatic and 50 acres of upland habitat that will be relocated to the toe of the new Sacramento Bypass levee.

Yellow-billed Cuckoo Habitat

Yellow-billed cuckoos use riparian habitat for foraging and nesting. Suitable habitat occurs within the lower American River. The project will affect 65 acres of riparian habitat that could be used by the yellow-billed cuckoo. While riparian habitat occurs along Arcade Creek, Magpie Creek, and NEMDC it is very narrow and cuckoos are not likely to use these areas. Riparian habitat occurs along the Sacramento River and in some areas may be of such a width that a cuckoo could stop and use it during migration, but it is not wide enough to support a nesting pair of cuckoos. The Corps will remove 110 acres of riparian habitat along the Sacramento River and disturb an additional 50 acres of riparian habitat by removing the understory and placing rock around the large trees. The Sacramento Bypass does not have suitable habitat for the yellow-billed cuckoo. But riparian habitat does exist north of the existing Sacramento Weir along the Sacramento River (8 acres). Cuckoos have been observed in the Yolo Bypass in recent years (Ebird 2015).

Conservation Measures

Valley Elderberry Longhorn Beetle

- The Corps assumes complete avoidance of the valley elderberry longhorn beetle when a 100-foot (or wider) buffer is established and maintained around elderberry shrubs.
- When work will occur within the 100-foot buffer, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.
- Any damage done to the buffer area will be restored.
- Buffer areas will continue to be protected after construction.
- No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas.
- Elderberry shrubs that cannot be avoided would be transplanted to an appropriate riparian area at least 100 feet from construction activities.
- Elderberry shrubs will be surveyed prior to construction to ensure that the actual effects match the estimated effects of this biological opinion. If the Corps will effect more valley elderberry longhorn beetle habitat than estimated than they will reinitiate consultation with the Service.
- If possible, elderberry shrubs would be transplanted during their dormant season (November through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation will apply.
- Elderberry compensation will be planted in the American River Parkway. The Corps has six existing sites which are offsetting previous Corps flood control projects along the lower American River and near Folsom Dam. The Corps will find areas within the lower American River parkway which will either expand existing compensation areas or provide for connectivity between conserved valley elderberry longhorn beetle habitat. Sites within the lower American River parkway will be coordinated with Sacramento County Parks and the Service during the design phase of the project. Sites will be designed and developed prior to any effects to valley elderberry

longhorn beetle habitat. The Corps will create 69.91 acres of riparian habitat which supports valley elderberry longhorn beetle within the lower American River parkway for the transplantation of elderberry shrubs. In addition, the local sponsors will create an additional 40 acres of land to benefit the valley elderberry longhorn beetle or purchase 40 acres of credits at a Service approved conservation bank to offset the loss of habitat due to trimming of elderberry shrubs along the lower American River, Sacramento River, Dry/Robla Creeks, Arcade Creek, Magpie Creek, and NEMDC.

- Management of these lands will include all measures specified in the Service's conservation guidelines (1999a) related to weed and litter control, fencing, and the placement of signs.
- Monitoring will occur for 10 consecutive years or for 7 non-consecutive years over a 15-year period. Annual monitoring reports will be submitted to the Service.
- Compensation areas will be protected in perpetuity and have a funding source for maintenance (endowment).

Giant Garter Snake

- Unless approved otherwise by the Service, construction will be initiated only during the giant garter snakes' active period (May 1–October 1, when they are able to move away from disturbance).
- Construction personnel will be given a Service-approved worker environmental awareness program.
- A survey for giant garter snakes will be conducted within 24 hours prior to construction beginning in potential giant garter snake habitat. Should there be any interruption in work for greater than 2 weeks, a biologist will resurvey the area within 24 hours prior to the restart of construction.
- Giant garter snakes encountered during construction will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.
- Habitat temporarily affected for one season (the 5.5 acre borrow site along the NEMDC and the 75 acres along the toe drain of the Sacramento Bypass levee) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants. If for any reason construction extends into another active season the Corps will replace the habitat on-site and purchase credits at a ratio of 1:1 at a Service approved conservation bank.
- Habitat temporarily affected for more than three or more seasons will be restored and twice as much habitat will be created.
- Habitat permanently affected in the Sacramento Bypass in the form of drainage ditches and irrigation canals will be compensated for through the purchase of 135 acres of credits at a Service approved conservation bank.
- One year of monitoring will be conducted for the 80.5 acres that are temporarily affected.

- The Corps will purchase credits at a conservation bank prior to any permanent disturbance of giant garter snake habitat.
- A biological monitor will be on-site during all ground disturbing activities at borrow site 2.
- Exclusionary fencing will be placed, at least 10 days prior to the beginning of ground disturbing activities after May 1, to exclude giant garter snakes from entering areas where upland disturbance (borrow site 2 and Sacramento Bypass) will occur during the active season (May 1 to October 1). Prior to fencing installation, the fence line will be mowed (with a minimum height of 6 inches) in order to conduct a surface survey of potential burrows. Fencing will be installed with a minimum of 6 inches buried in the ground and a minimum of 24 inches above ground. Fence staking will be installed on the inside of the exclusion area. One-way escape funnels will be installed every 50 to 100 feet and sealed along the fence line to provide an escape for any giant garter snake that may be within the exclusion area. The fencing will enclose the entirety of the site, or additional exclusionary fencing can be extended 200 to 400 feet beyond the proposed entrance area. The fencing will be inspected before the start of each work day and maintained by the contractor until completion of the project. The fencing will be removed only when project activities are completed.

Yellow-Billed Cuckoo

- Prior to construction, surveys will be conducted to determine the presence of yellow-billed cuckoos within the project area in accordance with any required Service survey protocols and permits at the time of construction.
- If surveys find cuckoos in the area, vegetation removal will be done outside of the cuckoo nesting season.
- Riparian habitat that is removed due to project construction along the American River will be replanted within the American River parkway. The Corps intends to expand existing conserved riparian lands within the parkway that could support the yellow-billed cuckoo. The design of replacement riparian areas will be coordinated with the Service to ensure that the habitat benefits both valley elderberry longhorn beetles and yellow-billed cuckoos.

Fisheries Conservation Measures

- In-water construction activities (e.g., placement of rock revetment) will be limited to the work window of August 1 through November 30. If the Corps wants to work outside of this window they will consult with National Marine Fisheries Service (NMFS) and/or the Service.
- The Corps will purchase 42 acres of delta smelt credits from a Service-approved conservation bank to off-set the loss of 14 acres of shallow water habitat.
- The Corps will purchase an additional 32 acres of delta smelt credits from a Service-approved conservation bank to off-set the loss of spawning habitat due to the placement of riprap on the river bed.
- Erosion control measures (BMPs), including Storm Water Pollution Prevention Program and Water Pollution Control Program, that minimize soil or sediment from entering the river shall be installed, monitored for effectiveness, and maintained

throughout construction operations to minimize effects to federally listed fish and their designated critical habitat.

- Screen any water pump intakes, as specified by NMFS and the Service screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt.
- The Corps shall include as part of the project, a Riparian Corridor Improvement Plan with the overall goal of maximizing the ecological function and value of the existing levee system within the Sacramento Metropolitan area.

Additional Minimization and Conservation Measures

- Obtain an ETL approved vegetation variance exempting sites from vegetation removal prior to final design and construction phase for the Sacramento River.
- Construction will be scheduled when listed terrestrial and aquatic species will be least likely to occur in the project area. If construction needs to extend into the timeframe that species are present, then coordination/reinitiation with the Service will occur.
- Compensation for impacts to native riparian habitat will occur on a 2:1 basis on-site or in close proximity to the impact area. Riparian vegetation impacted under the SAFCA 408/404 actions will be replaced on a 3:1 canopy cover acreage basis.
- Stockpile all liquid chemicals and supplies at a designated impermeable membrane fuel and refueling station with a 110% containment system.
- Stockpile construction materials such as portable equipment, vehicles, and supplies, at designated construction staging areas and barges, exclusive of any riparian and wetland areas.
- Implement BMPs to prevent slurry from seeping out to the river and require piping systems on the landside of the levee.
- Project related vehicles will observe a 20-mile-per-hour speed limit within construction areas, except on County roads and on State and federal highways.
- Site access will be limited to the smallest area possible in order to minimize disturbance. Litter, debris, unused materials, equipment, and supplies will be removed from the project area daily. Such materials or waste will be deposited at an appropriate disposal or storage site.
- Immediately (within 24 hours) cleanup and report any spills of hazardous materials to the resource agencies. Any such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.
- Designating a Service approved biologist as a point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all employee education program conducted by the Corps.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of the effects assessment, the action area encompasses the Sacramento River from the Sacramento Bypass downstream to River Mile 45, the Yolo Bypass south the confluence of the Sacramento Bypass, the lower American River from Arden Way to the confluence of the Sacramento River, Arcade Creek from Marysville Boulevard to the confluence of the NEMDC, the NEMDC from the south Dry

Creek levee to just south of the NEMDC Arcade Creek confluence, the southern Dry Creek levee between Dry Creek Road and Rose Street, the borrow site along the NEMDC, and any borrow sites. Additionally, we are including a buffer of 300 feet from construction to account for effects to listed species due to dust and noise.

Analytical Framework for the Jeopardy Analysis

The following analysis relies on four components to support the jeopardy determination for the giant garter snake, valley elderberry longhorn beetle, yellow-billed cuckoo, and delta smelt: (1) the *Status of the Species*, which evaluates the species' range-wide condition, the factors responsible for that condition, and their survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on these species; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on these species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the delta smelt, valley elderberry longhorn beetle, giant garter snake, and yellow-billed cuckoo. Additionally, for non-Federal activities in the action area, we will evaluate those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both its survival and recovery in the wild.

The following analysis places an emphasis on using the rang-wide survival and recovery needs of the delta smelt, valley elderberry longhorn beetle, giant garter snake, and yellow-billed cuckoo, and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analytical Framework Adverse Modification

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.2. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this biological opinion relies on four components: (1) the *Status of the Critical Habitat*, which evaluates the range-wide condition of critical habitat for the delta smelt in terms of primary constituent elements (PCE)s, the factors responsible for that condition, and the intended recovery function of the critical habitat at the provincial and range-wide scale; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units and; (4) *Cummulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the delta smelt critical habitat are evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the delta smelt.

The analysis in this biological opinion places an emphasis on using the intended range-wide recovery function of delta smelt critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Status of the Species and Environmental Baseline

Valley Elderberry Longhorn Beetle Status of the Species

Please refer to the *Withdrawl of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife* (Service 2014) for the current status of the species. Ongoing threats to the valley elderberry longhorn beetle include habitat loss due to flood control projects, development projects, and invasive species. While these threats continue to affect the valley elderberry longhorn beetle throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the valley elderberry longhorn beetle.

Valley Elderberry Longhorn Beetle Environmental Baseline

The project footprint along both the Sacramento River and the American River contain riparian vegetation. The beetle is known in numerous locations along the American River parkway (CNDD 2015). Suitable habitat for the beetle in the form of elderberry shrubs occurs within the action area along the Sacramento River, the American River, and Arcade Creek.

Sacramento River - Riparian habitat along the Sacramento River, south of the city of Sacramento, occurs in narrow bands along the riverbank and levee. Generally an overstory layer is present composed of cottonwood, sycamore, and oak trees. Shrubs occur as a mid-story layer including buttonbush, blue elderberry, white alder, and Oregon ash. Elderberry shrubs occur randomly along the reach of river proposed for improvements. The Corps has documented at least 73 elderberry shrubs along the Sacramento River reach where construction is proposed. Natural river processes of erosion and accretion effect elderberry shrubs which is the host plant of the valley elderberry longhorn beetle by eroding away bank and potentially elderberry shrubs. Levee maintenance can adversely affect elderberries within this stretch of the Sacramento River either by pruning or drift of herbicides used along the levee slope.

American River – The valley elderberry longhorn beetles have been identfied along the lower American River Parkway in the CNDDB (2015). Additionally, the Corps has designed and built six sites along the lower American River as habitat for the valley elderberry longhorn beetle. These sites extend from RM 0.9 up to RM 21. Levee maintenance can adversely affect elderberry shrubs, though the largest threat to valley elderberry longhorn beetle is fires that have been started in the parkway and burned habitat that supports valley elderberry longhorn beetles.

Delta Smelt Status of Species

Listing Status: The Service proposed to list the delta smelt as threatened with proposed critical habitat on October 3, 1991 (56 FR 50075). The Service listed the delta smelt as threatened on March 5, 1993 (58 FR 12854), and designated critical habitat for this species on December 19, 1994 (59 FR 65256). The delta smelt was one of eight fish species addressed in the *Recovery Plan for the Sacramento–San Joaquin Delta Native Fishes* (Service 1996). This recovery plan is currently under revision. A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004). The 2004 review affirmed the need to retain the delta smelt as a threatened species. A 12-month finding on a petition to reclassify the delta smelt was completed on April 7, 2010 (75 FR 17667). After reviewing all available scientific and commercial information, the Service determined that re-classifying the delta smelt from a threatened to an endangered species was warranted, but precluded by other higher priority listing actions (Service 2010).

Distribution: The delta smelt is endemic to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta) in California, and is restricted to the area from San Pablo Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties (Moyle 2002). Their range extends from San Pablo Bay upstream to Verona on the Sacramento River and Mossdale on the San Joaquin River. The delta smelt was formerly considered to be one of the most common pelagic fish in the upper Sacramento-San Joaquin Estuary.

Description: Live delta smelt are nearly translucent with a steely-blue sheen to their sides and have been characterized to have a pronounced odor reminiscent of cucumber (Moyle 2002). Although delta smelt have been recorded to reach lengths of up to 120 millimeters (mm) (4.7 in) (Moyle 2002), mean fork length of the delta smelt from 1974 to 1991 was measured to be 64.1 ± 0.1 mm. Since then, catch data from 1992 - 2004 showed mean fork length decreased to 54.1 ± .01 mm (Bennett 2005; Sweetnam 1999). Delta smelt are also identifiable by their relatively large eye to head size (Moyle 2002). Delta smelt have a small, translucent adipose fin located between the dorsal and caudal fins.

The delta smelt is one of six species currently recognized in the *Hypomesus* genus (Bennet 2005). Genetic analyses have confirmed that *H. transpacificus* presently exists as a single intermixing population (Stanley *et al.* 1995; Trenham *et al.* 1998; Fisch *et al.* 2011). Within the genus, delta smelt is most closely related to surf smelt (*H. pretiosis*), a species common along the western coast of North America. Despite morphological similarities, the delta smelt is less-closely related to the wakasagi (*H. nipponensis*), an andadromous western Pacific species introduced to Central Valley reservoirs in 1959, and may be seasonally sympatric with delta smelt in the estuary (Trenham *et al.* 1998). Allozyme studies have demonstrated that wakasagi and delta smelt are genetically distinct and presumably derived from different marine ancestors (Stanley *et al.* 1995).

Life History and Biology

Adult-Spawning: Adult delta smelt spawn during the late winter and spring months, with most spawning occurring during April through mid-May (Moyle 2002). Spawning occurs primarily in sloughs and shallow edge areas in the Delta. Delta smelt spawning has also been recorded in Suisun Marsh and the Napa River (Moyle 2002). Most spawning occurs at temperatures between 12-18°C. Although spawning may occur at temperatures up to 22°C, hatching success of the larvae is very low (Bennett 2005).

Fecundity of females ranges from about 1,200 to 2,600 eggs, and is correlated with female size (Moyle 2002). Moyle *et al.* (1992) considered delta smelt fecundity to be "relatively low." However, based on Winemiller and Rose (1992), delta smelt fecundity is fairly haigh for a fish its size. Captive delta smelt can spawn up to 4-5 times. While most adults do not survive to spawn a second season, a few (<5 percent) do (Moyle 2002; Bennett 2005). Those that do survive are typically larger (90-110 mm Standard Length[sdl]) females that may contribute disproportionately to the population's egg supply (Moyle 2002 and references therein). Two-year-old females may have 3-6 times as many ova as first year spawners.

Most of what is known about delta smelt spawning habitat in the wild is inferred from the location of spent females and young larvae captured in the California Department of Fish and Wildlife Spring Kodiak Trawl (SKT) and 20-mm Survey, respectively. In the laboratory, delta smelt spawned at night (Baskerville-Bridges *et al.* 2000; Mager *et al.* 2004). Other smelts, including marine beach spawning species and estuarine populations and the landlocked Lake Washington longfin smelt, are secretive spawners, entering spawning areas during the night and leaving before dawn. If this behavior is exhibited by delta smelt, then delta smelt distribution based on the SKT, which is conducted during daylight hours in offshore habitats, may reflect general regions of spawning activity, but not actual spawning sites.

Delta smelt spawning has only been directly observed in the laboratory and eggs have not been found in the wild. Consequently, what is known about the mechanics of delta smelt spawning is derived from laboratory observations and observations of related smelt species. Delta smelt eggs are 1 mm diameter and are adhesive and negatively buoyant (Moyle 1976, 2002; Mager *et al.* 2004; Wang 1986, 2007). Laboratory observations indicate that delta smelt are broadcast spawners, discharging eggs and milt close to the bottom over substrates of sand and/or pebble in current (DWR and Reclamation 1994; Brown and Kimmerer 2002; Lindberg *et al.* 2003; Wang 2007). Spawning over gravel or sand can also aid in the oxygenation of delta smelt eggs. Eggs that may have been laid in silt or muddy substrates might get buried or smothered, preventing their oxygenation from water flow (Lindberg pers. comm. 2011). The eggs of surf smelts and other beach spawning smelts adhere to sand particles, which keeps them negatively buoyant but not immobile, as the sand may move ("tumble") with water currents and turbulence (Hay 2007). It is not known whether delta smelt eggs "tumble incubate" in the wild, but tumbling of eggs may moderately disperse them, which might induce predation risk within a localized area.

The locations in the Delta where newly hatched larvae are present, most likely indicates spawning occurrence. The 20-mm trawl has captured small (~5 mm sdl) larvae in Cache Slough, the lower Sacramento River, San Joaquin River, and at the confluence of these two rivers (e.g., 20-mm trawl survey 1 in 2005). Larger larvae and juveniles (size > 23 mm sdl), which are more efficintly sampled by the 20-mm trawl gear, have been captured in Cache Slough and the Sacramento Deep Water Ship Channel in July (e.g. 20-mm trawl survey 9 in 2008). Because they are small fish inhabiting pelagic habitats with strong tidal and river currents, delta smelt larval distribution depends on both the spawning area from which they originate and the effect of transport processes caused by flows. Larval distribution is further affected by water salinity and temperature. Hydrodynamic simulations reveal that tidal action and other factors may cause substantial mixing of water with variable salinity and temperature among regions of the Delta (Monson *et al.* 2007). This could result in rapid dispersion of larvae away from spawning sites.

The timing of spawning may affect delta smelt population dynamics. Lindberg (2011) has suggested that smelt larvae that hatch early, around late February, have an advantage over larvae hatched during late spawning in May. Early season larvae have a longer growing season and may be able to grow larger faster during more favorable habitat conditions in the late winter and early spring. An early growing season may result in higher survivorship and a stronger spawning capability for that generation. Larvae hatched later in the season have a shorter growing season which effectively reduces survivorship and spawning success for the following spawning season.

Larval Development: Mager *et al.* (2004) reported that embryonic development to hatching takes 11-13 days at 14-16° C for delta smelt, and Baskerville-Bridges *et al.* (2000) reported hatching of delta smelt eggs after 8-10 days at temperatures between 15-17° C. Lindberg *et al.* (2003) reported high hatching rates of delta smelt eggs in the laboratory at 15° C, and Wang (2007) reported high hatching rates at temperatures between 14-17° C. Hatching success peaks near 15°C (Bennett 2005) and swim bladder inflation occurring at 60-70 days post hatch at 16-17°C (Mager *et al.* 2004). At hatching and during the succeeding three days, larvae are buoyant, swim actively near the water surface, and do not react to bright direct light (Mager *et al.* 2004). As development continues, newly hatched delta smelt become semi-buoyant and sink in stagnant water. However, larvae are unlikely to encounter stagnant water in the wild.

Growth rates of wild-caught delta smelt larvae are faster than laboratory-cultured individuals. Mager *et al.* (2004) reported growth rates of captive-raised delta smelt reared at near-optimum temperatrues (16-17°C). Their fish were about 12 mm long after 40 days and about 20 mm long after 70 days. In contrast, analyses of otoliths indicated that wild delta smelt larvae were 15-25 mm, or nearly twice as long at 40 days of age (Bennett 2005). By 70 days, most wild fish were 30-40 mm long and beyond the larval stage. This suggests there is a strong selective pressure for rapid larval growth in nature, a situation that is typical for fish in general (Houde 1987). Successful feeding seems to depend on a high density of food organisms and turbidity, and increases with stronger light conditions (Baskerville-Bridges *et al.* 2000; Mager *et al.* 2004; Baskerville-Bridges *et al.* 2004). The food available to larval fishes is constrained by mouth gape and status of fin development. Larval delta smelt cannot capture as many kinds of prey as larger individuals, but all life stages have small gapes that limit their range of potential prey. Prey availability is also constrained by habitat use, which affects what types of prey are encountered. Larval delta smelt are visual feeders. They find and select individual prey organisms and their ability to see prey in the water is enhanced by turbidity (Baskerville-Bridges *et al.* 2004). Thus, delta smelt diets are largely comprised of small crustacea that inhabit the estuary's turbid, low-salinity, open-water habitats (i.e., zooplankton). Larval delta smelt have particularly restricted diets (Nobriga 2002). They do not feed on the full array of zooplankton with which they co-occur; they mainly consume three copepods, *Eurytemora affinis*, *Pseudodiaptomus forbesi*, and freshwater species of the family Cyclopidae. Further, the diets of first-feeding delta smelt larvae are largely restricted to the larval stages of these copepods; older, larger life stages of the copepods are increasingly targeted as the delta smelt larvae grow, their gape increases, and they become stronger swimmers.

The triggers for and duration of delta smelt larval movement from spawning areas to rearing areas are not known. Hay (2007) noted that eulachon larvae are probably flushed into estuaries from upstream spawning areas within the first day after hatching, but downstream movement of delta smelt larvae occurs much later. Most larvae gradually move downstream toward the two parts per thousand (ppt) isohaline (X2). X2 is scaled as the distance in kilometers from the Golden Gate Bridge (Jassby *et al.* 1995).

At all life stages, delta smelt are found in greatest abundance in the water column and usually not in close association with the shoreline. They inhabit open, surface waters of the Delta and Suisun Bay, where they presumably aggregate in loose schools where conditions are favorable (Moyle 2002). In years of moderate to high Delta outflow (above normal to wet water years), delta smelt larvae are abundant in the Napa River, Suisun Bay and Montezuma Slough, but the degree to which these larvae are produced by locally spawning fish versus the degree to which they originate upstream and are transported by tidal currents to the bay and marsh is uncertain.

Juveniles: Young-of-the-year delta smelt rear in the low-salinity zone (LSZ) from late spring through fall and early winter. Once in the rearing area growth is rapid, and juvenile fish are 40-50 mm sdl long by early August (Erkkila *et al.* 1950; Ganssle 1966; Radtke 1966). They reach adult size (55-70 mm sdl) by early fall (Moyle 2002). Delta smelt growth during the fall months slows considerably (only 3-9 mm total), presumably because most of the energy ingested is being directed towards gonadal development (Erkkila *et al.* 1950; Radtke 1966).

Delta Smelt Population Dynamics and Abundance Trends

As a consequence of channelization, water operations, and agriculture in the Delta there has been a change to the physical appearance, water salinity, water clarity, and hydrology in the Delta such that most life stages of the delta smelt are now distributed across a smaller area than historically (Arthur *et al.* 1996; Feyrer *et al.* 2007). Wang (1991) noted in a 1989 and 1990 study of delta smelt larval distribution that, in general, the San Joaquin River was used more intensively for spawning than the Sacramento River. Nobriga *et al.* (2008) found that delta smelt capture probabilities in the Summer Townet Survey (TNS) are highest at specific conductance levels of 1,000 to 5,000 $\mu S\ cm^{-1}$ (approximately 0.6 to 3.0 practical salinity unit [psu]). Similarly, Feyrer *et al.* (2007) found a decreasing relationship between abundance of delta smelt in the Fall Midwater Trawl (FMWT) and specific conductance during September through December. The location of the low salinity zone (LSZ) and changes in delta smelt habitat quality in the San Francisco Estuary can be indexed by changes in X2. The LSZ historically had the highest primary productivity and is where zooplankton populations (on which delta smelt feed) were historically most dense (Knutson and Orsi 1983; Orsi and Mecum 1986). However, this has not always been true since the invasion of the overbite clam (Kimmerer and Orsi 1996). The abundance of many local aquatic species has tended to increase in years when winter-spring outflow has high and Z2 was pushed seaward (Jassby *et al.* 1995), implying that the quantity and quality (overall suitability) of estuarine habitat increases in years when outflows are high. However, delta smelt is not one of the species whose abundance has statistically covaried with winter-spring freshwater flows (Stevens and Miller 1983; Moyle *et al.* 1992; Kimmerer 2002a; Bennett 2005).

The distribution of juvenile delta smelt has also changed over the last several decades. During the years 1970 through 1978, delta smelt catches in the TNS survey declined rapidly to zero in the Central and South Delta and have remained near zero since. A similar shift in FMWT catches occurred after 1981 (Arthur *et al.* 1996). This portion of the Delta has also had a long-term trend increase in water clarity during July through December (Arthur *et al.* 1996; Feyrer *et al.* 2007; Nobriga *et al.* 2008).

The CDFW has conducted several long-term monitoring surveys that have been used to index the relative abundance of delta smelt. The 20-mm Survey has been conducted every year since 1995. This survey targets late-stage delta smelt larvae. Most sampling has occurred April-June. The TNS has been conducted nearly every year since 1959. This survey targets 38-mm striped bass, but collects similar-sized juvenile delta smelt. Most sampling has occurred June-August. The Fall Midwater Trawl Survey has been conducted nearly every year since 1967. This survey also targets age-0 striped bass, but collects delta smelt > 40 mm in length. The FMWT samples monthly, September-December. The relative abundance index data and maps of the sampling stations used in these surveys are available at http://www.CDFW.ca.gov/delta/. The methods that underlie the surveys have been described previously (Stevens and Miller 1983; Moyle *et al.* 1992; Dege and Brown 2004). The delta smelt catch data and relative abundance indices derived from these sampling programs have been used in numerous publications (e.g., Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995; Kimmerer 2002b; Dege and Brown 2004; Bennett 2005; Feyrer *et al.* 2007; Sommer *et al.* 2007; Kimmerer 2008; Newman 2008; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; Mac

Nally *et al.* 2010; Thomson *et al.* 2010; Feyrer *et al.* 2011; Maunder and Deriso 2011). These abundance index time series document the long-term decline of the delta smelt.

Early statistical assessments of delta smelt population dynamics concluded that at best, the relative abundance of the adult delta smelt population had only a very weak influence on subsequent juvenile abundance (Sweetnam and Stevens 1993). Thus, early attempts to describe abundance variation in delta smelt ignored stock-recruit effects and researchers looked for environmental variables that were directly correlated with interannual abundance variation (e.g., Stevens and Miller 1983; Moyle *et al.* 1992; Sweetnam and Stevens 1993; Herbold 1994; Jassby *et al.* 1995). Because delta smelt live in a habitat that varies in size and quality with Delta outflow, the authors cited above searched for a linkage between Delta outflow (or X2) and the TNS and FMWT indices. Generally, these analyses did not find strong support for an outflow-abundance linkage. These analyses led to a prevailing conceptual model that multiple interacting factors had caused the delta smelt decline (Moyle *et al.* 1992; Bennett and Moyle 1996; Bennett 2005). It has also recently been noted that delta smelt's FMWT index is partly influenced by explanation for why few analyses could consistently link springtime environmental conditions to delta smelt's fall index.

One published exception to the multi-factor hypothesis was proposed by Gilbert (2010), who posited that nutrient pollution was the root cause of all the food web and fish assemblage changes that caused the decline of delta smelt and other pelagic fishes. However, the statistical approach she used to support her hypothesis was not appropriate and the untransformed data sets do not support this hypothesized chain of consequences stemming solely from wastewater inputs to the Delta (Jassby *et al.* in press). It is now recognized that delta smelt abundance plays an important role in subsequent abundance (Bennett 2005; Maunder and Deriso 2011). Bennett (2005) assessed (1) the influence of adult stock as indexed by the FMWT versus the next generation of juveniles indexed by the following calendar year's TNS; (2) the influence of the juvenile stock indexed by the TNS versus the subsequent adult stock indexed a few months later in the FMWT; (3) the influence of the FMWT on the following year's FMWT and on the FMWT two years later, and (4) he did the same for the TNS data. He concluded that (1) two-year-old delta smelt might play an important role in delta smelt population dynamics, (2) it was not clear wheter juvenile production was a density-independent or density-dependent function of adult abundance, and (3) adult production was a density-dependent function of juvenile abundance and the carrying capacity of the estuary to support this life-stage transition had declined over time. These conclusions are also supported by Maunder and Deriso (2011).

The concept of density-dependence and how it has affected the delta smelt is important because it may be used as a reason not to protect particular life stages from sources of mortality. Bennet (2005) concluded it was (statistically) unclear whether density-dependence occurs between generations. He also noted that the delta smelt indices strongly suggest that density-dependence has occurred, at least over the long-term, during the juvenile stage. The uncertainty about density-dependence between generations results because statistical assessments of the relationship between the adult stock and the next generation of recruits (juveniles_ result in similar fits for linear (density-independent) and nonlinear (density-dependent) relationships (Bennett 2005; Maunder and Deriso 2011).

One reason for this is that delta smelt population dynamics may have changed over time. Previous papers have reported a delta smelt step-decline during 1981-1982 (Kimmerer 2002a; Thomson *et al.* 2010). Prior to this decline, the stock-recruit data are consistent with "Ricker" type density-dependence where increasing adult abundance resulted in decreased juvenile abundance. Since the decline, recruitment has been positively and essentially linearly related to prior adult abundance, suggesting that reproduction has been basically density-independent for about the past 30 years.

This means that since the early 1980s, more adults translates into more juveniles and fewer adults translates into fewer juveniles without being 'compensated for' by density-dependence. In contrast to the transition among generations, the weight of scientific evidence strongly supports the hypothesis that, at least over the history of Interagency Ecological Program (IEP) fish monitoring, delta smelt has experienced density-dependence during the juvenile stage of its life cycle, i.e., between the summer and fall (Bennett 2005; Maunder and Deriso 2011). This has been inferred because, statistically, the FMWT index does not increase linearly with increases in the summer townet index. Rather, the best-fitting relationships between the summer townet index and the FMWT index show that the FMWT indices approach an asymptote as the summer townet increases or possibly even declines at the highest summer townet indices.

From a species conservation perspective, the most relevant aspect of this juvenile density dependence is that the carrying capacity of the estuary for delta smelt has declined (Bennett 2005). Thus, the delta smelt population decline has occurred for two basic reasons. First, the compensatory density-dependence that historically enabled juvenile abundance to rebound from low adult numbers stopped happening. This change had occurred by the early 1980s as described above. The reason is still not known, but the consequence of the change is that for the past several decades, adult abundance drives juvenile production in a largely density-independent manner. Thus, if numbers of adults or adult fecundity decline, juvenile production will also decline (Kimmerer 2011). Second, because juvenile carrying capacity has declined, juvenile production hits a 'ceiling' at a lower abundance than it once did. This limits adult abundance and possibly per capita fecundity, which cycles around and limits the abundance of the next generation of juveniles. The mechanism causing carrying capacity to decline is likely due to the long-term accumulation of deleterious habitat changes, both physical and biological, during the summer-fall (Bennett *et al.* 2008; Feyrer *et al.* 2007; 2011; Maunder and Deriso 2011).

Habitat

The existing physical appearance and hydrodynamics of the Delta have changed substantially from the environment in which native fish species like delta smelt evolved. The Delta once consisted of tidal marshes with networks of diffuse dendritic channels connected to floodplains of wetlands and upland areas (Moyle 2002). The in-Delta channels were further connected to drainages of larger and smaller rivers and creeks entering the Delta from the upland areas. In the absence of upstream reservoirs, freshwater inflow from smaller rivers and creeks and the Sacramento and San Joaquin Rivers were highly seasonal and more strongly and reliably affected by precipitation patterns than they are today. Consequently, variation in hydrology, salinity, turbidity, and other characteristics of the Delta aquatic ecosystem was greater in the past than it is today (Kimmerer 2002a). For instance, in the early 1900s, the location of maximum salinity intrusion into the Delta during dry periods varied from Chipps Island in the lower Delta to Stockton along the San Joaquin River and Merritt Island in the Sacramento River. Operations of upstream reservoirs have reduced spring flows while releases of water for Delta water export and increased flood control storage have increased late summer and fall inflows (Knowles 2002), though Delta outflows have been tightly constrained during late summer-fall for several decades. The following is a brief description of the changes that have occurred to delta smelt's habitat that are relevant to the environmental baseline for this consultation.

Changes to the LSZ: There have been documented changes to the delta smelt's LSZ habitat that have led to present-day, baseline habitat conditions. The close association of delta smelt with the San Francisco estuary LSZ has been known for many years (Stevens and Miller 1983; Moyle *et al.* 1992). Peterson (2003) developed a conceptual model that hypothesized how, "stationary and dynamic components of estuarine habitats" interacted to influence fisheries production in tidal river estuaries.

Peterson's model suggests that when the dynamic and static aspects of estuarine habitat sufficiently overlap, foraging, growth, density, and survival are all high, and that enables fish production to outpace losses to predators. The result is high levels of successful recruitment of new individuals. The model also hypothesizes that when the dynamic and static aspects of an estuarine habitat do not sufficiently overlap, foraging, growth, density, and survival are impaired such that losses to predators increase and recruitment of new individuals decreases. This model was developed specifically for species spawned in marine environments that were subsequently transported into estuaries. However, the concept of X2, which was developed in the San Francisco estuary to describe how freshwater flow affected estuarine habitat (Jassby *et al.* 1995), played a role in the intellectual development of Peterson's model. The Peterson model also provides a useful framework to conceptualize delta smelt's LSZ habitat.

Currently available information indicates that delta smelt habitat is most suitable for the fish when low-salinity water is near 20°C, highly turbid, oxygen saturated, low in contaminants, supports high densities of calanoid copepods and mysid shrimp (Moyle *et al.* 1992; Lott 1998; Nobriga 2002), and occurs over comparatively static 'landscapes' that support sandy beaches and bathymetric variation that enables the fish and their prey to aggregate (Kimmerer *et al.* 2002a; Bennett *et al.* 2002; Hobbs *et al.* 2006). Almost every component listed above has been degraded over time (see below). The Service has determined that this accumulation of habitat change is the fundamental reason or mechanism that has caused delta smelt to decline.

Alterations to estuarine bathymetry and salinity distribution (~ 1850-present): The position of the LSZ, where delta smelt rear, has changed over the years. The first major change in the LSZ was the conversion of the landscape over which tides oscillate and river flows vary (Moyle *et al.* 2010). The ancestral Delta was a large tidal marsh-floodplain habitat totaling approximately 700,000 acres. Most of the historic wetlands within the system were diked and reclaimed for agriculture or other human uses by 1920 (Atwater *et al.* 1979). Channels were dredged deep (~12 meters[m]) to accommodate shipping traffic from the Pacific Ocean and San Francisco Bay to ports in Sacramento and Stockton. These changes left Suisun Bay and the confluence of the Sacramento-San Joaquin Rivers as the largest and most bathymetrically variable places in the LSZ. This region remained a highly productive nursery for many decades (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995). However, the deepened channels created to support shipping and flood control, requires more freshwater outflow to maintain the LSZ in the large Suisun Bay and River confluence than was once required (Gartrell 2010). The construction of the CVP and SWP not only provided water supply for urban, agricultural and industrial users, but also provided water needed to combat salinity intrusion into the Delta, which was observed by the early 20th century. California's demand for freshwater (keeps) continues to increase, thus seasonal salinity intrusion perpetually reduces the temporal overlap of the LSZ (indexed by X2) within the Suisun Bay (region), especially in the fall (Feyrer *et al.* 2007; 2011). Consequently, the second major habitat change in the Delta has been in the frequency with which the LSZ is maintained in Suisun Bay for any given amount of precipitation. There was a step-decline in the LSZ in 1977 from which it has never recovered for more than a few years at a time. Based on model forecasts of climate change and water demand, this trend is expected to continue (Feyrer *et al.* 2011).

Summer and fall environmental quality has decreased overall in the Delta because outflows are lower and water transparency is higher. These changes may be due to increased upstream water diversions for flooding rice fields (Kawakami *et al.* 2008). The confluence of the Sacramento and San Joaquin Rivers has, as a result, become increasingly important as a rearing location for delta smelt, with physical environmental conditions constricting the species range to a relatively narrow area (Feyrer *et al.* 2007; Nobriga *et al.* 2008). This has increased the likelihood that most of the juvenile population is exposed to chronic and cyclic environmental stressors, or catastrophic events. For instance, all seven delta smelt collected during the September 2007 FMWT survey were captured at statistically significantly higher salinities than what would be expected based upon historical distribution data generated by Feyrer *et al.* (2007). During the same year, the annual bloom of toxic cyanobacteria (Microcystis aeruginosa) spread far downstream to the west Delta and beyond during the summer (Peggy Lehman, pers comm). This has been suggested as an explanation for the anomaly in the distribution of delta smelt relative to water salinity levels (US Bureau of Reclamation 2008).

Bank Protection (Levees): The placement of riprap bank protection has led to the loss of riparian habitat, large woody debris, shallow water habitat, and natural channel migration. Bank stabilization and riprapping has been shown to change natural river processes such as erosion and accretion which reduces habitat complexity; creates a smooth, hydraulically enhanced surface that is not conducive to the habitat requirements of fish including delta smelt; stops woody vegetation from entering the river and reduces the long-term recruitment of large woody debris; inhibits plant growth through a change is substrate; lowers the amount of outside food sources because of the lack of riparian and wetland vegetation for aquatic invertebrates; and increases stream edge velocities which decreases available refuge areas for fish (Service 2000). More than half of the Sacramento River's lower 194 miles have been riprapped, mostly under the Corps Sacramento River bank Protection Project. Today most of the riparian forests and wetlands have been removed and the Sacramento River has been constrained to not allow natural erosion and accretion to occur.

Turbidity: From 1999 to present, the Delta experienced a change in estuarine turbidity that culminated in an estuary-wide step-decline in 1999 (Schoellhamer 2011). For decades, the turbidity of the modified estuary had been sustained by very large sediment deposits resulting mainly from gold mining in the latter 19th century. Sediments continued to accumulate into the mid-20th century, keeping the water relatively turbid even as sediment loads from the Sacramento River basin declined due to dam and levee construction (Wright and Schoellhamer 2005). The flushing of the sediment deposits may also have made the estuary deeper overall and thus a less suitable nursery from the 'static' bathymetric perspective (Schroeter 2008).

Delta smelt are associated with highly turbid waters; there is a negative correlation between the frequency of delta smelt occurrence in survey trawls during the summer, fall and early winter and water clarity. For example, the likelihood of delta smelt occurrence in trawls at a given sampling station decreases with increasing Secchi depth at the stations (Feyrer *et al.* 2007, Nobriga *et al.* 2008). This is very consistent with behavioral observations of captive delta smelt (Nobriga and Herbold 2008). Few daylight trawls catch delta smelt at Secchi depths over 0.5 m and capture probabilities for delta smelt are highest at 0.40 m depth or less. First-feeding delta smelt larvae require relatively turbid (muddy) waters to capture prey, but older fish do not require turbidity to capture prey and very high turbidity may even have some inhibitory effect on prey consumption (Hasenbein *et al.* 2013). Delta smelt may also use turbidity as cover from predators; this was hypothesized based on long-term monitoring of the distribution of fish in the wild (e.g., Feyrer *et al.* 2007) and recently supported by a laboratory experiment (Ferrari *et al.* 2014).

Temperature: Temperature also affects delta smelt distribution. Swanson and Cech (1995) and Swanson *et al.* (2000) indicate delta smelt tolerate temperatures (<8° C to >25° C), however warmer water temperatures >25° C restrict their distribution more than colder water temperatures (Nobriga and Herbold 2008). Delta smelt of all sizes are found in the main channels of the Delta and Suisun Marsh and the open waters of Suisun Bay where the water is well oxygenated and temperatures are usually less than 25° C in summer (Nobriga *et al.* 2008). Currently, delta smelt are subjected to thermally stressful temperatures every summer, and all available regional climate change projections predict central California will be warmer still in the coming decades (Dettinger 2005). We expect warmer estuary temperatures to be yet another significant conservation challenge based on climate change models. Warmer water temperatures would increase delta smelt mortality and constrict suitable habitat throughout the Delta during the summer months. Higher temperatures would shrink delta smelt distribution into the fall, limiting their presence to Suisun Bay and in waters with less than optimal salinities (Brown *et al.* 2013). Water temperatures are presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding the nominal lethal limit of 25°C for short periods. Coldwater fishes begin to have behavioral impairments (Marine and Cech 2004) and lose competitive abilities (Taniguchi *et al.* 1998) prior to reaching their thermal tolerance limits. Thus, the estuary can already be considered thermally stressful to delta smelt and can only become more so if temperatures warm in the coming decades.

Foraging Ecology: Delta smelt feed primarily on small planktonic crustaceans, and occasionally on insect larvae (Moyle 2002). Juvenile-stage delta smelt prey upon copepods, cladocerans, amphipods, and insect larvae (Moyle 2002). Historically, the main prey of delta smelt was the euryhaline copepod *Eurytemora affinis* and the euryhaline mysid *Neomysis mercedis.* The slightly larger *Pseudodiaptomus forbesi* has replaced *E. affinis* as a major prey source of delta smelt since its introduction into the Bay-Delta, especially in summer, when it replaces *E. affinis* in the plankton community (Baxter *et al.* 2008; Moyle 2002). The most common copepod in the estuary now is a small nonnative species, *Limnoithona tetraspina.* It has been suggested that *L. tetraspina* may be an inferior food for pelagic fishes including delta smelt because of its small size and generally sedentary behavior (Bouley and Kimmerer 2006). Experimental studies addressing this issue have suggested that smelt larvae will attack *L. tetraspina* until they grow large enough to successfully capture larger copepods; also, growth rate of delta smelt fed *L. tetraspina* was lower than that of smelt fed the larger copepods (Sullivan *et al.*, unpublished). *L. tetraspina* is sometimes consumed in large numbers by juvenile delta smelt during late summer when this copepod is abundant in the LSZ (Slater and Baxter 2014). *Acartiella sinensis*, a calanoid copepod species that invaded the Delta at the same time as *L. tetraspina*, also occurs at high densities in Suisun Bay and in the western Delta over the last decade. Delta smelt eat these newer copepods, but *Pseudodiaptomus* remains their dominant prey (Baxter *et al.* 2008).

River flows influence estuarine salinity gradients and water residence times and thereby affect both habitat suitability for benthos and the transport of pelagic plankton upon which delta smelt feed. High tributary flow leads to lower residence time of water in the Delta, which generally results in lower plankton biomass (Kimmerer 2004). In contrast, higher residence times, which result from low tributary flows, can result in higher plankton biomass but water diversions, overbite clam grazing (Jassby *et al.* 2002) and possibly contaminants (Baxter *et al.* 2008) remove a lot of plankton biomass when residence times are high. These factors all affect food availability for planktivorous fishes that utilize the zooplankton in Delta channels. Delta smelt cannot occupy much of the Delta anymore during the summer (Nobriga *et al.* 2008). Thus, there is the potential for mismatches between regions of high zooplankton abundance in the Delta and delta smelt distribution now that the overbite clam has decimated LSZ zooplankton densities.

The delta smelt compete with and are prey for several native and introduced fish species in the Delta. The introduced Mississippi silverside may prey on delta smelt eggs and/or larvae and compete for copepod prey (Bennett and Moyle 1996; Bennett 2005). Young striped bass also use the LSZ for rearing and may compete for copepod prey and eat delta smelt. Centrarchid fishes and coded wire tagged Chinook salmon smolts released in the Delta for survival experiments since the early 1980s may potentially also prey on larval delta smelt (Brandes and McLain 2001; Nobriga and Chotkowski 2000). Studies during the early 1960s found delta smelt were only an occasional prey fish for striped bass, black crappie and white catfish (Turner and Kelley 1966). However, delta smelt were a comparatively rare fish even then, so it is not surprising they were a rare prey. Striped bass appear to have switched to piscivorous feeding habits at smaller sizes than they historically did, following severe declines in the abundance of mysid shrimp (Feyrer *et al.* 2003). Nobriga and Feyrer (2008) showed that Mississippi silverside, which is similar in size to delta smelt, was only eaten by subadult striped bass less than 400-mm fork length. While largemouth bass are not pelagic, they have been shown to consume some pelagic fishes (Nobriga and Feyrer 2007).

Other Stressors

Aquatic Macrophytes: For many decades, the Delta's waterways were turbid and growth of submerged plants was apparently unremarkable. That began to change in the mid-1980s, when the Delta was invaded by the non-native plant, *Egeria densa*, a fast-growing aquatic macrophyte that has now taken hold in many shallow habitats throughout the Delta (Brown and Michnuik 2007; Hestir 2010). *Egeria densa* and other non-native species of submerged aquatic vegetation (SAV) grow most rapidly in the summer and late fall when water temperatures are warm (> 20°C) and outflow is relatively low (Hestir 2010). The large canopies formed by these plants have physical and biological consequences for the ecosystem (Kimmerer *et al.* 2008). First, the dense nature of SAV promotes sedimentation of particulate matter from the water column, which increases water transparency that then limits the amount of habitat available for delta smelt (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Second, dense SAV canopies provide habitat for a suite of non-native fishes that occupy the littoral and shallow habitats of the Delta, displacing native fishes (Nobriga *et al.* 2005; Brown and Michniuk 2007). Finally, the rise in SAV colonization over the last three decades has led to a shift in the dominant trophic pathways that fuel fish production in the Delta. Until the latter 1980s, the food web of most fishes was often dominated by mysid shrimp (Feyrer *et al.* 2003) that were subsidized by phytoplankton food sources (Rast and Sutton 1989). Now, most littoral and demeral fishes of the Delta have diets dominated by the epibenthic amphipods that eat SAV detritus or the epiphytic algae attached to SAV (Grimaldo *et al.* 2009).

E. densa and other non-native submerged aquatic vegetation (e.g., *Myriophyllum spicatum*) can affect delta smelt in direct and indirect ways. Directly, submerged aquatic vegetation can over whelm littoral habitats (inter-tidal shoals and beaches) where delta smelt may spawn making them unsuitable for spawning. Indirectly, submerged aquatic vegetation decreases turbidity (by trapping suspended sediment) which has contributed to a decrease in both juvenile and adult smelt habitat (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Increased water transparency may delay feeding and may also make delta smelt more susceptible to predation pressure.

Predators: Delta smelt is a rare fish and has been a rare fish (compared to other species) for at least the past several decades (Nobriga and Herbold 2008). Therefore, it has also been rare in examinations of predator stomach contents. Delta smelt were occasional prey fish for striped bass, black crappie, and white catfish in the early 1960s (Turner and Kelly 1966) but went undetected in a recent study of predator stomach contents (Nobriga and Feyrer 2007). The predator with the highest historical documentation of predation on delta smelt is striped bass (*Morone saxatilis*, Stevens 1963; 1966; Thomas 1967). In these studies, striped bass were confirmed to prey on both juvenile and adult delta smelt. Striped bass are widely distributed in pelagic areas of the San Francisco Bay-Delta and parts of its watershed, and thus striped bass distribution fully encompasses the distribution of delta smelt juveniles and adults (Nobriga *et al.* 2013). Striped bass also tend to aggregate in the vicinity of water diversion structures, where delta smelt are frequently entrained (Nobriga and Feyrer 2007). No inverse correlations between the abundance of striped bass and the relative abundance of delta smelt have been found to date using a variety of statistical approaches (Mac Nally et al 2010; Thomson *et al.* 2010; Maunder and Deriso 2011; Miller *et al.* 2012; Nobriga et al 2013). Although the relative rarity of delta smelt in the estuary food web would presumably make them a n incidental prey item for striped bass, it is possible that striped bass abundance and demand for prey are always high enough to limit delta smelt population growth rate (Nobriga *et al.* 2013).

Fish eggs and larvae can be opportunistically preyed upon by many invertebrate and vertebrate animals. There has always been a very long list of potential predators of delta smelt's eggs and larvae. One of these is the nonnative Mississippi silverside (*Menidia audens*), which like delta smelt is and annual fish with a maximum length near 100 mm (4 inches). Mississippi silversides may be both predators and competitors of delta smelt (Bennett 2005). Mississippi silversides were first introduced to the San Francisco Bay-Delta in the mid-1970s, and have increased dramatically in numbers since the mid-1980s. They forage in schools around the shoreline habitats and tidal marsh channels of the San Francisco Bay-Delta, where they are exceptionally common (Matern *et al.* 2002); Nobriga *et al.* 2005; Gewant and Bollens 2012). They readily consume delta smelt larvae in aquarium tests Bennett (20025_ concluded that "delta smelt are at high risk of eggs or larvae co-occur with schools of foraging silversides."

Another known predator is the largemouth bass are freshwater fish that prefer clear waters along shorelines (littoral habitat) with relatively dense water plants (Nobriga and Feyrer 2007; Brown and Michniuk 2007; Baxter *et al.* 2008). This is a suite of habitat characteristics that is distinctly different from those described above for delta smelt. Thus, unlike delta smelt and striped bass, delta smelt and largemouth bass have different habitat requirements (e.g., Nobriga *et al.* 2005) and their distributions do not strongly overlap. However, there has been a major increase in the Delta's largemouth bass population since the early 1990's that is believed to have been facilitated by the spread of the introduced plant *Egeria densa*, which provides rearing habitat for the bass (Baxter *et al.* 2008). Despite increases in largemouth bass populations and habitat, Nobriga and Feyrer (2007) did not find delta smelt as largemouth bass prey. Nor have more recent and extensive surveys of largemouth bass stomach contents. In captivity however, even young juvenile largemouth bass will attempt to consume delta smelt (Ferrari *et al.* 2014) so they presumably represent a predation threat when the species closely co-occur in the wild. In contrast to the situation for striped bass, several researchers have found inverse correlations between the relative abundance of largemouth bass or multi-species indices that included largemouth bass and the relative abundance of delta smelt (MacNally *et al.* 2010; Thomson *et al.* 2010; Maunder and Deriso 2011). At this time however, there is no way to determine whether these correlations are causative (predation by largemouth bass caused delta smelt to decline) or not (delta smelt simply use different habitats than largemouth bass and delta smelt habitat has decreased whil largemouth bass habitat has increased).

Other potential predators of eggs and larvae of smelt in littoral habitats are yelllowfin goby, entrarchids, and Chinook salmon. Potential native predators of juvenile and adult delta smelt would also have included numerous bird and fish species and this may be reflected in delta smelt's annual life-history. Annual fish species, also known as "opportunistic strategists", are adapted to high mortality rates in the adult stage (Winemiller and Rose 1992). This high mortality is usually due to predation or highly unpredictable environmental conditions, both of which could have characterized the ancestral niche of delta smelt.

Predation is a common source of density-dependent mortality in fish populations (Rose *et al.* 2001). Thus, it is possible that predation was a mechanism that historically generated the density-dependence observable in delta smelt population dynamics that has been noted by Bennett (2005) and Maunder and Deriso (2011). As is the case with other fishes, the vulnerability of delta smelt to predators may be influence primarily by habitat suitability. It is widely documented that pelagic fishes, including many smelt species, experience lower predation risks under turbid water conditions (Thetmeyer and Kils 1995; Utne-Palm 2002; Horpilla *et al.* 2004). Growth rates, a result of feeding success plus water temperature, are also well known to affect fishes' cumulative vulnerability to predation (Sogard 1997).

Competition: It has been hypothesized that delta smelt are adversely affected by competition from other introduced fish species that use overlapping habitats, including Mississippi silversides, (Bennett and Moyle 1995) striped bass, and wakasagi (Sweetnam 1999). Laboratory studies show that delta smelt growth is inhibited when reared with Mississippi silversides (Bennett 2005) but there is no empirical evidence to support the conclusion that competition between these species is a factor that influences the abundance of delta smelt in the wild. There is some speculation that the overbite clam competes with delta smelt for copepod nauplii (Nobriga and Herbold 2008). It is unknown how intensively overbite clam grazing and delta smelt directly compete for food, but overbite clam consumption of shared prey resources does have other ecosystem consequences that appear to have affected delta smelt indirectly.

Microcystis: Large blooms of toxic blue-green algae, *Microcystis aeruginosa*, were first detected in the Delta during the summer of 1999 (Lehman *et al.* 2005). Since then *M. aeruginosa* has bloomed each year, forming large colonies throughout most of the Delta and increasingly down into eastern Suisun Bay. Blooms typically occur between late spring and early fall (peak in the summer) when temperatures are above 20°C. *M. aeruginosa* can produce natural toxins that pose animal and human health risks if contacted or ingested directly. It is unclear whether microcystins and other toxins produced by local blooms are acutely toxic to fishes at current concentrations; however, the toxins accumulate in fish and their prey. During the summer of 2005, Age-0 striped bass and Mississippi silversides that were co-occurring with the *Microcystis* bloom showed various forms of liver damage (Lehman *et al.* 2010). When ingested with food, microcystins have been experimentally shown to cause substantial impairment of health in threadfin shad (Acuna *et al.* 2012). In addition, the copepods that delta smelt eat are particularly susceptible to these toxins (Ger 2008; Ger *et al.* 2010). An investigation of food web effects and fish toxicity concluded that even at low abundances, *M. aeruginosa* may impact estuarine fish productivity through both toxicity and food web impacts (Lehman *et al.* 2010). *M. aeruginosa* is most likely to affect juvenile delta smelt during summer blooms. Microcystis blooms may also decrease dissolved oxygen to lethal levels for fish (Saiki *et al.* 1998), although delta smelt do not strongly overlap the densest *Microcystis* concentrations, so dissolved oxygen is not likely a problem. *Microcystis* blooms are a symptom of eutrophication and high ammonia to nitrate ratios in the water.

Contaminants: Contaminants can change ecosystem functions and productivity through numerous pathways. However, contaminant loading and its ecosystem effects within the Delta are not well understood. Although a number of contaminant issues were first investigated during the Pelagic Organism Decline (POD) years, concern over contaminants in the Delta is not new. There are long-standing concerns related to mercury and selenium levels in the watershed, Delta, and San Francisco Bay (Linville *et al.* 2002; Davis *et al.* 2003). Phytoplankton growth rate may, at times, be inhibited by high concentrations of herbicides (Edmunds *et al.* 1999). New evidence indicates that phytoplankton growth rate is chronically inhibited by ammonium concentrations in and upstream of Suisun Bay (Wilkerson *et al.* 2006, Dugdale *et al.* 2007). Contaminant-related toxicity to invertebrates has been noted in water and sediments from the Delta and associated watersheds (e.g., Kuivila and Foe 1995, Giddings 2000, Werner *et al.* 2000, Weston *et al.* 2004). Undiluted drain water from agricultural drains in the San Joaquin River watershed can be acutely toxic (quickly lethal) to fish and have chronic effects on growth (Saiki *et al.* 1992).

Evidence for mortality of young striped bass due to discharge of agricultural drainage water containing rice herbicides into the Sacramento River (Bailey *et al.* 1994) led to new regulations for

water discharges. Bio assays using caged Sacramento sucker (Catostomus occidentalis) have revealed deoxyribonucleic acid strand breakage associated with runoff events in the watershed and Delta (Whitehead *et al.* 2004). Kuivila and Moon (2004) found that peak desities of larval and juvenile delta smelt sometimes coincided in time and space with elevated concentrations of dissolved pesticides in the spring. These periods of co-occurrence lasted for up to 2-3 weeks, but concentrations of individual pesticides were low and much less than would be expected to cause acute mortality. However, the effects of exposure to the complex mixtures of pesticides actually present are unknown.
Current science suggests the possible link between contaminants and the POD may be the effects of contaminant exposure on prey items, resulting in an indirect effect on the survival of POD species (Johnson *et al.* 2010). The POD investigators initiated several studies beginning in 2005 to address the possible role of contaminants and disease in the declines of Delta fish and other aquatic species. Their primary study consists of twice-monthly monitoring of ambient water toxicity at fifteen sites in the Delta and Suisun Bay. In 2005 and 2006, standard bioassays using the amphipod *Hyalella azteca* had low (<5 percent) frequency of occurrence of toxicity (Werner *et al.* 2008). The results indicated that 2007, a dry year, showed a higher incidence of toxic events than in the previous (wetter) year, 2006 (Werner *et al.* 2010). Parallel testing with the addition of piperonyl butoxide, an enzyme inhibitor, indicated that both organophosphate and pyrethroid pesticides may have contributed to the pulses of toxicity. Most of the tests that were positive for *H. azteca* toxicity have come from water samples from the lower Sacramento River.

Pyrethroids are of particular concern because of their widespread use, and their tendency to be genotoxic (DNA damaging) to fishes at low doses (in the range of micrograms per liter) (Campana *et al.* 1999). The pyrethroid esfenvalerate is associated with delayed spawning and reduced larval survival of bluegill sunfish (*Lepomis macrochirus*) (Tanner and Knuth 1996) and increased susceptibility of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) to disease (Clifford *et al.* 2005). In addition, synthetic pyrethroids may interfere with nerve cell function, which could eventually result in paralysis (Bradbury and Coats 1989; Shafer and Meyer 2004). Weston and Lydy (2010) found the largest source of pyrethroids flowing into the Delta to be coming from the Sacramento Regional Waste water Treatment Plant, where only secondary treatment occurs. Their data not only indicate the presence of these contaminants, but the concentrations found exceeded acute toxicity thresholds for the amphipod *Hyalella azteca*. This is of substantial concern because the use of insecticides flowing into the Delta. Furthermore, this was not the case for the Stockton Wastewater Treatment facility, where tertiary treatment occurs, suggesting that different treatment methods may remove or etain pyretroids differently (Baxter *et al.* 2010).

In conjunction with the POD investigation, larval delta smelt bioassays were conducted simultaneously with a subset of the invertebrate bioassays. The water samples for these tests were collected from six sites within the Delta during May-August of 2006 and 2007. Results from 2006 indicated that delta smelt are highly sensitive to high levels of ammonia, low turbidity, and low salinity. There is some preliminary indication that reduced survival may be due to disease organisms (Werner *et al.* 2008). No significant mortality of larval delta smelt was found in the 2006 bioassays, but there were two instances of significant mortality in June and July of 2007. In both cases, the water samples were collected from sites along the Sacramento River and had relatively low turbidity and salinity levels and moderate levels of ammonia. It is also important to note that no significant *H. azteca* mortality was detected in these water samples. While H. Azteca tests are very useful for detecting biologically relevant levels of water column toxicity for zooplankton, interpretation of the *H. azteca* test results with respect to fish should proceed with great caution. The relevance of the bioassay results to field conditions remains to be determined. Werner *et al.* (2010b) conducted *in situ* testing in the laboratory and compared contaminant sensitivity of delta smelt to common bioassay organisms, including *H. azteca*. The investigations included contaminants commonly observed in the

Delta, such as organophosphate and pyrethroid insecticides, copper, and total ammonia. In the laboratory, delta smelt were 1.8 to >11 times more sensitive thatn fathead minnow to ammonia, copper and all insecticides tested (except permethrin). The invertebrates tested were more sensitive to contaminants than delta smelt or fathead minnows. *Eurytemora affinis* and *Ceriodaphnia dubia* were the most sensitive to total ammonia. *C. dubia* was the most sensitive to copper and organophosphates pesticides. *H. azteca* was the most sensitive test organism to pyrethroids. Toxicity was not detected for the Sacramento River at Hood or the San Joaquin River at Rough and Ready Island during the 2009 in situ testing period. Delta smelt survival was low in treatment and control waters. Werner *et al.* (2010b) concluded that larval smelt may be too sensitive to salinity, temperature and transport stress for *in situ* exposures and recommended using surrogate species in future tests.

Persistent confinement of the spawning population of delta smelt to the Sacramento River increases the likelihood that a substantial portion of the spawners will be affected by a catastrophic event or localized chronic threat. For instance, large volumes of highly concentrated ammonia released into the Sacramento River from the Sacramento Regional County Sanitation District may affect embryo survival or inhibit prey production. Further, agricultural field in the Yolo Bypass and surrounding areas are regularly sprayed by pesticides, and water samples taken from Cache Slough sometimes exhibited toxicity to *H. azteca* (Werner *et al.* 2008; 2010). The thresholds of toxicity for delta smelt for most of the known contaminants have not been determined, but the exposure to a combination of different compounds increases the likelihood of adverse effects. The extent to which delta smelt larvae are exposed to contaminants varies with flow entering the Delta. Flow pulses during spawning increase exposure to many pesticides (Kuivila and Moon 2004) but decrease ammonia concentrations from wastewater treatment plants.

The POD investigations into potential contaminant effects also include the use of biomarkers that have been used previously to evaluate toxic effects on POD fishes (Bennett and Moyle 1996, Bennett 2005). The results to date have been mixed. A pathogen survey of 105 adult delta smelt, sampled from January through May, at several sites in the Delta, found that disease did not appear to overtly influence the health of the surveyed population for that year (Foott and Bigelow 2010). Histopathological and viral evaluation of young longfin smelt collected in 2006 indicated no histological abnormalities associated with exposure to toxics or disease (Foott *et al.* 2006). There was also no evidence of viral infection or high parasite loads. Similarly, young threadfin shad showed no histological evidence of contaminant effects or of viral infections (Foott *et al.* 2006). Parasites were noted in threadfin shad gills at a high frequency but the infections were not considered severe. Both longfin smelt and threadfin shad were considered healthy in 2006. Adult delta smelt collected from the Delta during the winter of 2005 also were considered healthy, showing little histopathological evidence for starvation or disease (Teh 2007). However, there was some evidence of low frequency endocrine disruption. In 2005, nine of 144 (six percent) of adult delta smelt males sampled were intersex, having immature oocytes in their testes (Teh 2007). Bennett (2005) reported that about 10 percent of the delta smelt analyzed for histopathological anomalies in 1999-2000 showed evidence of deleterious contaminant exposure. In contrast, 30-60 percent of these fish had liver glycogen depletion consistent with food limitation.

In contrast, preliminary histopathological analyses have found evidence of significant disease in other species and for POD species collected from other areas of the estuary. Massive intestinal infections with an unidentified myxosporean were found in yellowfin goby (*Acanthogobius flavimanus*) collected from Suisun Marsh. Severe viral infection was also found in Mississippi silverside and juvenile delta smelt collected from Suisun Bay during summer 2005. Lastly, preliminary evidence suggests that contaminants and disease may impair survival of age-0 striped bass. Baxter *et al.* 2008 found high occurrence and severity of parasitic infections, inflammatory conditions, and muscle degeneration in young striped bass collected in 2005; levels were lower in 2006. Several biomarkers of contaminant exposure including P450 activity (i.e., detoxification enzymes in liver), acetylcholinesterase activity (i.e., enzyme activity in brain), and vitellogenin induction (i.e., presence of egg yolk protein in blood of males) were also reported from striped bass collected in 2006 (Ostrach 2008).

Delta smelt can also be exposed to other toxic substances. Recent toxicological research has provided dose-response curves for several contaminants (Connon *et al.* 2009; 2011). This research has also shown that gene expression changes and impairment of delta smelt swimming performance occur at contaminant concentrations lower than levels that cause mortality.

Climate Change: Climate change is likely already impacting the delta smelt. Climate change may affect the delta smelt directly by creating physiological stress, the primary impacts of climate change on the species are expected to be through changes in the availability and distribution of delta smelt habitat.

The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years of being a typical period for such measurements (IPCC 2013a). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (for example, temperature or precipitation) that persists for an extended period, whether the change is due to natural variability or human activity (IPCC 2013a). Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has increased since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions.

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has increased since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (for these and other examples, see Solomon *et al.* 2007;; IPCC 2013b;; IPCC 2014). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (Solomon *et al.* 2007; IPCC 2013b). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), whom concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (Meehl *et al.* 2007, entire; Ganguly *et al.* 2009; Prinn *et al.* 2011). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increasing global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (Meehl *et al.* 2007; Ganguly *et al.* 2009; Prinn *et al.* 2011; IPCC 2013b). See IPCC 2013b (entire), for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation.

Current Drought Conditions and Relative Abundance: California is experiencing its fourth consecutive dry water-year due to low rainfall and low snowpack. On January 17, 2014, the Governor of California declared a State of Emergency due to the drought and directed state officials to take all necessary actions to make water immediately available (Office of the Governor 2014). As of June 2015, the Governor's drought declaration remains in place and the current drought conditions are comparable to the driest years on record in California. The severity of California's drought has been exacerbated by record warm temperatures and below-normal precipitation in 2015, resulting in a severely reduced snowpack. During the last two years, Federal and state governments (Bureau of Reclamation and California Department of Water Resources) have taken actions to ensure the reduced water quality and supply does not reach a level of concern for human health and safety, while complying with biological opinions. The actions taken include the 2015 placement of a salinity rock barrier on West False River and numerous Temporary Urgency Change Orders to modify requirements under Decision 1641 to meet certain water quality objectives, reduction of river flows caused by low reservoir storage, and river temperature requirements.

Drought conditions and some drought management actions have decreased suitable and available aquatic habitat in the Delta for delta smelt breeding and survival, thereby reducing the overall population in the Delta. Fish surveys indicate that the relative abundance of delta smelt is very low. In the last five years, the FMWT, TNS, and 20mm survey results have produced some of the lowest adult and larval delta smelt abundance indexes on record (CDFW 2013, 2014, 2015). The 2014 FMWT abundance index which determines the relative population status for the delta smelt was set at 9, which is the lowest index on record. The low index numbers and relatively few occurrences represent the additive impact of drought to the delta smelt and its habitat.

Status of the Delta Smelt Critical Habitat

The Service designated critical habitat for the delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code) (Service 1994).

Conservation Role of Delta Smelt Critical Habitat

The Service's primary objective in designating critical habitat was to identify the key components of delta smelt habitat that support successful spawning, larval and juvenile transport, rearing, and adult migration. Delta smelt are endemic to the Bay-Delta and the vast majority only live one year. Thus, regardless of annual hydrology, the Delta must provide suitable habitat all year, every year. Different regions of the Delta provide different habitat conditions for different life stages, but those habitat conditions must be present when needed, and have sufficient connectivity to provide migratory pathways and the flow of energy, materials and organisms among the habitat components. The entire Delta and Suisun Bay are designated as critical habitat; over the course of a year, the entire habitat is occupied.

Description of the Primary Constituent Elements

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements (PCEs) essential to the conservation of the species:

Primary Constituent Element 1: "Physical habitat" is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary's low-salinity zone (LSZ) (Bennett *et al.* 2002, Hobbs *et al.* 2006).

Primary Constituent Element 2: "Water" is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

Primary Constituent Element 3: "River flow" is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and Old and Middle Rivers flow influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones. River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

Primary Constituent Element 4: "Salinity" is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5-6.0 psu (parts per thousand salinity) (Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995, Kimmerer 2002a). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from San Pablo Bay (45 kilometers) to as far upstream as Rio Vista on the Sacramento River (95 kilometers). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle. In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.

Overview of Delta Smelt Habitat Requirements and the Primary Constituent Elements

Delta smelt live their entire lives in the tidally-influenced fresh- and brackish waters of the San Francisco Estuary (Moyle 2002). Delta smelt are an open-water, or pelagic, species. They do not associate strongly with structure. They may use nearshore habitats for spawning (PCE #1), but free-swimming life stages mainly occupy offshore waters (PCE #2). Thus, the distribution of the population is strongly influenced by river flows through the estuary (PCE #3) because the quantity of fresh water flowing through the estuary changes the amount and location of suitable low-salinity, open-water habitat (PCE #4). This is true for all life stages. During periods of high river flow into the estuary, delta smelt distribution can transiently extend as far west as the Napa River and San Pablo Bay. Delta smelt distribution is highly constricted near the Sacramento-San Joaquin river confluence during periods of low river flow into the estuary (Feyrer *et al.* 2007). In the 1994 designation of critical habitat, the best available science held that the delta smelt population was responding to variation in spring X2.

Alterations to Estuarine Bathymetry (PCE # 1) (~ 1850-present)

The first major change in the LSZ was the conversion of the landscape over which tides oscillate and river flows vary (Nichols *et al.* 1986). The ancestral Delta was a large tidal marsh-floodplain habitat totaling approximately 300,000 acres. Most of the wetlands were diked and reclaimed for agriculture or other human use by the 1920s. The physical habitat modifications of the Delta and Suisun Bay were mostly due to land reclamation and urbanization. Water conveyance projects and river channelization have had some influence on the regional physical habitat by armoring levees with riprap, building conveyance channels like the Delta Cross Channel, storage reservoirs like Clifton Court Forebay, and by building and operating temporary barriers in the south Delta and permanent gates and water distribution systems in Suisun Marsh.

In the 1930s to 1960s, the shipping channels were dredged deeper (~12 m) to accommodate shipping traffic from the Pacific Ocean and San Francisco Bay to ports in Sacramento and Stockton. These changes left Suisun Bay and the Sacramento-San Joaquin river confluence region as the largest and most bathymetrically variable places in the LSZ. This region remained a highly productive nursery for many decades (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995). However, the deeper landscape created to support shipping and flood control requires more freshwater outflow to maintain the LSZ in the large Suisun Bay/river confluence region than was once required (Gartrell 2010).

Seasonal salinity intrusion reduces the temporal overlap of the LSZ (indexed by X2) with the Suisun Bay region, especially in the fall (Feyrer *et al.* 2007, 2010). Thus, the second major change has been in the frequency with which the LSZ is maintained in Suisun Bay for any given amount of precipitation. This metric showed a step-decline in 1977 from which it has never recovered for more than a few years at a time. Based on model forecasts of climate change and water demand, this trend is expected to continue (Feyrer *et al.* 2011). As such this alteration of PCE # 1 also affects the other PCEs, particularly PCE # 4. The major landscape factor affecting this interaction was the dredging of shipping channels.

Spawning delta smelt require all four PCEs, but spawners and embryos are the life stage that is believed to most require a specific structural component of habitat. Spawning delta smelt require sandy or small gravel substrates for egg deposition (Bennett 2005). The major invasive species effect on physical habitat is the dense growth of submerged aquatic vegetation in the Delta. These plants carpet large areas in parts of the Delta such as Frank's Tract. The vegetation beds act as mechanical filters removing turbidity and possibly other water quality components as the tides and river flows move water over them (Hestir 2010). Thus, the proliferation of submerged aquatic plants has likely also reduced the area of nearshore habitat suitable for delta smelt spawning.

Alterations to Water (PCE # 2)

PCE # 2 is primarily referring to a few key water quality components (other than salinity) that influence spawning and rearing habitat suitability for delta smelt. Research to date indicates that water quality conditions are more important than physical habitat conditions for predicting where delta smelt occur (Feyrer *et al.* 2007; Nobriga *et al.* 2008) probably because delta smelt is a pelagic fish except during its egg/embryo stage. However, the interaction of water quality and bathymetry is thought to generally affect estuarine habitat suitability (Peterson 2003) and there is evidence that delta smelt habitat is optimized when appropriate water quality conditions overlap the Suisun Bay region (Moyle *et al.* 1992; Hobbs *et al.* 2006; Feyrer *et al.* 2011). This is discussed further in the section about PCE # 4 (salinity).

Changing predation pressure (1879 to present): Noting is known about the historical predators of delta smelt or their possible influence on delta smelt. Fish eggs and larvae can be opportunistically preyed upon by many invertebrate and vertebrate animals so there has always been a very long list of potential predators of delta smelt's eggs and larvae. Potential native predators of juvenile and adult delta smelt would also have included numerous bird and fish species and this may be reflected in delta smelt's annual life-history. Annual fish species, also known as "opportunistic strategists", are adapted to high mortality rates in the adult stage (Winemiller and Rose 1992). This high mortality is usually due to predation or highly unpredictable environmental conditions, both of which could have characterized the ancestral niche of delta smelt.

The introduction of striped bass into the San Francisco Estuary in 1879 added a permanently resident, large piscivorous fish to the low-salinity zone: a habitat that is not known to have had an equivalent predator prior to the establishment of striped bass (Moyle 2002). This likely changed predation rates on delta smelt, but there are no data available to confirm this hypothesis. For many decades the estuary supported higher striped bass and delta smelt numbers than it does currently. This is evidence that delta smelt is able to successfully coexist with striped bass.

The current influence of striped bass and other predators on delta smelt population dynamics is also not known mainly because quantitative descriptions of predator impacts on rare prey are extremely difficult to generate. Delta smelt were observed in the stomach contents of striped bass and other fishes in the 1960s (Stevens 1963; Turner and Kelley 1966), but have not been observed in more recent studies (Feyrer *et al.* 2003; Nobriga and Feyrer 2007). Predation is a common source of density-dependent mortality in fish populations (Rose *et al.* 2001). Thus, it is possible that predation was a mechanism that historically generated the density-dependence observed in delta smelt population dynamics (Bennett 2005; Maunder and Deriso 2011). Because it is generally true for fishes, the vulnerability of delta smelt to predators is influenced primarily by habitat conditions. Turbidity may be a key mediatory of delta smelt's vulnerability to predators (Nobriga *et al.* 2005; 2008). Growth rates, an interactive outcome of feeding success and water temperature, are also well known to affect fishes' cumulative vulnerability to predation (Sogard 1997). Thus, predation rate is best characterized as an aspect food web function linked to PCE # 2.

Food web alterations attributable to the overbite clam (1987-present): The next major change to PCE #2 occurred following the invasion of the estuary by overbite clam (*Corbula amurensis*). The overbite clam was first detected in 1986 and from 1987-1990 its influence on the ecosystem became evident. Since 1987, there has been a step-decline in phytoplankton biomass (Alpine and Cloern 1992; Jassby *et al.* 2002). Phytoplankton in the LSZ is an important component of the pelagic food web that delta smelt are a part of because a key part of the diet of delta smelt's prey is phytoplankton. Not only does the overbite clam reduce food for delta smelt's prey, it can also graze directly on the larval stages of the copepods eaten by delta smelt (e.g., Kimmerer *et al.* 1994). The grazing pressure applied by the overbite clam rippled through the historical zooplankton community that fueled fishery production in the LSZ (Kimmerer and Orsi 1996; Orsi and Mecum 1996; Kimmerer 2002b; Feyrer *et al.* 2003). This major change in the way energy moved through the ecosystem has likely facilitated the numerous invasions of the estuary by suppressing the production of historically dominant zooplankton, which increases the opportunity for invasion by other species that are less dependent on high densities of LSZ phytoplankton.

The distribution and abundance of several LSZ fishes have changed since 1987 (Kimmerer 2002b; Kimmereer 2006; Rosenfield and Baxter 2007; Mac Nally *et al.* 2010). Surprisingly, the changes in phytoplankton and zooplankton production have not been as evident for delta smelt as for other organisms (Kimmer 2002b; Kimmerer 2006; Sommer *et al.* 2007; Mac Nally *et al.* 2010). Nonetheless, delta smelt collected in the FMWT have been persistently smaller since the overbite clam invasion (Sweetnam 1999; Bennett 2005). This is evidence for reduced growth rates that could have been caused by food web changes stemming from overbite clam grazing. The Service considers the prey density aspect of the estuarine food web to be a component of PCE #3 ("Water"). The Central Valley Project and State Water Project entrain some food web production (about 4.5 percent on a daily average basis was attributed to all water diversions in the Delta; Jassby *et al.* 2002). However, prey densities have been most strongly affected by clam grazing (Kimmerer *et al.* 1994; Jassby *et al.* 2002). Urban wastewater input, *Microcystis* blooms, and pesticide loads may also impair the production of zooplankton eaten by delta smelt or eaten by delta smelt's prey (Wilkerson *et al.* 2006; Dugdale *et al.* 2007; Jassby 2008; Ger *et al.* 2009; Werner *et al.* 2010).

Proliferation of submerged aquatic vegetation (1980s to present): For many decades, the Delta's waterways were turbid and the growth of submerged plants was apparently unremarkable. That began to change in the mid-1980s, when the Delta was invaded by non-native plant *Egeria densa*, a fast-growing aquarium plant that has taken hold in many shallow habitats (Brown and Michnuik 2007; Hestir 2010). *Egeria densa* and other non-native species of submerged aquatic vegetation (SAV) grow most rapidly in the summer and late fall when water temperatures are warm (>20°C) and outflow is relatively low (Hestir 2010). The large canopies formed by these plants have physical and biological consequences for the ecosystem (Kimmerer *et al.* 2008). First, dense SAV promotes water transparency. Increased water transparency leads to a loss of habitat for delta smelt (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Second, dense SAV canopies provide habitat for a suite of non-native fishes, including largemouth bass, which now dominate many shallow habitats of the Delta and displace native fishes (Nobriga *et al.* 2005; Brown and Michniuk 2007). Finally, SAV colonization over the last three decades has led to a shift in the dominant freshwater food web pathways and that fuel fish production (Grimaldo *et al.* 2009b). It is noteworthy that SAV-dominated habitats are comparatively productive (Nobriga *et al.* 2005; Grimaldo *et al.* 2009b), but most of the productivity they generate remains in the nearshore environment and therefore does not contribute much to pelagic fish production (Grimaldo *et al.* 2009b).

Reduced turbidity (1999-present): The next major change was a change in estuarine turbidity that culminated in an estuary-wide step-decline in 1999 (Schoellhamer 2011). For decades, the turbidity of the modified estuary had been sustained by very large sediment deposits resulting mainly from gold mining in the latter 19th century. The sediments continued to accumulate into the mid-20th century, keeping the water relatively turbid even as sediment loads from the Sacramento River basin declined due to dam and levee construction (Wright and Schoellhamer 2004). The flushing of the sediment deposits may also have made the estuary deeper overall and thus a less suitable nursery from the 'static' bathymetric perspective (Schroeter 2008). Delta smelt larvae require turbidity to initiate feeding (Baskerville-Bridges *et al.* 2004), and as explained above, older fish are thought to use turbidity as cover from predators. Thus, turbidity is an aspect of PCE # 2 which is a necessary water quality aspect of delta smelt's critical habitat.

Dams and armored levees have contributed to the long-term decline in sediment load to the estuary (Wright and Schoellhamer 2004) and to the clearing of estuary water. This is a long-term effect that stemmed from building and maintaining infrastructure. Opportunities to substantively address this change are limited due to the extreme Central Valley flood and water supply risks that will result from decommissioning dams or removing levees.

Changing water temperature (present through long-term climate forecasts): Delta smelt is already subjected to thermally stressful temperatures every summer in the Delta. Water temperatures are presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding the nominal lethal limit of 25°C for short periods. Coldwater fishes begin to have behavioral impairments (Marine and Cech 2004) and lose competitive abilities (Taniguchi *et al.* 1998) prior to reaching their thermal tolerance limits. Thus, the estuary can already be considered thermally stressful to delta smelt and can only become more so if temperatures warm in the coming decades.

All available regional climate change projections predict central California will be warmer still in the coming decades (Dettinger 2005). It is expected that warmer estuary temperatures will be yet another significant conservation challenge (Brown *et al.* 2013; Cloern *et al.* 2011). This is true because they will limit abiotic habitat suitability further than indicated by flow-based projection (e.g., Feyrer *et al.* 2011). In addition, warmer water temperatures mean that higher prey densities will be required just to maintain present-day growth rates, which are already lower than they once were (Sweetnam 1999; Bennett 2005). Water temperature is mainly affected by climate variation, both as air temperature and as flood and drought scale flow variation (Kimmer 2004; Wagner *et al.* 2011).

Sensitivities to contaminants (ongoing): Delta smelt's spawning migration coincides with early winter rains (Sommer *et al.* 2011). This 'first-flush' of inflow to the Delta brings sediment-bound pesticides with it (Bergamaschi *et al.* 2001), and peak densities of larvae and juveniles can co-occur with numerous pesticides (Kuivila and Moon 2004). Bennett (2005) reported that about 10 percent of the delta smelt analyzed for histopathological anomalies in 1999-2000 showed evidence of deleterious contaminant exposure, but this was low compared to the 30-60 percent of these fish that appeared to be food-limited.

Delta smelt can also be exposed to other toxic substances. Recent toxicological research has provided dose-response curves for several contaminants (Connon *et al.* 2009; 2011). This research has also shown the gene expression changes and impairment of delta smelt swimming performance occur at contaminant concentrations lower than levels that cause mortality. Climate scale flow variation (e.g., flood versus drought scale variation) affects the amount of methyl mercury (Darryl Slotton presentation) entering the ecosystem and may have some influence on the meaningful dilution of ammonium from urban wastewater inputs (Dick Dugdale presentation).

Invasive species may also affect PCE #2 by changing contaminant dynamics. For instance, *Microcystis* blooms generate toxic compounds that can kill delta smelt prey (Ger *et al.* 2009) and accumulate in the estuarine food web (Lehman *et al.* 2010). A second example is the biomagnification of selenium in the food web by *Corbula* (Stewart *et al.* 2004). This has been considered a potential issue for the clam's predators – namely sturgeon, splittail, and diving ducks (Richman and Lovvorn 2004; Stewart *et al.* 2004). However, it is not known whether this change in selenium dynamics negatively affects delta smelt and other fishes that do not directly prey on the clams.

Alterations of River Flows (PCE # 3)

This PCE refers to the transport flows that help guide young delta smelt from spawning habitats to rearing habitats, and to flows that guide adult delta smelt from rearing habitats to spawning habitats. Delta outflow also has some influence on delta smelt's supporting food web (Jassby *et al.* 2002; Kimmerer 2002a) and it affects abiotic habitat suitability as well (Feyrer *et al.* 2007; 2011). The latter is expanded upon in the discussion of PCE # 4. The environmental driver with the strongest influence on PCE # 3 is highly dependent on the time-scale being considered. The tide has the largest influence on flow velocities and directions in delta smelt's critical habitat at very short timescales (minutes to days), whereas interannual variation in precipitation and runoff has the largest influence on flows into and through the Delta at very long timescales (years to decades), and sometimes at shorter time scales (days to weeks) during major storm events. Changes to flow regimes can have the largest influence on PCE #3 at timescales of weeks to seasons. This is particularly true during periods of low natural inflow, for instance during the fall and during droughts, and in the south Delta where Old and Middle River flows are often managed using changes in export flow rates.

Entrainment into water export diversions (1951 to present): The amount of water diverted from the estuary has generally increased over time, and most of the increase during the 1950s and 1960s was due to CVP exports and since the latter 1960s, SWP exports. There are two basic potential fishery impacts that result from water diversion from the Delta: ecosystemic impacts and direct entrainment. From the ecosystemic perspective, water diversions are unnatural 'predators' because they 'consume' organisms at every trophic level in the ecosystem from phytoplankton (Jassby *et al.* 2002) to fish (Kimmerer 2008). Unlike natural predators which typically shift their prey use over time in association with changes in prey fish density (Nobriga and Feyrer 2008), fractional entrainment losses of fishes to diversions are functions of water and demand (e.g., Grimaldo *et al.* 2009). Thus, water diversions not only elevate 'predation' mortality in an aquatic system, but they can do so in an atypical, density-independent manner. Diversions and fish collection facilities in the south Delta are very large structures which attract large aggregations of actual predatory fish and prey on smaller species like delta smelt before they reach the fish salvage facilities and within these facilities (Gingras 1997).

Estimated entrainment losses of delta smelt to SWP and CVP diversions can be substantial in some years (Kimmerer 2008). Given the delta smelt's current density-independent population dynamics, even a statistically indiscernible entrainment effect on the population is likely to cause the species to continue to decline (Kimmerer 2011). The entrainment losses of delta smelt are not generally observed until they reach the early juvenile stage (~20-30 mm in length), but combinations of 20-mm Survey distribution data and hydrodynamic modeling provide evidence that their risk of entrainment into the CVP and SWP diversions can be described by any of several indices that integrate Delta inflow and export flow (Kimmerer and Nobriga 2008; Kimmerer 2008; Service 2008; Grimaldo *et al.* 2009).

Delta smelt entrainment losses estimated from survey data and hydrodynamics can also be substantial in some years (Kimmerer 2008), though it is possible that Kimmerer may have overestimated them (Miller 2011). Nonetheless, increasing higher outflow (or lower X2) moves the bulk of the larval population increasingly west, which results in fewer larvae distributed in the south Delta where they are at highest risk of entrainment. At the same time, indices like the export to inflow ratio or Old and Middle river flow are useful metrics for gauging the effect of exports on the south Delta.

The risk of delta smelt entrainment into smaller agricultural irrigation diversions used mainly to irrigate crops within the Delta is also related to flow conditions. These in-Delta irrigation diversions generally have mean flow rates less than 1 cubic meter per second (Nobriga *et al.* 2004). The lower the Delta outflow, the higher the proportion of the young delta smelt population that overlaps the array of irrigation diversions in the Delta (Kimmerer and Nobriga 2008). However, the irrigation diversions are not currently considered to represent a substantial source of mortality because they individually draw small quantities of water relative to channel volumes (Nobriga *et al.* 2004).

In Suisun Marsh, water diversions are largely made to support waterfowl production. Some Suisun Marsh diversions are larger for the size of channels they are in than most of the agricultural irrigation diversions in the Delta. Based on hydrodynamic simulations, proximity to water diversions in the marsh is expected to correlate strongly with entrainment (Culberson *et al.* 2004), and substantial delta smelt losses have been reported when these diversions are not screened (Pickard *et al.* 1982). Entrainment risk for delta smelt in western Suisun Marsh is considered low because the habitat surrounding the diversions is often too saline (Enos *et al.* 2007).
Salinity PCE # 4

The core delta smelt habitat, is the LSZ (Moyle *et al.* 1992; Bennett 2005). The LSZ is where freshwater transitions into brackish water; the LSZ is defined as the area of the estuary where salinity ranges from 0.5-6.0 psu (Kimmerer 2004). This area is always moving due to tidal and river flow variation. The 2 psu isohaline is a specific location within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention, changes in the location of the LSZ are described in terms of the distance from the Golden Gate Bridge to the 2 psu isohaline (X2); X2 is an indicator of habitat suitability for many of the estuary's organisms and it is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995; Kimmerer 2002b; Kimmerer *et al.* 2009). The LSZ expands and moves downstream when river flows into the estuary are high (Kimmerer *et al.* 2009). Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from as far downstream of San Pablo Bay (45 km) to as far upstream as Rio Vista on the Sacramento River (95 km).

Larval delta smelt tend to reside somewhat landward (upstream) of X2 (Dege and Brown 2004), but the center of juvenile distribution tends to be very near X2 until the fish start making spawning migrations in the winter (Feyrer *et al.* 2011; Sommer *et al.* 2011). Because of this association between the distribution of salinity in the estuary and the distribution of the delta smelt population, the tidal and river flows that comprise PCE # 3 affect PCE # 4.

The expansion and contraction of the LSZ affects the areal extent of abiotic habitat for delta smelt, both during spring (Kimmerer *et al.* 2009) and fall (Feyrer *et al.* 2007; 2011). In the spring, most delta smelt are larvae or young juveniles and the LSZ is typically maintained over the expansive Suisun Bay region. Thus, abiotic habitat "limitation" is unlikely and no consistent influence of spring X2 variation on later stage abundance estimates has been reported to date (Jassby *et al.* 1995; Bennett 2005; Kimmerer *et al.* 2009). In fact, historical maxima in juvenile abundance according to CDFW's TNS occurred in low outflow years when abiotic habitat area was comparatively low (Kimmerer 2002a; Kimmerer *et al.* 2009).

In contrast, during fall delta smelt are late stage juveniles and for the past decade or more, the LSZ has been persistently constricted by low Delta outflow. Fall habitat conditions affect delta smelt distribution and the concurrent FMWT abundance index (Feyrer *et al.* 2007; 2011). However, the quantitative life cycle models developed to date have not found evidence for a year over year effect of fall LSZ location on delta smelt population dynamics (Mac Nally *et al.* 2010; Thompson *et al.* 2010; Maunder and Deriso 2011).

It is now recognized that some delta smelt occur year-round in the Cache Slough region including the Sacramento Deep Water Shipping Channel and Liberty Island (Kimmerer 2011; Miller 2011; Sommer *et al.* 2011). The latter has been a consistently available habitat only since 1997. This region is often lower in salinity than 0.6 psu, the lower formal limit of the LSZ as defined by Kimmerer (2004). Delta smelt likely use it because it is one of the most turbid habitats remaining in the Delta (Nobriga *et al.* 2005). A recent population genetic study found no evidence that delta smelt inhabiting this region are unique compared to delta smelt using the LSZ-proper (Fisch *et al.*

2011), therefore it is likely that individual delta smelt migrate between the LSZ and the Cache Slough region. This is consistent with the high summer water temperatures observed there, which might compel individual delta smelt to seek out cooler habitats within and outside the Cache Slough region.

Delta Smelt Environmental Baseline

The portions of the Action Area that fall within the range of delta smelt include the Sacramento River east levee, south of Sacramento and the Sacramento Weir. Delta smelt typically migrate up into this area as early as December and move out in the spring and summer. The proposed project contains habitat components that can be used for feeding, spawning, rearing, and movement. Some amount of erosion protection has already occurred within the action area. Additionally, the Corps has a project which will place rock along 31,000 linear feet of the right bank of the Sacramento River immediately across the river and extending upstream from the proposed project footprint. Compensation for the placement of this rock will be through the development of a setback levee that will provide 118 acres of newly created shallow water habitat.

Giant Garter Snake Status of the Species

For the most recent assessment of the species' range-wide status please refer to the *Giant Garter Snake (Thamnophis gigas) 5-year Review: Summary and Evaluation* (Service 2012) for the current status of the species. Ongoing threats to giant garter snake include habitat loss from water transfers, rice fallowing due to drought conditions, habitat disturbance and loss from irrigation and drainage ditch maintenance, climate change, and invasive species. While these threats continue to effect the giant garter snake throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the giant garter snake.

Giant Garter Snake Environmental Baseline

The *Draft Recovery Plan for the Giant Garter Snake* (Service 1999b) subdivides the range of the species into four recovery units. Each recovery unit includes populations. The action area for the proposed project is located within the Yolo Basin-Willow Slough unit and the American Basin unit. According to the 2012, 5-year review (Service 2012) the abundance and distribution of giant garter snakes has not changed significantly. Within the Action Area habitat loss and fragmentation is the most significant threat to the giant garter snake. Urbanizing areas within the Action Area include Sacramento and West Sacramento. Habitat loss through water transfers and rice fallowing also negatively affects giant garter snakes. In the Sacramento Valley, rice has served as a substitute for the large amounts of historical wetlands that used to exist in the Central Valley. Loss of this habitat has been shown to reduce or exclude giant garter snakes compared to areas which are actively irrigated in rice (Wylie *et al.* 2002a, b, 2004).

Flood control maintenance and agricultural activities can reduce and prevent the establishment of vegetation and burrows needed by the giant garter snake for cover and shelter on canals, levees, and agricultural ditches. This can also reduce the prey base for giant garter snake, affecting their feeding. Additionally, clearing, scraping and/or re-contouring canals, ditches, and levees, destroys burrows and crevices that are used as over-wintering habitat and during the summer for thermoregulation, shedding, and giving birth. These activities are being conducted by local maintaining agencies throughout the Action Area.

Other factors which effect the giant garter snake population in the Action Area include vehicular mortality particularly where canals or aquatic habitat are bordered by roads such as the crown of the levees. Non-native predators such as game fish, bull frogs (*Rana catesbiana*), and domestic cats can affect giant garter snake populations (Service 1999b). This can be particularly detrimental to young and juvenile giant garter snakes. All of the Action Area has non-native predators occurring in it.

Snakes have been located within the Yolo Bypass within 2 miles of the Sacramento Bypass. Numerous irrigation and drainage canals exist which provide connectivity from the Sacramento Bypass and areas that are known to support snakes in the Yolo Bypass. A snake observed 0.5 mile to the west of the NEMDC along Elkhorn Boulevard in 1996 (CNDDB 2015). Borrow site 2's northern boundary is Elkhorn Boulevard on the east side of the NEMDC. Giant garter snakes could be using the NEMDC for aquatic habitat and the surrounding grasslands for uplands.

Western Yellow-Billed Cuckoo Status of the Species

For the most recent assessment of the species range-wide status please refer to the October 3, 2014, *Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus occidentalis)* (79 FR 59991). Ongoing threats to the yellow-billed cuckoo include habitat loss from flood control projects and maintenance, alterations to hydrology, climate change, and invasive species. While these threats continue to affect the yellow-billed cuckoo throughout its range, no project, to date, has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the yellow-billed cuckoo.

Western Yellow-Billed Cuckoo Baseline

Yellow-billed cuckoo detections have occurred most frequently in the upper Sacramento River where levees are setback from the river or do not exist. Additionally, the last 20 years has seen a large amount of riparian restoration occur in the upper Sacramento River. Habitat in the action area tends to be more narrow and linear than in the upper Sacramento River. Levees were constructed close to the bank of the Sacramento River leaving narrow bands of small patch sizes. Construction of the setback levee along the right bank of the Sacramento River as part of the West Sacramento Flood Control Project will provide some wider patches of riparian habitat that will benefit the yellow-billed cuckoo. The American River has a wider floodplain due to levees being setback from the channel. There are some patches large enough to support nesting yellow-billed cuckoos, though cuckoos have not been observed nesting along the American River.

Effects of the Proposed Action

Valley Elderberry Longhorn Beetle

Vegetation removal, including elderberries could cause mortality of any beetle larvae within the elderberry shrub. Transplanting the shrubs between November 1 and February 15, when the shrubs are dormant, will minimize the likelihood of killing larvae within the shrub. Transplanting the shrub could still result in mortality to larvae within the shrub, particularly if the shrub does not survive transplantation. Proper care of the transplants through watering in the initial years can minimize this loss and increase the likelihood that the shrub will survive and provide continued habitat for the valley elderberry longhorn beetle.

Construction that occurs near elderberry shrubs that will be protected in place can kill adult beetles if construction equipment is operating between the months of March and June when valley elderberry longhorn beetles have emerged from the elderberry shrubs and are locating mates for reproduction. Fencing the area which contains riparian habitat, specifically elderberry shrubs, and keeping a minimum of a 20 foot buffer from the dripline of the elderberry shrub will keep construction equipment from driving too close to the shrubs and minimize the number of beetles that might be struck or run over by equipment.

Transplanting elderberry shrubs out of the construction footprint has the potential to affect valley elderberry longhorn beetle dispersal if there is potential to remove large areas of elderberry shrubs. The Corps has provided maps of where existing valley elderberry longhorn beetle habitat exists and where shrubs will be removed due to the project. Along the Sacramento River, 13 elderberry shrubs distributed within 70 acres of riparian habitat will be transplanted as part of the project, however during surveys the Corps has documented an additional 60 elderberry shrubs that will be protected in place along the Sacramento River. The Corps has also proposed to include elderberry shrub plantings along the bank repair footprint where the elevation is suitable so the shrubs are not inundated too frequently. Along the American River, 250 elderberry shrubs distributed within 65 acres of riparian habitat will be transplanted as part of the project. The American River has many conservation sites and the Corps has proposed to offset the removal of elderberry shrubs through development of additional sites and enlargement of existing sites in the lower American River Parkway. The Corps is proposing to create an additional 69.91 acres of habitat for the valley elderberry longhorn beetle in the lower American River Parkway.

Trimming of elderberry shrubs can result in the loss of some habitat for the valley elderberry longhorn beetle. Unlike transplantation however, the shrub remains within the riparian corridor and can provide habitat for the beetle during dispersal. There is potential for one of the pruned stems to contain the larvae of the valley elderberry longhorn beetle. While elderberry shrubs do resprout readily, there is a temporal loss of habitat for the beetle and as part of the maintenance any resprouted stems will be removed in order to provide maintenance equipment access. To offset these effects the local maintaining agencies have proposed to create a 40-acre conservation area for the valley elderberry longhorn beetle. This area will be selected as described in the preceding paragraph. This will ensure habitat connectivity and help with long-term maintenance and monitoring of these lands.

Delta Smelt

Construction along the Sacramento River will place bank protection along a 50,300 linear foot section of the left bank of the Sacramento River. Delta smelt are a pelagic species that is typically found in the center of the channel. However, as described in the status of the species they do spawn on sandy beaches in shallow water habitat (0 to 3 meters) and in this portion of the Sacramento River are found close to the banks. The rock footprint will change the substrate along the 50,300 linear feet of 33 acres of shallow water habitat. Additionally 13 acres are being converted from riverine bank edge to a rock wedge. Construction related effects to individual delta smelt will be avoided because construction is occurring between August 1 and November 30, a time when delta smelt are located further downstream in the Delta and Suisun Bay. Effects due to increasing sediment downstream of the work area will be minimized through the conservation measures involving monitoring water quality during construction to ensure that effects do not extend into the portion of the Delta that delta smelt occupies during the late summer/fall period. Construction to widen the Sacramento Weir will occur on the landside of the existing Sacramento River right bank levee. Upon completion of the weir extension the levee removed between August 1 and November 30 avoiding effects to delta smelt habitat.

The primary negative effect of the project on potential spawning habitat is the change of substrate from sand to riprap. Rock used for bank protection is large enough to retard erosional forces of the river and therefore has interstitial spaces. Should delta smelt spawn over this riprap substrate, it is very likely that any eggs will fall into these interstitial spaces resulting in the loss of eggs and potentially causing fertilization to not occur if the eggs fall into the interstitial spaces. The Corps has proposed to offset this loss of spawning potential in these areas through the purchase of 33 acres of credits at a Service-approved delta smelt conservation bank. The placement of rock will permanently narrow the channel by 13 acres through the change of riverine edge to rock wedge. Rock slope protection limits the lateral mobility of a river channel, increases flow velocities (Sedell *et al.* 1990), limit sediment transport, and eliminates bankside refugia areas (Gregory *et al.* 1991). Rock placement can also affect primary productivity through the loss of vegetation. The Corps will protect large trees in place and plant riparian benches at the conclusion of the rock placement to replace the loss of vegetation. Planting benches and vegetation planting will also help to offset the increased velocities that the bank protection sites will experience due to the smoother rock surface. To offset the complete loss of riverine edge habitat the Corps has proposed to purchase 39 acres of credits at a Service-approved delta smelt conservation bank for a total of 72 acres of credits.

The Corps has proposed to evaluate effects to listed species including delta smelt when long-term maintenance activities for the Sacramento River can be described. If maintenance activities will affect delta smelt the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the delta smelt from any long-term levee maintenance activities.

Delta Smelt Critical Habitat

This opinion on the critical habitat for the delta smelt does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR § 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U. S. Fish and Wildlife Service* (No. 03-35279) to complete the following analysis with respect to the proposed critical habitat.

Implementation of the proposed project will affect PCE #1 Physical Habitat as described under the environmental baseline section above. The placement of rock will change the substrate of shallow water habitat for 46 acres. Any loss of shallow water habitat will be compensated through the purchase of credits at a delta smelt conservation bank. It is expected that planting the sites post-construction will replace any loss of primary productivity within the Sacramento River water column.

Giant Garter Snake

Borrow Site 2 – Upland habitat will be disturbed at borrow site 2 (5.5 acres) when heavy equipment is brought in to remove soil for the Arcade Creek levee repair. Removal of soil from the site will result in the crushing of burrows that snakes use for aestivating and thermoregulation. Fencing the borrow site prior to borrow excavation will minimize the likelihood that snakes will be in the borrow site when construction equipment begins to mobilize. Fencing the site will temporarily (one active season) exclude the use of the area for giant garter snake. This could result in snakes having to move further distances to find upland refugia in the summer months and expose them to predation or other sources of mortality such as being run over by a vehicle on the levee road on the opposite side of the NEMDC. Because the aquatic habitat will not be disturbed by the project, there will not be any effects on the snake's ability to forage.

Upon completion of the project, the site will restored and re-graded to create three habitat types. The creation of additional tule marsh along the edge of the canal will benefit giant garter snakes that may be using the NEMDC as it will provide cover, an area for prey production, and refugia from predators. Additionally, the seasonal wetland bench will only provide aquatic habitat in the winter months when the snake is typically in burrows. The wetland bench will provide some upland habitat for the giant garter snake during the summer when the snake is active in the form of basking habitat and if dried wetland vegetation remains some refugia from predators; however, because the site will be flooded in the winter it will not serve as overwintering habitat for the snake. The remaining 3.5 acres of the borrow site will be restored to native grassland and will function as summer upland refugia and basking and in the winter serve as overwintering habitat for the snake.

Sacramento Bypass – Enlarging the Sacramento Bypass and Weir will result in both permanent and temporary effects to giant garter snake habitat. Construction of the widened bypass will have similar effects to giant garter snake as the work along borrow site 2. Snakes could be crushed by heavy equipment, entombed in refugia when burrows collapse, and exposed to increased predation because they may have to travel further to find habitat that is unavailable to them due to the project. The 25 acres of aquatic habitat and 50 acres of upland habitat that will be temporarily affected because of the relocation of a levee toe drain will be replaced within one year of construction. The Corps has committed to creating a toe drain that closely mimics the existing aquatic and upland habitat along the northern levee of the Sacramento Bypass. The effects of crushing snakes and exposing them to increased predation will be minimized through the use of the conservation measures described in the project description above.

Permanently, 15 acres of aquatic and 30 acres of upland habitat will be lost through the removal of drainage ditches and farm canals in the area that is currently outside of the bypass footprint. The Corps has committed to offsetting the loss of this habitat through the purchase of 135 acres of giant garter snake credits at a Service-approved conservation bank. Conservation banks provide protection, conservation easement, and funding, endowment, in perpetuity for the giant garter snake. These long-term protections and location of the conservation banks all contribute to the long-term recovery of the giant garter snake.

Operation of the expanded Sacramento Weir and Bypass will result in an increase of water surface elevation of approximately 0.5-foot on the levee slopes on either side of the Yolo Bypass. However, when this increase occurs, during a 200-year flood event, the Yolo Bypass levees already contain water up to 21 feet deep. As a result, giant garter snake burrows would likely already be saturated before the additional water associated with the widened Sacramento Bypass is a factor. The additional 0.5-foot resulting from this action would not significantly change the timing or duration of this flooding and would not result in further impacts to giant garter snake habitat.

The Corps has proposed to evaluate effects to listed species including giant garter snake when long-term maintenance activities for the Sacramento Bypass can be described. If maintenance activities will affect giant garter snakes the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the giant garter snake from any long-term levee maintenance activities.

Yellow-Billed Cuckoo

Sacramento River – The Corps is planning on removing 70 acres of riparian habitat along the Sacramento River. The riparian corridor in this section of the Sacramento River is narrow (about 100 feet wide) because the levees were constructed so close to the edge of the channel bank. This is too narrow for the yellow-billed cuckoo to nest, however it is possible for the yellow-billed cuckoo to use this as a stopover when migrating to the Central Valley to breed. Vegetation removal will reduce the width of the riparian corridor from 100 feet to 40 feet on average. The Corps proposal to plant the bank protection sites will create a 25-foot wide planting berm leaving a loss of about 35 feet of riparian corridor. The Corps proposes to offset the loss of the 70 acres of riparian through the creation of 140 acres of riparian habitat along the lower American River.

American River – The construction of launchable rock trench will remove 65 acres of riparian habitat along the lower American River. The lower American River does have habitat patches large enough to support nesting yellow-billed cuckoos. Large patches of habitat will not be removed; rather a strip will be removed adjacent to the levee which could reduce the size of some of the potential nesting areas. To compensate for this the Corps is proposing to plant 130 acres along the lower American River. As described in the conservation measures, the Corps will develop a Riparian Conservation Plan that will determine the best locations to develop additional riparian habitat. The conservation areas will provide both habitat for yellow-billed cuckoo and valley elderberry longhorn. The areas will also ensure that there is a net increase of potential yellow-billed cuckoo nesting habitat along the lower American River Parkway. There will be a temporal loss of habitat because riparian habitat can take up to 20 years to develop.

In addition to the habitat loss for both the Sacramento and American Rivers, construction itself has the potential to adversely affect yellow-billed cuckoos. Construction that occurs when the cuckoo is in the Sacramento Valley has the potential to harass the bird due to noise. To minimize effects to the cuckoo due to construction noise the Corps conservation measure to do protocol level surveys prior to beginning construction will enable the Corps to determine if yellow-billed cuckoos are nesting near the construction footprint. The Corps has committed to avoid construction near an active yellow-billed cuckoo nest. However, cuckoos that could be foraging in the area could be harassed due to construction activities and noise and move to other locations in the lower American River parkway which could expose individual cuckoos to increased predation.

The Corps has proposed to evaluate effects to listed species including yellow-billed cuckoo when long-term maintenance activities for the Sacramento River and American River can be described. If maintenance activities will affect yellow-billed cuckoos the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the yellow-billed cuckoo from any long-term levee maintenance activities.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Valley Elderberry Longhorn Beetle

Non-Federal adverse effects to the valley elderberry longhorn beetle include effects from nearby pesticide spraying drifting into valley elderberry longhorn beetle habitat and levee and channel maintenance. In the areas of the urbanized areas of the American and Sacramento Rivers human started fires is by far the largest effect to valley elderberry longhorn beetles. Over the last several years numerous fires have burned portions of the American River Parkway.

Delta Smelt

Adverse effects to delta smelt may result from point and non-point source chemical contaminant discharges within the action area. These contaminants include but are not limited to ammonia and free ammonium ion, numerous pesticides and herbicides from agricultural activities, and oil and gasoline product discharges. Oil and gasoline product discharges may be introduced into the Sacramento River from shipping and boating activities and from urban activities and runoff. Other future, non-Federal actions within the action area that are likely to occur and may adversely affect delta smelt include: the dumping of domestic and industrial garbage that decreases water quality; oil and gas development and production that may affect aquatic habitat and may introduce pollutants into the water; agricultural activities, including burning or removal of vegetation on levees that reduce riparian and wetland habitats that contribute to the quality of habitat used by delta smelt; and livestock grazing activities that may degrade or reduce riparian and wetland habitats that contribute to the quantity and quality of habitat used by delta smelt.

San Francisco Bay-Delta Climate Change

The effects of climate change do not act in isolation; they are anticipated to exacerbate existing threats to delta smelt. We considered the potential effects of climate change on the delta smelt based on projections derived from various modeling scenarios. A series of publications (Feyrer *et al.* 2011; Cloern *et al.* 2011; Brown *et al.* 2013) have modeled future impacts of climate change in the Delta and projected how this will affect delta smelt. These models used the B1 and A2 scenarios from the 2007 IPCC report. Each scenario included both a warmer-wetter and warmer-dryer sub scenario. Modeled predictions presented in these publications are based on current baseline conditions (no increased outflow, no breeching of levees) which may or may not change in the future. Temperature increases are likely to lead to a continued rise in sea level, further increasing salinity which will increasingly restrict delta smelt's already limited geographic range (Feyrer *et al.* 2011; Cloern *et al.* 2011; Brown *et al.* 2013). Higher air temperatures will reduce snowpacks, melt snow earlier in the winter or spring, and increase water temperatures. These changes will likely alter freshwater flows, possibly shifting and condensing the timing and location of delta smelt reproduction (Brown *et al.* 2013).

Projections indicate that temperature and precipitation changes will diminish snowpack, changing the availability of natural water supplies (Reclamation 2011). Warming may result in more precipitation falling as rain and less storage as snow. This would result in increased rain on snow events and increase winter runoff with an associated decrease in runoff for the remainder of the year (Reclamation 2011). Sacramento Valley Ecoregion projections include a 27 percent decrease in annual freshwater flows and earlier snowmelts, with increased freshwater flows in January and February but reduced throughout the rest of the year (PRBO Conservation Science 2011). Earlier seasonal warming increases the likelihood of rain-on-snow events, which are associated with mid-winter floods. Smaller snowpacks that melt earlier in the year may result in increased drought frequency and severity (Rieman and Isaak 2010). Thus overall, these changes may lead to increased frequency of flood and drought cycles during the 21st century (Reclamation 2011).

Sea level rise is likely to increase the frequency and range of saltwater intrusion. Salinity within the northern San Francisco Bay is projected to rise by 4.5 by the end of the century (Cloern *et al.* 2011). Elevated salinity levels could push the position of X2 farther up the estuary if outflows were not increased to compensate for it. Fall X2 mean values are projected to increase by a mean of about 7 km to the area of Antioch for a distance of about 90 km from the Golden Gate Bridge by 2100 (Brown *et al.* 2013). This increase in the position of X2 in the fall is expected to result in a decrease in suitable physical habitat (Brown *et al.* 2013) if current levees and channel structures are maintained. A decrease in spring habitat due to the movement of X2 upstream due to sea level rise is also expected to result from climate change.

We expect warmer estuary temperatures to be yet another significant conservation challenge based on climate change models. Mean annual water temperatures within the upper Sacramento River portion of the Bay-Delta estuary are expected to approach or exceed 14 °C during the second half of this century (Cloern *et al.* 2011). Warmer water temperatures could reduce delta smelt growth, increase delta smelt mortality and constrict suitable habitat within the estuary during the summer months. Due to warming temperatures, delta smelt are projected to spawn an average of 10 to 25 days earlier in the season depending on the location (Brown *et al.* 2013). Also due to expected temperature increases, total number of high mortality days is expected to increase for all IPCC climate change scenarios (Brown *et al.* 2013). The number of stress days is expected to be stable or decrease partly because many stress days will become high mortality days. This could lead to delta smelt being forced to grow under highly stressful conditions during summer and fall with less time to mature because of advanced spawning (Brown *et al.* 2013). Growth rates have been shown to slow as water temperatures increase therefore requiring delta smelt to consume more food to reach growth rates that are normal at lower water temperatures (Rose *et al.* 2013a). Delta smelt are already often smaller than they used to be (Sweetnam 1999; Bennett 2005) and expected temperature increases due to climate change will likely further slow growth rates.

At the same time, warmer water will tend to move the spawning season earlier in the year (Brown *et al.* 2013). That means the fish will have to grow faster still to compensate for that shorter growing season to produce even as many eggs as they do now – and that may already be a serious limitation on their population fecundity (Rose *et al.* 2013b). Higher temperatures may restrict delta smelt distribution into the fall, limiting their presence in Suisun Bay for more than just salinity reasons and force greater inhabitation of cooler high salinity waters (Brown *et al.* 2013). Water temperatures are already presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding 25 °C for short periods.

The delta smelt is currently at the southern limit of the inland distribution of the family Osmeridae along the eastern Pacific coast. That indicates that this region was already about as warm as that fish family can handle. Increased temperatures associated with climate change may result in a habitat in the Bay-Delta that is outside of the species ecological tolerance limits.

Giant Garter Snake

The Service is aware of other projects currently under review by the State, county, and local authorities where biological surveys have documented the occurrence of federally-listed species. These projects include such actions as urban expansion, water transfer projects that may not have a Federal nexus, and continued agricultural development. The cumulative effects of these known actions pose a significant threat to the eventual recovery of the species. Additionally, an undetermined number of future land use conversions and routine agricultural practices are not subject to Federal permitting processes and may alter the habitat or increase incidental take of snakes, and are, therefore, cumulative to the proposed project. For example other cumulative effects include: (1) unpredictable fluctuations in aquatic habitat due to water management and diversions; (2) dredging and clearing of vegetation from irrigation canals; (3) discing or mowing upland habitat; (4) increased vehicular traffic on access roads adjacent to aquatic habitat; (5) use of burrow fumigants on levees and other potential upland refugia; (6) human intrusion into habitat; (7) use of inappropriate plastic erosion control netting (Stuart *et al.* 2001); (8) riprapping or lining of canals and stream banks; (9) fluctuations in acreages of rice production due to market conditions or water availability; (10) ornamental cultivation; (11) routine grounds maintenance of upland habitat; (12) contaminated runoff from agriculture and urbanization; (13) maintenance of non-Federal flood control structures; and (14) predation by feral animals and pets. Specific cumulative effects related to the proposed project include maintenance activities and/or an increased potential for vandalism, which may degrade or destroy habitat or cause unpredictable fluctuations in habitat.

Yellow-Billed Cuckoo

Habitat that is currently occupied by the yellow-billed cuckoo occurs on public and privately owned lands. Activities on non-Federal lands that may affect the yellow-billed cuckoo include the construction and maintenance of recreational hiking and bicycle trails; restoration of native riparian habitat; transportation related projects like construction and maintenance of State, county, and private roads and bridges; flood channel maintenance by the State water resources agencies, and conversion of riparian habitat to agriculture on private lands.

Conclusion

After reviewing the current status of the valley elderberry longhorn beetle, delta smelt, giant garter snake and yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed ARFC project, and the cumulative effects on these species, it is the Service's biological opinion that the proposed AFRC project, is not likely to jeopardize the continued existence of these species. The Service reached this conclusion because the project-related effects to the species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the conservation measures proposed by the Corps including: creating additional riparian habitat for the valley elderberry longhorn beetle and the yellow-billed cuckoo; purchasing credits at conservation banks for giant garter snake and delta smelt; and restoring any temporarily affected habitat to pre-project conditions.

After reviewing the current status of designated critical habitat for delta smelt, the environmental baseline of critical habitat in the action area, the effects of the proposed ARFC project, and the cumulative effects, it is the Service's biological opinion that the proposed ARFC project, as proposed, is not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the delta smelt critical habitat, to serve its intended conservation role for the species based on the Corps proposal to purchase credits at a conservation bank for permanent effects to the substrate of the Sacramento River. The effects to delta smelt critical habitat are small and discrete, relative to the entire area designated, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the delta smelt.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by Service regulations at 50 CFR 17.3 as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the same regulations as an act which actually kills or injures wildlife. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps and SAFCA so that become binding conditions of any contract issued for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require their contractor or SAFCA or to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take

Valley Elderberry Longhorn Beetle

The Service anticipates that incidental take of valley elderberry longhorn beetle will be difficult to detect due to its life history and ecology. Specifically, valley elderberry longhorn beetles can be difficult to locate due to the fact that a majority of their life cycle is spent in the elderberry shrub and finding a dead or injured individual is unlikely due to their relatively small size. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities; therefore, the Service is authorizing take incidental to the proposed action as harm, harassment, injury, and mortality of all valley elderberry longhorn beetles within 263 shrubs that will be transplanted as a result of construction and 40 acres of elderberry shrubs that will be trimmed for maintenance purposes over the project's 50 year life.

Delta Smelt

The Service expects that incidental take of delta smelt will be difficult to detect or quantify for the following reasons: the small size of adults, their occurrence in turbid aquatic habitat makes them difficult to detect, and the low likelihood of finding dead or impaired specimens. The Service anticipates that the extent of incidental take will be minimized due to the proposed conservation measures and low relative abundance. Due to the difficulty in quantifying the number of delta smelt that will be taken as a result of the proposed action, the number of acres of affected habitat becomes a surrogate for the species that will be taken. The Service anticipates that all individual adult delta smelt in the 46 acres of the action area may be subject to incidental take in the form of harm as described in this biological opinion. Incidental take of delta smelt for maintenance activities is not covered in this biological opinion.

Giant Garter Snake

The Service anticipates that incidental take of the snake will be difficult to detect or quantify for the following reasons: snakes are cryptically colored, secretive, and known to be sensitive to human activities. Snakes may avoid detection by retreating to burrows, soil crevices, vegetation, and other cover. Individual snakes are difficult to detect unless they are observed, undisturbed, at a distance. Most close-range observations represent chance encounters that are difficult to predict. It is not possible to make an accurate estimate of the number of snakes that will be harassed during construction activities, including in staging areas and roads carrying vehicular traffic. In instances when take is difficult to detect, the Service may estimate take in numbers of species per acre of habitat lost or degraded as a result of the action as a surrogate measure for quantifying individuals.

Therefore, the Service anticipates the number of giant garter snakes that may be found in 125.5 acres of aquatic and upland habitat will be harmed or killed as a result of habitat modification due to the proposed project. Incidental take of giant garter snake for maintenance activities is not covered in this biological opinion.

Yellow-Billed Cuckoo

The Service anticipates that incidental take of yellow-billed cuckoo will be difficult to detect due to its life history and ecology. Specifically, yellow-billed cuckoos can be difficult to locate due to their cryptic appearance and behavior and finding a dead or injured individual is unlikely. There is a risk of harm and harassment as a result of proposed construction activities and operations and maintenance of the restoration plantings; therefore, the Service is authorizing take incidental to the proposed action as harm of all yellow-billed cuckoos within 135 acres. Incidental take of yellow-billed cuckoo for maintenance activities is not covered in this biological opinion.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

All necessary and appropriate measure to avoid or minimize effects on the species resulting from implementation of this project have been incorporated into the project's proposed conservation measures. Therefore, the Service believes the following reasonable and prudent measure is necessary and appropriate to minimize incidental take of the species.

1. All conservation measures, as described in the biological assessment and restated here in the Project Description section of this biological opinion, shall be fully implemented and adhered to. Further, this reasonable and prudent measure shall be supplemented by the terms and conditions below.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are nondiscretionary.

1. The Corps shall include full implementation and adherence to the conservation measures as a condition of any permit or contract issued for the project.

2. The Corps will develop a Riparian Planting Plan. The plan will evaluate locations for riparian vegetation planting based on land use in the lower American River Parkway, effects from future projects, such as the reoperation of Folsom Dam, where existing riparian and valley elderberry longhorn beetle habitat exists, creating and maintaining connectivity between large riparian patches, and coordination with Sacramento County Parks. The plan will maximize habitat quality for both the valley elderberry longhorn beetle and the yellow-billed cuckoo.

3. In order to monitor whether the amount or extent of incidental take anticipated from implementation of the project is approached or exceeded, the Corps shall adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, the Corps must immediately reinitiate formal consultation as per 50 CFR 402.16.

   (a) For those components of the action that will result in habitat degradation or modification whereby incidental take in the form of harm is anticipated, the Corps will provide monthly updates to the Service with a precise accounting of the total acreage of habitat impacted. Updates shall also include any information about changes in project implementation that result in habitat disturbance not described in the Project Description and not analyzed in this biological opinion.
   (b) For those components of the action that may result in direct encounters between listed species and project workers and their equipment whereby incidental take in the form of harassment, harm, injury, or death is anticipated, the Corps shall immediately contact the Service's Sacramento Fish and Wildlife Office (SFWO) at (916) 414-6600 to report the encounter. If the encounter occurs after normal working hours, the Corps shall contact the SFWO at the earliest possible opportunity the next working day. When injured or killed individuals of the listed species are found, the Corps shall follow the steps outlined in the Salvage and Disposition of Individuals section below.
   (c) Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as a Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it. The bag containing the specimen must be frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen. The Service contact persons are the Habitat Conservation Division Chief at the Sacramento Fish and Wildlife Office at (916) 414-6600; the Assistant Field Supervisor of ESA/Regulatory Division at the Bay Delta Fish and Wildlife Office at (916) 930-5603; and the Resident Agent-in-Charge of the Service's Office of Law Enforcement at (916) 569-8444.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. The Service recommends the Corps develop and implement restoration measures in areas designated in the Delta Fishes Recovery Plan (Service 1996) the Giant Garter Snake Recovery Plan (1999) and the Valley Elderberry Longhorn Beetle Recovery Plan (1984).

2. The Corps and SAFCA should develop and implement projects that support DWR's Central Valley Flood System Conservation Strategy. This document provides goals and measurable objectives and potential projects which could be implemented in a manner that while improving the riverine ecosystem also will improve the flood system.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation with the Corps on the American River Common Features GRR Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions regarding this biological opinion, please contact Jennifer Hobbs (jennifer_hobbs@fws.gov or (916) 414-6541) or Doug Weinrich, Assistant Field Supervisor at the letterhead address, (916) 414-6600.

Sincerely,

Jennifer M. Norris
Field Supervisor

cc:
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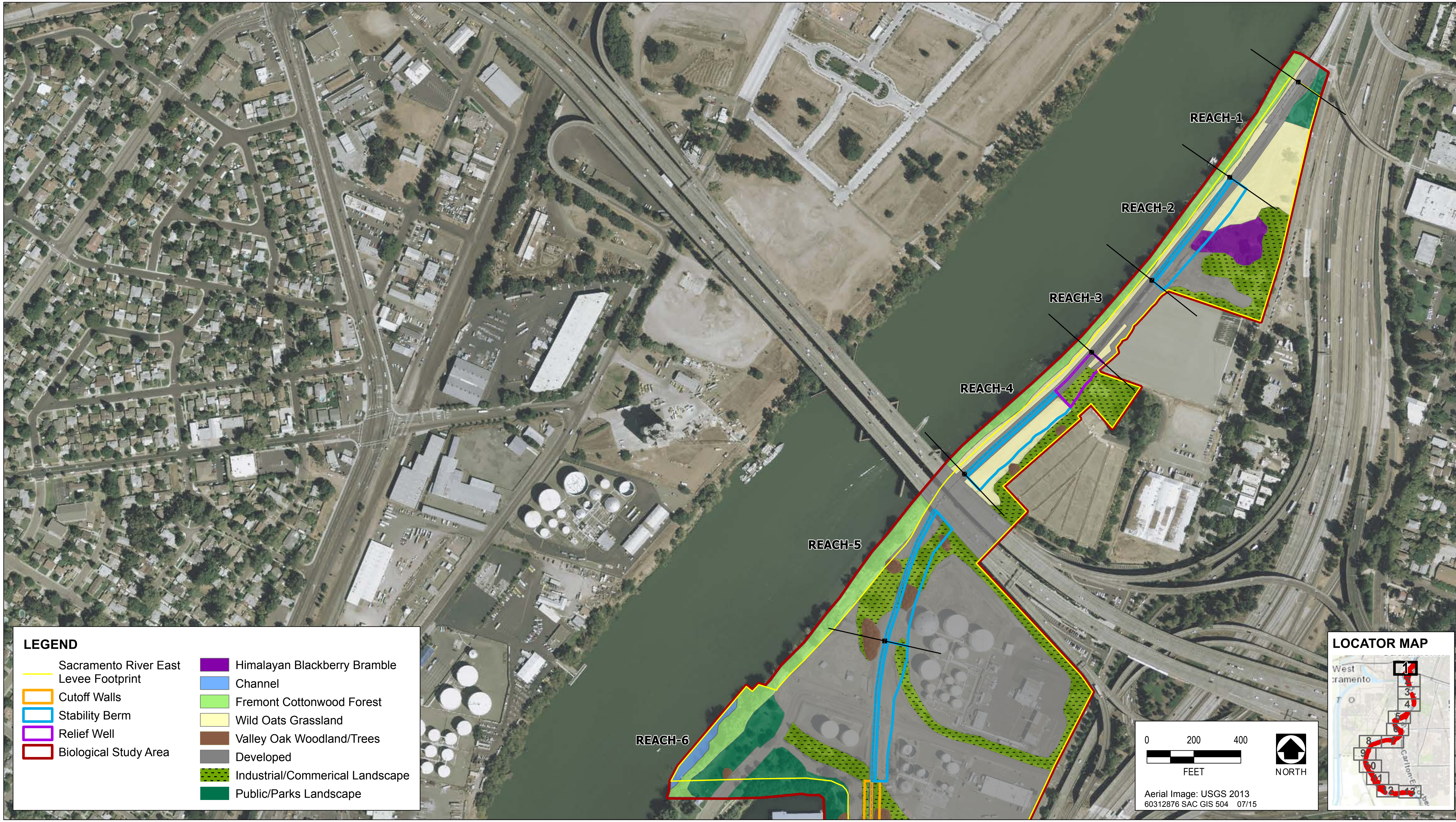


Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 1

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

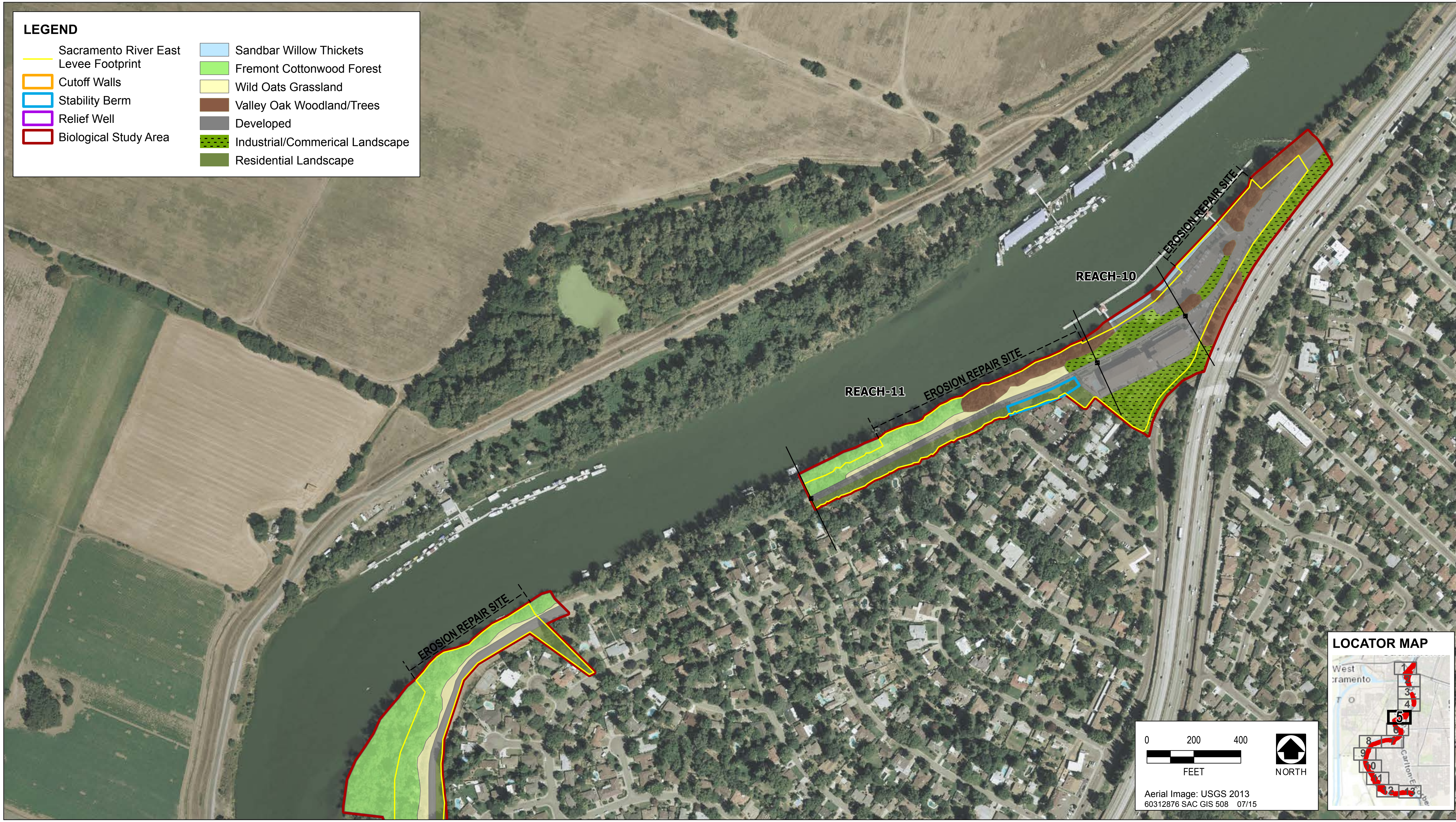
Sacramento River East Levee Habitat Map 2

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 3

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 4



Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 5

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 6

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 7

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 8

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 9

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

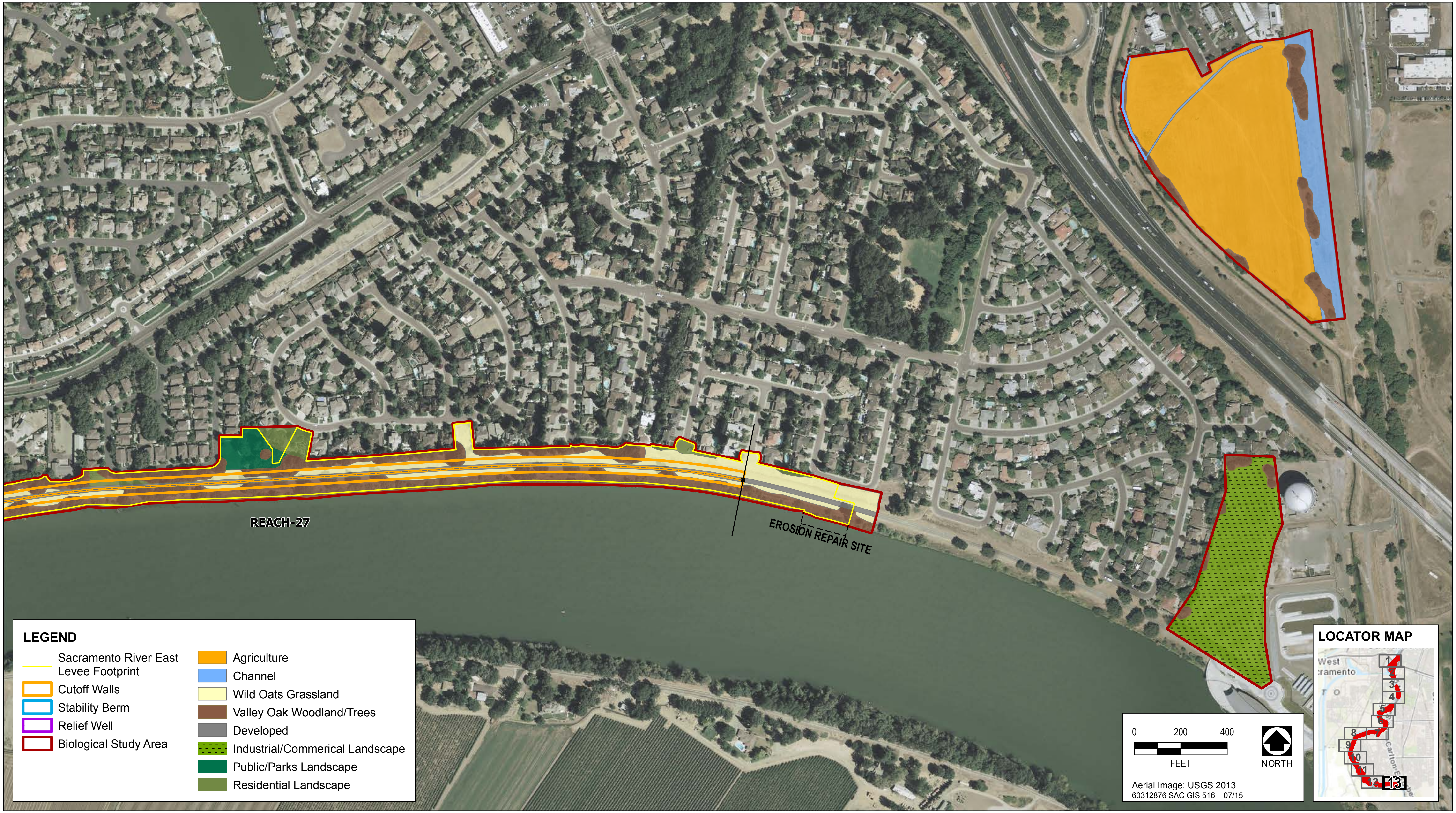
Sacramento River East Levee Habitat Map 10

Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 11

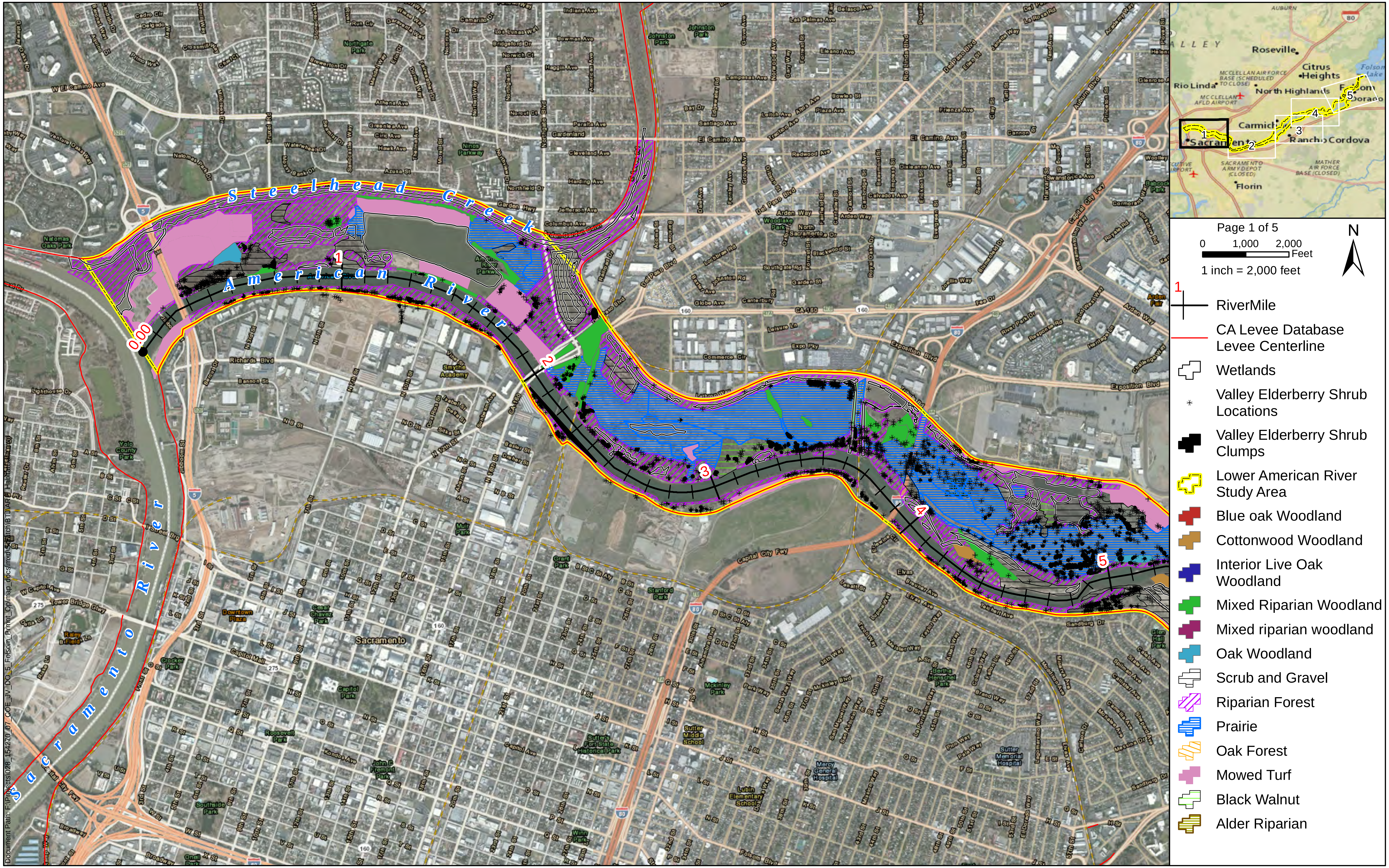
Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 12



Source: GEI Consultants, Inc. 2014, MBK Engineers 2014, data collected and compiled by AECOM in 2014

Sacramento River East Levee Habitat Map 13



Steelhead Creek
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Rio Linda
North Highlands
Carmichael
Rancho Cordova
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Page 1 of 5
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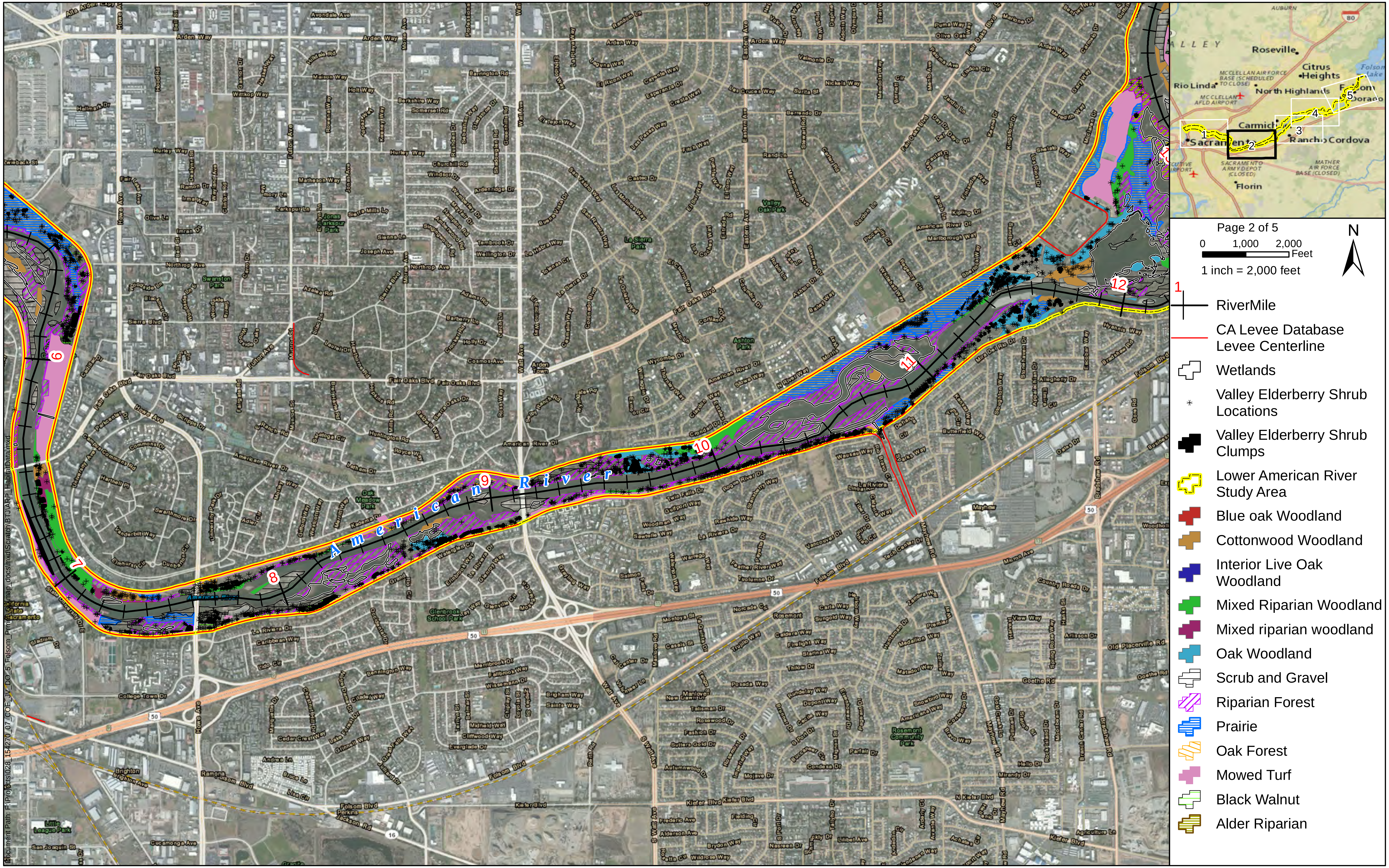
Valley Elderberry Shrub Locations
Valley Elderberry Shrub Clumps
Lower American River Study Area
Blue oak Woodland
Cottonwood Woodland
Interior Live Oak Woodland
Mixed Riparian Woodland
Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
Prairie
Oak Forest
Mowed Turf
Black Walnut
Alder Riparian



American River
Page 2 of 5
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1 inch = 2,000 feet
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RiverMile
CA Levee Database Levee Centerline
Wetlands
Valley Elderberry Shrub Locations
Valley Elderberry Shrub Clumps
Lower American River Study Area
Blue oak Woodland
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Interior Live Oak Woodland
Mixed Riparian Woodland
Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
Prairie
Oak Forest
Mowed Turf
Black Walnut
Alder Riparian
Roseville
Citrus Heights
Rio Linda
North Highlands
Carmichael
Rancho Cordova
Florin

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 1

Programmatic Agreement

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT, SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

WHEREAS, the U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the American River Common Features Project (Project) as authorized in the Water Resources Development Act (WRDA) of 1996, Pub L. No. 104-303, §101(a)(1), 110 STAT. 3658, 3662-3663 (1996), as amended by the WRDA 1999, Pub. L. No. 106-53, Section 366, 113 STAT. 269, 319-320 (1999) and the Energy and Water Development and Related Agencies Appropriations Act of 2008, Pub. L. No. 110-161, Section 130, 121 STAT. 1844, 1947 (2008), and as authorized by Section 7002 of the Water Resources Reform and Development Act (WRRDA) of 2014 (Pub. L. No. 113-121, § 7002, 128 Stat. 1193, 1366); and

WHEREAS, the Project is being developed to provide flood risk management to the City of Sacramento, including areas along the Sacramento and American Rivers, and around and within the Natomas Basin, including the Natomas Cross Canal, the Sacramento Bypass, the Pleasant Grove Creek Canal, the Natomas East Main Drain Canal, Arcade Creek, Dry Creek, Robla Creek, and Magpie Creek located in Sacramento and Yolo Counties, California. The authorized project is a single purpose flood risk management project shown in **Attachment 1** and further described in **Attachment 2**; and

WHEREAS, the Corps proposes to construct levee improvements including, but not limited to: seepage cutoff walls, seepage berms, levee slope flattening, relief wells, adjacent levees, stability berms, drained stability berms, levee raising, floodwalls, bypass widening, riverbank erosion protection, and launchable rock erosion protection; and

WHEREAS the State of California Central Valley Flood Protection Board (CVFPB) is the non-Federal sponsor for the Project and the CVFPB has been invited to be a Concurring Party to this Programmatic Agreement (Agreement); and

WHEREAS, the Corps has determined that the Project activities constitute an Undertaking, as defined in 36 C.F.R. § 800.16(y), and therefore is subject to Section 106 of the National Historic Preservation Act of 1966, 54 U.S.C. § 306108 (NHPA); and

WHEREAS, the Corps has determined that the Project may have an effect on properties that are either listed or eligible for listing in the National Register of Historic Places (NRHP) and has consulted with the California State Historic Preservation Officer (SHPO) pursuant to the NHPA; and

WHEREAS, pursuant to 36 C.F.R. § 800.4(b)(2), the Corps may implement the Project in phases as funding is available and construction authority is provided and, as a result, efforts to identify and evaluate Historic Properties and the determination of effects to those properties may be deferred until more specific project information for each phase is known; and

WHEREAS, this Agreement shall establish the process the Corps shall follow for compliance with 54 U.S.C. § 306108 (formerly 16 U.S.C. § 470f, referred to hereinafter as "Section 106"), taking into consideration the views of the Signatory and Concurring Parties; and

WHEREAS, a total of 69 cultural resources are known to be present within the Area of Potential Effects (APE) and although extensive archaeological inventory has been completed within the APE under other projects, portions of the APE have not been inventoried; and

WHEREAS, the presence of levees, alluvial deposition, and other built environment features have obscured the presence of cultural resources and a full assessment of archaeological sites cannot be made in advance of construction; and

WHEREAS, the levees of the Sacramento and American Rivers are the one known potential Historic Property within the APE that will be affected by the Project; and

WHEREAS, the Corps is aware that there is a high probability for buried cultural resources that may not be identified prior to construction and that also may be eligible for inclusion in the NRHP, and therefore this Agreement documents a framework for managing post-review discoveries per 36 C.F.R. § 800.13; and

WHEREAS, the Corps, with the concurrence of SHPO, has decided to comply with Section 106 of the NHPA for the Undertaking through the execution and implementation of this Programmatic Agreement (Agreement) because the Corps cannot fully determine the effects of the Undertaking on Historic Properties [36 C.F.R. § 800.14(b)(1)(ii)], for all phases and segments of the Project at this time; and

WHEREAS, in accordance with 36 C.F.R. §§ 800.2(c)(2)(ii)(A), 800.3(f)(2), and 800.14(b)(2)(i), the Corps has contacted federal and state recognized Native American Tribes, via letter(s), phone call(s), and meetings, to invite them to consult on the Project and this Agreement, including the Buena Vista Rancheria of the Me-Wuk Indians of California, the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, the Colfax-Todds Valley Consolidated Tribe, the Cortina Wintun Environmental Protection Agency, the El Dorado Miwok Tribe, the Enterprise Rancheria of

Maidu Indians of California, the Ione Band of Miwok Indians of California, the Mechoopda Indian Tribe of Chico Rancheria, the Mooretown Rancheria of Maidu Indians, the Nashville-El Dorado Miwok, the Shingle Springs Band of Miwok Indians, the Strawberry Valley Rancheria, the T'si-Akim Maidu, the United Auburn Indian Community of the Auburn Rancheria, the Wilton Rancheria, the Yocha Dehe Wintun Nation, and interested Native American individuals; the Corps has invited them (and others who may be identified in the future as appropriate Concurring Parties) to participate as Concurring Parties to this Agreement; and the Corps will continue consultation throughout the duration of this agreement; and

WHEREAS, the Corps shall make the terms and conditions of this Agreement part of the conditions of any contracts issued by the Corps for this Project; and

WHEREAS, the definitions set forth in 36 C.F.R. § 800.16 are incorporated herein by reference and apply throughout this Agreement; and

WHEREAS, the definitions for Signatory Parties set forth in 36 C.F.R. § 800.6(c)(1), and the definitions for Concurring Parties set forth in 36 C.F.R. § 800.6(c)(3), are incorporated herein by reference and apply throughout this Agreement; and

WHEREAS, in accordance with 36 C.F.R. § 800.14(b)(3), the Corps notified and invited the Advisory Council on Historic Preservation (ACHP) per 36 C.F.R. § 800.6(a)(1)(C) to participate in consultation to resolve potential adverse effects of the Project, including development of this Agreement, and the ACHP has declined to participate pursuant to 36 C.F.R. § 800.6(a)(1)(iii) in a letter dated August 7, 2012; and

WHEREAS, in accordance with 36 C.F.R. § 800.6(a)(4) and 36 C.F.R. § 800.14(b)(2)(ii), the Corps has notified the public of the Project and provided an opportunity for members of the public to comment on the Project and the Section 106 process as outlined in this Agreement; and

NOW, THEREFORE, the signatories agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effects of the undertaking on Historic Properties and to satisfy the Corps' Section 106 responsibilities for all individual aspects of the undertaking.

The Corps shall ensure that the following measures are carried out:

STIPULATIONS

I. TIME FRAMES AND REVIEW PROCEDURES

For all documents and deliverables produced in accordance with the stipulations of this Agreement, the Corps shall provide a draft document to the SHPO, Concurring Parties, and Native American interested parties and Tribes for review. Any written comments provided by the SHPO, Concurring Parties, and Native American interested parties and Tribes, within thirty (30) calendar days from the date of receipt, shall be considered in the revision of the document or deliverable. The Corps shall document and report the written comments received for the document or deliverable and how comments were addressed. The Corps shall provide a revised final document or deliverable to the SHPO for concurrence. The SHPO shall have thirty (30) calendar days to respond. Failure of the SHPO, Concurring Parties, and Native American interested parties and Tribes to respond within thirty (30) calendar days of any submittal shall not preclude Corps from moving to the next step in this Agreement.

Should the SHPO object to the final document or deliverable submitted for concurrence, the Corps and SHPO shall consult for a period not to exceed fifteen (15) calendar days following the receipt of the SHPO's written objection in an effort to come to agreement on the issues to which the SHPO has objected. Should the SHPO and the Corps be unable to agree on the issues to which the SHPO has objected, the SHPO and the Corps shall proceed in accordance with **Stipulation XV (Dispute Resolution)**, below. The timeframe to consult to resolve a disagreement or objection may be extended by mutual consent of the Corps and the SHPO.

II. AREA OF POTENTIAL EFFECTS

The APE for Project activities shall include the construction footprint of the activity and a reasonable buffer determined through consultation between SHPO and the Corps, and shall take into account the likelihood of direct and indirect effects to Historic Properties resulting from the Project. **Attachment 1** includes an overall APE map for the Project. Because the Project will occur in phases, it may be necessary to further define the APE for each phase as phases are authorized and funded for design and construction. Prior to activities under **Stipulation IV (Identification and Evaluation)**, the Corps shall submit to the SHPO, Concurring Parties, and Native American interested parties and Tribes a map of the APE for the current phase and a description of the Project activities occurring for that phase, in accordance with **Stipulation I (Timeframes and Review Procedures)**. Revisions to the APE will not necessitate modifications to this Agreement.

A. For purposes of this Agreement, the APE for each phase shall be defined to meet, at a minimum, the following criteria:

The APE for any segment of the levees that are being improved as part of the phase of the Project shall include the levee segment and a corridor extending not less than 150 meters from the landside toe of the levee segment.

B. The APE also shall include:

(1) The extent of all Project construction and excavation activity required to construct flood control facilities and to modify irrigation and drainage infrastructure; and

(2) The additional right-of-way/easements obtained by the Corps as part of the Project's features; and

(3) All areas used for excavation of borrow material and habitat creation; and

(4) All construction staging areas, access routes, spoil areas, and stockpiling areas.

C. After the APE has been defined and consulted on in accordance with **Stipulation II (Area of Potential Effects)** above, construction or other Project activities may require revisions to the APE. If the APE is revised, the Corps shall consult on that revision in accordance with **Stipulation I (Timeframes and Review Procedures)**, and the Corps shall determine the potential for Project activities in a revised APE to affect potential Historic Properties, in accordance with **Stipulation IV (Identification and Evaluation)**.

III. HISTORIC PROPERTIES MANAGEMENT PLAN

The Corps, in consultation with the SHPO, Concurring Parties, and Native American interested parties and Tribes, shall develop a Historic Property Management Plan (HPMP), which provides the framework by which remaining identification, evaluation of eligibility, findings of effect, and resolution of adverse effect efforts to Historic Properties will occur. The HPMP shall include consideration of property types, treatment of property types, expected methodology for identification and evaluation of potential historic properties, potential templates for work plans, provisions for avoidance or protection of historic properties, and consideration for identification and treatment of human remains. The HPMP shall be appended to this Agreement (**Attachment 3)** and will form the basis for any Historic Property Treatment Plans (HPTPs) that may be required for one or more phases of the Project. The HPMP shall be developed after execution of the Agreement, but before construction commences. For the overall Project and individual phases, the HPMP shall be the means for the Corps to comply with 36 C.F.R. § 800.6 and provide standardized methods for dealing with unanticipated discoveries in accordance with 36 C.F.R. § 800.13(a).

The HPMP may be amended and appended to this Agreement without amending the Agreement.

A. Review: The Corps shall submit the Draft HPMP to the SHPO, Concurring Parties, and Native American interested parties and Tribes for review and comment pursuant to **Stipulation I (Timeframes and Review Procedures)**.

B. Historic Property Treatment Plans: The Corps shall consult the SHPO, pursuant to 36 C.F.R. § 800.5, when the Corps has determined that a Project activity will result in adverse effects to a Historic Property. An HPTP specific to the phase of the Project or the Historic Property will be drafted to describe how the Corps intends to resolve adverse effects and that HPTP may be appended to the HPMP. HPTPs shall be consistent with the HPMP and may incorporate by reference historic contexts, methods, procedures, and research designs, as appropriate. When incorporating portions of the HPMP by reference, the HPTP shall at a minimum include the date of the HPMP and where the HPMP is available to be viewed.

(1) An HPTP may address individual or multiple Historic Properties or Historic Property types. An HPTP shall stipulate those actions the Corps shall take to resolve the adverse effects of the Project on Historic Properties within the project phase or specific action specified by the HPTP. For properties eligible under criteria specified in 36 C.F.R. § 60.4 (A) through (D), mitigation other than data recovery may be considered in the treatment plan (e.g., HABS/HAER, oral history, historic markers, exhibits, interpretive brochures or publications, or other means as deemed appropriate by the signatories). In addition to the SHPO, Concurring Parties, and Native American interested parties and Tribes the Corps may invite the interested public, in accordance with **Stipulation XIII (Public Consultation and Public Notice)**, to comment on the means of mitigation, as appropriate. HPTPs shall include specifications (including content and number of copies) for publication of brochures, pamphlets or synthesis reports for distribution to the general public. The Corps shall ensure that all provisions of an HPTP are carried out as stipulated in the HPTP.

(2) Historic Context, Recordation, and Treatment of Levees: The Sacramento and American River levees are a known potential Historic Property within the APE that may be affected by the Project. Sections of the levees have been recorded and evaluated for their individual eligibility for listing in the NRHP but no overall historic context or evaluation of the levee system has been developed. Because the specific project design that may alter the levees will not be developed until after the Project has been approved for design, a determination of effect and, if necessary, an HPTP, cannot be developed until after approval and execution of this Agreement. In order to document the levees for evaluation, the Corps will develop a historic context and HPTP for recordation of the Sacramento and American River levees as historic structures within the APE in order to evaluate the effects of the Project on the levees. If a historic context and/or HPTP for the levees within the APE has already been developed, the Corps may incorporate it as deemed appropriate by the Corps. The HPTP shall consider the levees in the context of the entire Sacramento and American River levee systems. Additionally, the HPTP shall require the development of clear and specific criteria for determining: (1) recordation guidelines for the levees within the APE, (2) contributing and non-contributing elements of the levee system, (3) thresholds of adverse effect, and (4) treatment of adverse effects. The HPTP shall be developed after execution of the Agreement and before construction commences. The Corps shall submit the HPTP for review, in accordance with **Stipulation I (Timeframes and Review Procedures)**.

(3) HPTPs will be submitted and reviewed in accordance with **Stipulation I (Timeframes and Review Procedures)**, except for those HPTPs developed for Historic Properties discovered during construction activities, which shall follow the review timeframes identified in **Stipulation IX (Discovery of Unknown Historic Properties)**. Circulation of an HPTP shall not include a recirculation of the HPMP.

D. Reporting: Reports and other data pertaining to the inventory of Historic Properties and the treatment of effects to Historic Properties will be distributed to Concurring Parties to this Agreement, Native American Tribes, and other members of the public, consistent with **Stipulation XIV (Confidentiality)** of this Agreement, unless parties have indicated through consultation that they do not want to receive a report or data.

E. Amendments/Addendums/Revisions: If an Historic Property type that is not coveredby an existing HPTP is discovered within the APE subsequent to an initial inventory effort for a phase, or if there are previously unexpected effects to an Historic Property, and the Corps and SHPO agree that the Project may adversely affect the Historic Property, the Corps shall submit an addendum to the HPTP or a new HPTP to the SHPO and Concurring Parties for review and comment, and shall follow the provisions of **Stipulation IX (Discovery of Unknown Historic Properties)**. The HPTP may cover multiple discoveries for the same property type.

F. Data Recovery: When data recovery is proposed, the Corps, in consultation with the SHPO, shall ensure that HPTPs are developed consistent with the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* and the ACHP's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites" (ACHP, May 18, 1999).

G. **Final Phase Report Documenting Implementation of the Historic Properties Treatment Plan(s):** Within one year after the completion of all work for each phase of the Project, the Corps shall submit to the SHPO, Signatory Parties, Concurring Parties, and Native American interested parties and Tribes, a Final Phase Report documenting the results of all work prepared for that phase under the HPTPs, and the information learned from each of the Historic Properties. The submittal of the Final Phase Report shall be in accordance with **Stipulation I (Timeframes and Review Procedures)**.

IV. IDENTIFICATION AND EVALUATION

Should the HPMP not be finalized at the time that a phase of the Project may be proceeding to design and construction, the Corps shall consult with the Signatory Parties before issuing a notice to proceed on any phase of the Project. Should the Signatory Parties agree that the work may proceed, the Corps shall comply with **Stipulation IV A., B., and C. (Identification and Evaluation)** and, as necessary, **Stipulation VI (Determination of Effects)**. The Corps shall complete any identification and evaluation, and as necessary, any evaluation of effects to Historic Properties prior to proceeding with construction. If the Signatory Parties do not agree to proceed with the phase of the Project the Corps shall follow **Stipulation XV (Dispute Resolution)**.

A. **Identification of Potential Historic Properties:** An inventory of Historic Properties within the APE, consistent with the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716–44740) will be initiated for the Project, or for individual phases of the Project, as construction details become available.

Survey recordation shall include features, isolates, and re-recordation of previously recorded sites, as necessary. The survey shall ensure that potential Historic Properties such as historical structures and buildings, historical engineering features, landscapes, viewsheds, and traditional cultural properties (TCPs) with significance to Native American communities, are recorded in addition to archeological sites. Recordation of historic structures, buildings, objects, and sites shall be prepared using the California Department of Parks and Recreation (DPR) 523 Site Record forms.

B. Property Types Exempt from Evaluation: Attachment 4 to this Agreement lists the property types that the Signatories agree shall be exempt from evaluation as determined by the Corps in consultation with the SHPO. The Corps shall evaluate all other identified properties in accordance with **Stipulation IV.C** (**Evaluation of Potential Historic Properties)**.

C. Evaluation of Potential Historic Properties: After recordation on DPR 523 Site Record forms, potential Historic Properties shall be evaluated by a qualified professional for their eligibility for listing in the NRHP consistent with the *Secretary of Interior's Standards for Evaluation*, 36 C.F.R. § 60.4. In accordance with **Stipulation I (Timeframes and Review Procedures),** the Corps shall submit a completed inventory and evaluation for each phase of Project work.

V. GEOTECHNICAL INVESTIGATIONS

For the purposes of gathering engineering data and for project planning, it may be necessary for the Corps to conduct limited geotechnical investigations at areas within the APE.

A. The Corps may conduct geotechnical investigations (e.g., borings, potholing, or trenches) for planning and exploratory efforts. The Corps shall follow Stipulation V.A(1) and (2), or may follow Stipulation V.A(3) if unable to follow Stipulation V.A(1) and (2):

(1) A records and literature search and consultation with Native Americans has been conducted and it has been determined there are no known existing potential Historic Properties located within 50 feet of the areas identified for geotechnical investigations, and an archeological field survey of the areas identified for geotechnical investigations has been conducted and it has been determined there are no known potential Historic Properties present;

(2) A potential Historic Property is identified during the records and literature search or field survey and consultation process as being within an area where geotechnical investigation will occur, and the geotechnical investigation is relocated at least 50 feet outside the site boundaries; or

(3) Provisions for an archeological monitor meeting the qualifications described in **Stipulation VII.C. (Archeological Monitor Standards)** are included in the contract specifications for the geotechnical investigations. As appropriate, or when geotechnical activities may occur in sensitive areas, an archeological monitor will be present for all ground disturbing activities.

B. If potential Historic Properties are discovered during geotechnical investigations, **Stipulation IX (Discovery of Unknown Historic Properties)** shall be followed;

C. A Memorandum for Record shall be written documenting the results of the records and literature search, the archeological field survey, any decisions to relocate geotechnical investigation areas, the determination for inclusion of an archeological monitor for ground disturbing activities, and a record of communication with Native American interested parties and Tribes, as appropriate.

VI. DETERMINATION OF EFFECTS

Avoidance of adverse effects to Historic Properties is the preferred treatment approach. The Corps will consider redesign of Project elements in order to avoid Historic Properties and Project effects that may be adverse. However, it may not be possible to redesign the Project in order to avoid adverse effects to Historic Properties.

The Corps will apply the criteria of adverse effect, pursuant to 36 C.F.R. § 800.5(a)(1), to all Historic Properties within the APE that will be affected by the Project. The Corps shall submit determinations of effects in accordance with **Stipulation I (Timeframes and Review Procedures)**.

If effects to Historic Properties are determined to be adverse, **Stipulation III (Historic Properties Management Plan)**, above, will be followed.

VII. QUALIFICATIONS

A. Professional Qualifications: All technical work required for historic preservation activities implemented pursuant to this Agreement shall be carried out by or under the direct supervision of a person or persons meeting, at a minimum, the *Secretary of Interior's Professional Qualifications Standards* for archeology or history, as appropriate (48 FR 44739). "Technical work" here means all efforts to inventory, evaluate, and perform subsequent treatment such as data recovery excavation or recordation of potential Historic Properties that is required under this Agreement. This stipulation shall not be construed to limit peer review, guidance, or editing of documents by SHPO and associated Project consultants.

B. Historic Preservation Standards: Historic preservation activities carried out pursuant to this Agreement shall meet the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as standards and guidelines for historic preservation activities established by the SHPO. The Corps shall ensure that all reports prepared pursuant to this Agreement will be provided to the Signatories, Concurring Parties, and Native American interested parties and Tribes and are distributed in accordance with **Stipulation XIV (Confidentiality),** and meet published standards of the California Office of Historic Preservation, specifically, *Preservation Planning Bulletin* Number 4(a), "Archaeological Resources Management Reports (ARMR): Recommended Contents and Format" (December 1989).

C. Archeological Monitor Standards: Archeological monitoring activities required for exploratory, construction, or construction related ground disturbing activities implemented pursuant to this Agreement shall be carried out by a person meeting, at a minimum, the *Secretary of Interior's Professional Qualifications Standards* for prehistoric or historic archaeology, as appropriate (48 FR 44739). "Archeological monitoring" here includes monitoring ground disturbing activities that have been determined by the Corps to be occurring in areas potentially sensitive for Historic Properties or buried resources.

VIII. NOTICES TO PROCEED WITH CONSTRUCTION

Notices to Proceed may be issued by the Corps for individual construction segments, defined by the Corps in its construction specifications, after a Historic Properties inventory has been completed [per **Stipulation III (Historic Properties Management Plan)** or **Stipulation IV (Identification and Evaluation)**], and prior to treatment of adverse effects on Historic Properties within the APE provided that:

A. A plan to respond to inadvertent archeological discoveries is prepared by the Corps, and approved by SHPO, prior to the commencement of Project activities anywhere in the APE for that phase of the Project; and

B. Project development activities do not encroach within 30 meters (100 feet) of the known boundaries of any Historic Property as determined from archeological site record forms, other documentation, or as otherwise defined in consultation with the SHPO and other parties, as appropriate; and

C. An archeological monitor meeting the professional qualifications as described in **Stipulation VII (Qualifications)**, is present during any Project activities that are anticipated to extend either vertically or horizontally into any areas designated to be archeologically sensitive by the Corps, in consultation with SHPO, except in phases of construction for slurry walls where visual inspection of the construction area cannot be safely or feasibly accomplished.

IX. DISCOVERY OF UNKNOWN HISTORIC PROPERTIES

The Corps is responsible for complying with 36 C.F.R. § 800.13(a) in the event of inadvertent discoveries of Historic Properties during implementation of the Project. The HPMP will provide procedures for complying with post review and inadvertent discoveries of Historic Properties. If the Corps authorizes work before the HPMP is finalized and there is a discovery of an unknown Historic Property, the Corps shall follow 36 C.F.R. § 800.13(b). Additionally, the following procedures shall be followed:

A. Workforce Training: During implementation of Project activities, the Corps, or archeologists meeting the professional qualifications as described in **Stipulation VII (Qualifications)**, will provide training to all construction personnel, before they begin work, regarding proper procedures and conduct in the event that archeological materials are encountered during construction.

B. **Human Remains:** Treatment of human remains is governed by **Stipulation XII (Tribal Consultation and Treatment of Human Remains)**.

X. CURATION

To the extent that curation is determined to be appropriate mitigation to resolve adverse effects to Historic Properties, curation shall be conducted in accordance with 36 C.F.R. § 79, except those materials identified as Native American human remains and items associated with Native American burials. Archeological items and materials from State or privately owned lands shall be maintained in accordance with 36 C.F.R. § 79 until any specified analyses are complete. Although the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001 et seq.) does not apply to this Project, as there is no federally owned or administered property within the APE and the Corps will not be curating cultural materials subject to NAGPRA, this Agreement incorporates by reference the definitions for “human remains” and “funerary objects” set forth in 43 C.F.R § 10.2(d) and those definitions shall apply to actions under this Agreement. Further treatment of human remains is addressed in **Stipulation XII (Tribal Consultation and Treatment of Human Remains)**.

XI. TRIBAL INVOLVEMENT

A. In consultation with Native American interested parties and Tribes, the Corps will make a reasonable and good-faith effort to identify Historic Properties of traditional religious and cultural importance. The Corps shall ensure that consultation with Native American Tribes is initiated early with respect to the Project and continues throughout the Section 106 process.

B. In accordance with the guidance provided in National Register Bulletin 38 and Preservation Brief 36, the Corps will seek comments from all potentially interested Native American interested parties and Tribes in making determinations of NRHP eligibility for any Traditional Cultural Properties (TCPs) and Cultural Landscapes (as defined in Bulletin 38 and Preservation Brief 36). Review of documentation shall be consistent with **Stipulation I (Timeframes and Review Procedures)**.

C. Pursuant to 36 C.F.R. § 800.6(c)(2)-(3), the Corps shall consider requests by Native American Tribes to become Concurring Parties to this Agreement. In accordance with **Stipulation XIV (Confidentiality)**, Concurring Parties to this Agreement will receive documents produced under this Agreement, as appropriate.

D. Native American Tribes may choose not to sign this Agreement as a Concurring Party. Native American Tribes and individuals not acting as Concurring Parties to the Agreement will be contacted when the Corps identifies potential interest in a specific phase or action of the project. The Corps will make a good faith effort to identify any Native American organizations and individuals with interest in the proposed treatment of Historic Properties. The identification effort may include contacting the Native American Heritage Commission (NAHC), using online databases, and using personal and professional knowledge. The Corps will then contact each identified organization and individual by mail, inviting them to consult about the specific treatment of Historic Properties. If interest from the contacted parties is received by the Corps, the Corps will proceed to consult in accordance with **Stipulation XI.A. (Tribal Involvement)**. Further consultation may also be carried out through either letters of notification, public meetings, environmental assessments/environmental impact statements, site visits, and/or other method requested by a Native American interested party and Tribe. Failure of any contacted group to comment within thirty (30) calendar days shall not preclude the Corps from proceeding with the Project.

E. The Corps shall make a reasonable and good-faith effort to ensure that Native American Tribes, acting as either Concurring Parties or those expressing interest in the project, will be invited to participate in the development and implementation of the terms of this Agreement, including, but not limited to, the identification of the APE, identification of potential Historic Properties, determinations of eligibility, findings of effect, and the resolution of adverse effect for those Historic Properties. Review periods shall be consistent with **Stipulation I (Timeframes and Review Procedures)** except in situations involving unanticipated discoveries and treatment, which shall follow the review schedules of **Stipulation IX (Discovery of Unknown Historic Properties)**. The Corps shall ensure that all interested Native American reviewers shall receive copies of all final survey and evaluation reports.

XII. TRIBAL CONSULTATION AND TREATMENT OF HUMAN REMAINS

There is no federally owned property within the designated APE, therefore NAGPRA would not apply. The CVFPB and landowner shall ensure that Native American human remains and grave goods encountered during the Undertaking that are located on state or private land are treated in accordance with the requirements in California State Health and Safety Code, Section 7050.5 and Public Resources Code 5097.98. If Native American human remains are encountered within the context of a National Register eligible archaeological site, a clear means of identifying those remains and grave goods will be described in the HPMP. Any procedures described in the HPTP regarding the handling or treatment of human remains will be coordinated with the landowner to ensure that they are consistent with Public Resources Code 5097.98. In the event that any Native American human remains or associated funerary items are identified, the Most Likely Descendant (MLD), as identified by the Native American Heritage Commission, shall be invited to advise the CVFPB and landowner in the treatment of any Native American human remains and items associated with Native American burials.

XIII. PUBLIC CONSULTATION AND PUBLIC NOTICE

A. Pursuant to 36 C.F.R. § 800.6(c)(2)-(3), the Corps will consider requests by interested parties to become Concurring Parties to this Agreement. Within thirty (30) calendar days of the effective date of this Agreement, the Corps shall consult with the SHPO to compile a list of members of the interested public who shall be provided notice of this Agreement.

B. The interested public will be invited to provide input on the identification, evaluation, and proposed treatment of Historic Properties. This may be carried out through either letters of notification, public meetings, environmental assessment/environmental impact statements, and/or site visits. The Corps shall ensure that any comments received from members of the public are taken under consideration and incorporated where appropriate. Review periods shall be consistent with **Stipulation I (Timeframes and Review Procedures)**. In seeking input from the interested public, locations of Historic Properties will be handled in accordance with **Stipulation XIV (Confidentiality)**. In cases where the release of location information may cause harm to the Historic Property, this information will be withheld from the public in accordance with Section 304 of the NHPA (54 U.S.C. § 307103).

XIV. CONFIDENTIALITY

Confidentiality regarding the nature and location of the archaeological sites and any other cultural resources discussed in this Agreement shall be limited to appropriate Corps personnel, Corps contractors, Native American tribes, the SHPO, and those parties involved in planning, reviewing and implementing this Agreement in accordance with Section 304 of the NHPA (54 U.S.C. § 307103).

XV. DISPUTE RESOLUTION

A. Should any Signatory Party to this Agreement object in writing to any action proposed or carried out pursuant to this Agreement, the Corps will immediately notify the SHPO and the Concurring Parties of the objection and proceed to consult with the objecting party for a period of time, not to exceed thirty (30) calendar days, to resolve the objection. If the objection is resolved through consultation, the Corps may authorize the disputed action to proceed in accordance with the terms of such resolution. If the Corps determines that the objection cannot be resolved, the Corps shall forward all documentation relevant to the dispute to the ACHP. Within forty-five (45) calendar days after receipt of all pertinent documentation, the ACHP shall either:

(1) Advise the Corps that the ACHP concurs in the Corps' proposed response to the objection, whereupon the Corps will respond to the objection accordingly; or

(2) Provide the Corps with recommendations, which the Corps shall consider in reaching a final decision regarding the objection; or

(3) Notify the Corps that the ACHP will comment in accordance with the requirements of Section 106 of the NHPA, and proceed to comment. Any ACHP comment provided in response shall be considered by the Corps, pursuant to the requirements of Section 106 of the NHPA.

B. Should the ACHP not exercise one of the options under **Stipulation XV.A. (Dispute Resolution)** within forty-five (45) calendar days after receipt of all submitted pertinent documentation, the Corps' responsibilities under Section 106 of the NHPA are fulfilled upon implementation of the proposed response to the objection.

C. The Corps shall consider any ACHP recommendation or comment and any comments from the SHPO to this Agreement provided in accordance with this stipulation with reference only to the subject of the objection; the Corps' responsibility to carry out all actions under this Agreement that are not the subjects of the objection shall remain unchanged.

D. The Corps shall provide the SHPO with a written copy of its final decision regarding any objection addressed pursuant to **Stipulation XV.A. (Dispute Resolution)**.

E. At any time during implementation of the measures stipulated in this Agreement should an objection pertaining to the Agreement be raised by a Concurring Party, Native American Tribe, or a member of the public, the Corps shall notify the Signatory and Concurring Parties and take the objection under consideration, consulting with the objecting party and, should the objecting party request, any of the Signatory and Concurring Parties to this Agreement, for no longer than fifteen (15) calendar days. The Corps shall consider the objection, and in reaching its decision, will consider all comments provided by the other parties. Within fifteen (15) calendar days following closure of the comment period, the Corps will render a decision regarding the objection and respond to the objecting party. The Corps will promptly notify the other parties of its decision in writing, including a copy of the response to the objecting party. The Corps' decision regarding resolution of the objection will be final. Following issuance of its final decision, the Corps may authorize the action that was the subject of the dispute to proceed in accordance with the terms of that decision. The Corps' responsibility to carry out all other actions under this Agreement shall remain unchanged.

XVI. NOTICES

A. All notices, demands, requests, consents, approvals or communications from all parties to this Agreement to other parties to this Agreement shall be personally delivered, sent by United States Mail, or emailed, and all parties shall be considered in receipt of the materials five (5) calendar days after deposit in the United States mail, certified and postage prepaid, return receipt requested.

B. Signatory and Concurring Parties agree to accept facsimiles or copies of signed documents and agree to rely upon such facsimiles or copies as if they bore original signatures.

XVII. AMENDMENTS, NONCOMPLIANCE, AND TERMINATION

A. **Amendment:** Any Signatory Party to this Agreement may propose that the Agreement be amended, whereupon the Corps shall consult with the SHPO to consider such amendment. The Agreement may be amended only upon written concurrence of all Signatories.

All attachments to this Agreement, and other instruments prepared pursuant to this agreement including, but not limited to, the Project's description, initial cultural resource inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans, may be individually revised or updated through consultation consistent with **Stipulation I (Timeframes and Review Procedures)** and agreement in writing of the Signatories without requiring amendment of this Agreement, unless the Signatories through such consultation decide otherwise. In accordance with **Stipulation XI (Tribal Involvement)** and **Stipulation XIII (Public Consultation and Public Notice)**, the Concurring Parties, interested Native American Tribes, and interested members of the public, will receive amendments to the Project's description, initial cultural resource inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans, as appropriate, and copies of any amendment(s) to the Agreement.

B. **Termination:** Only the Signatories may terminate this Agreement. If this Agreement is not amended as provided for in **Stipulation XVII.A. (Amendment)**, or if any Signatory proposes termination of this Agreement for other reasons, the Signatory proposing termination shall notify the other Signatory in writing, explain the reasons for proposing termination, and consult with the other Signatory to seek alternatives to termination, within thirty (30) calendar days of the notification.

Should such consultation result in an agreement on an alternative to termination, the Signatories shall proceed in accordance with that agreement.

Should such consultation fail, the Signatory proposing termination may terminate this Agreement by promptly notifying the other Signatory and Concurring Parties in writing.

Beginning with the date of termination, the Corps shall ensure that until and unless a new agreement is executed for the actions covered by this Agreement, such undertakings shall be reviewed individually in accordance with 36 C.F.R. § 800.4-800.6.

C. Duration: This Agreement shall remain in effect for a period of ten (10) years after the date it takes effect and shall automatically expire and have no further force or effect at the end of this ten-year period unless it is terminated prior to that time. No later than ninety (90) calendar days prior to the expiration date of the Agreement, the Corps shall initiate consultation to determine if the Agreement should be allowed to expire automatically or whether it should be extended, with or without amendments, as the Signatories may determine. Unless the Signatories unanimously agree through such consultation on an alternative to automatic expiration of this Agreement, this Agreement shall automatically expire and have no further force or effect in accordance with the timetable stipulated herein.

XVIII. ANNUAL REPORTING

At the end of every calendar year following the execution of this Agreement, the Corps shall provide all parties to this Agreement a summary report detailing work carried out pursuant to its terms, if any. Such report shall describe progress made implementing the terms of the Agreement as well as include any scheduling changes proposed, any problems encountered, and any disputes and objections received in the Corps' efforts to carry out the terms of this Agreement. Any Signatory party may request to meet with the other Signatories to discuss implementation of this Agreement.

XIX. EFFECTIVE DATE

This Agreement shall take effect on the date that it has been fully executed by the Corps and the SHPO.

EXECUTION of this Agreement by the Corps and the SHPO, its transmittal to the ACHP, and subsequent implementation of its terms evidence that the Corps has afforded the ACHP an opportunity to comment on the undertaking and its effects on Historic Properties, that the Corps has taken into account the effects of the undertaking on Historic Properties, and that the Corps has satisfied its responsibilities under Section 106 of the NHPA and applicable implementing regulations for all aspects of the undertaking.

SIGNATORIES TO THIS AGREEMENT:

U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT

BY:________________________________ DATE : 9 Sep 15
Michael J. Farrell, Colonel, U.S. Army Corps of Engineers, District Commander

CALIFORNIA STATE HISTORIC PRESERVATION OFFICER

BY:________________________________ DATE: 10 Sept 2015
Julianne Polanco, State Historic Preservation Officer

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

STATE OF CALIFORNIA CENTRAL VALLEY FLOOD PROTECTION BOARD

BY:____DATE:___________
Leslie Gallagher, Executive Officer

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

BUENA VISTA RANCHERIA OF THE ME-WUK INDIANS OF CALIFORNIA

BY:____DATE: ____________
Rhonda L. Morningstar Pope, Chairwoman

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

CACHIL DEHE BAND OF WINTUN INDIANS OF THE COLUSA INDIAN COMMUNITY OF THE COLUSA RANCHERIA

BY:____DATE: ____________
Ambar Mohammed

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

COLFAX-TODDS VALLEY CONSOLIDATED TRIBE

BY:______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

CORTINA WINTUN ENVIRONMENTAL PROTECTION AGENCY

BY:_______________________________________DATE: ____________
Charlie Wright, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

EL DORADO MIWOK TRIBE

BY:______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

BY:_______________________________________DATE: ____________
Rose Enos

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

ENTERPRISE RANCHERIA OF MAIDU INDIANS OF CALIFORNIA

BY:______________________________________DATE: ____________
Glenda Nelson, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

FAIR OAKS HISTORICAL SOCIETY

BY:______________________________________DATE: ___________

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

BY:______________________________________DATE: ____________
Kesner Flores

**PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA**

CONCURRING PARTIES:

GOLDEN GATE STATE MUSEUM

BY:____DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

IONE BAND OF MIWOK INDIANS OF CALIFORNIA

BY:______________________________________DATE: ___________
Crystal Martinez, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

MECHOOPDA INDIAN TRIBE OF CHICO RANCHERIA

BY:_______________________________________DATE: ____________
Dennis Ramirez, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

MOORETOWN RANCHERIA OF MAIDU INDIANS

BY:_______________________________________DATE: ____________
Guy Taylor, Representative

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

NASHVILLE-EL DORADO MIWOK

BY:_______________________________________DATE: ____________
Cosme Valdez, Interim Chief Executive Officer

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

SACRAMENTO COUNTY HISTORICAL SOCIETY

BY:______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
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SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

SHINGLE SPRINGS BAND OF MIWOK INDIANS

BY:_______________________________________DATE: ____________
Nicholas Fonseca, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
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REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

SOCIETY FOR CALIFORNIA ARCHAEOLOGY

BY:_______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
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SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

STRAWBERRY VALLEY RANCHERIA

BY:_______________________________________DATE: ____________
Cathy Bishop, Chairperson

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

SUTTER COUNTY HISTORICAL SOCIETY

BY:_______________________________________DATE: ____________

**PROGRAMMATIC AGREEMENT
AMONG
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REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA**

CONCURRING PARTIES:

T'SI-AKIM MAIDU

BY:_______________________________________DATE: ____________
Don Ryberg, Chairman

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

UNITED AUBURN INDIAN COMMUNITY OF THE AUBURN RANCHERIA

BY:______________________________________DATE: ___________
Gene Whitehouse, Chairman

PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

WEST SACRAMENTO HISTORICAL SOCIETY

BY:_______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
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THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

WILTON RANCHERIA

BY:____DATE: ____________
Raymond Hitchcock, Chairperson

**PROGRAMMATIC AGREEMENT
AMONG
THE U.S.ARMY CORPS OF ENGINEERS AND
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SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA**

CONCURRING PARTIES:

YOLO COUNTY HISTORICAL SOCIETY

BY:______________________________________DATE: ____________

PROGRAMMATIC AGREEMENT
AMONG
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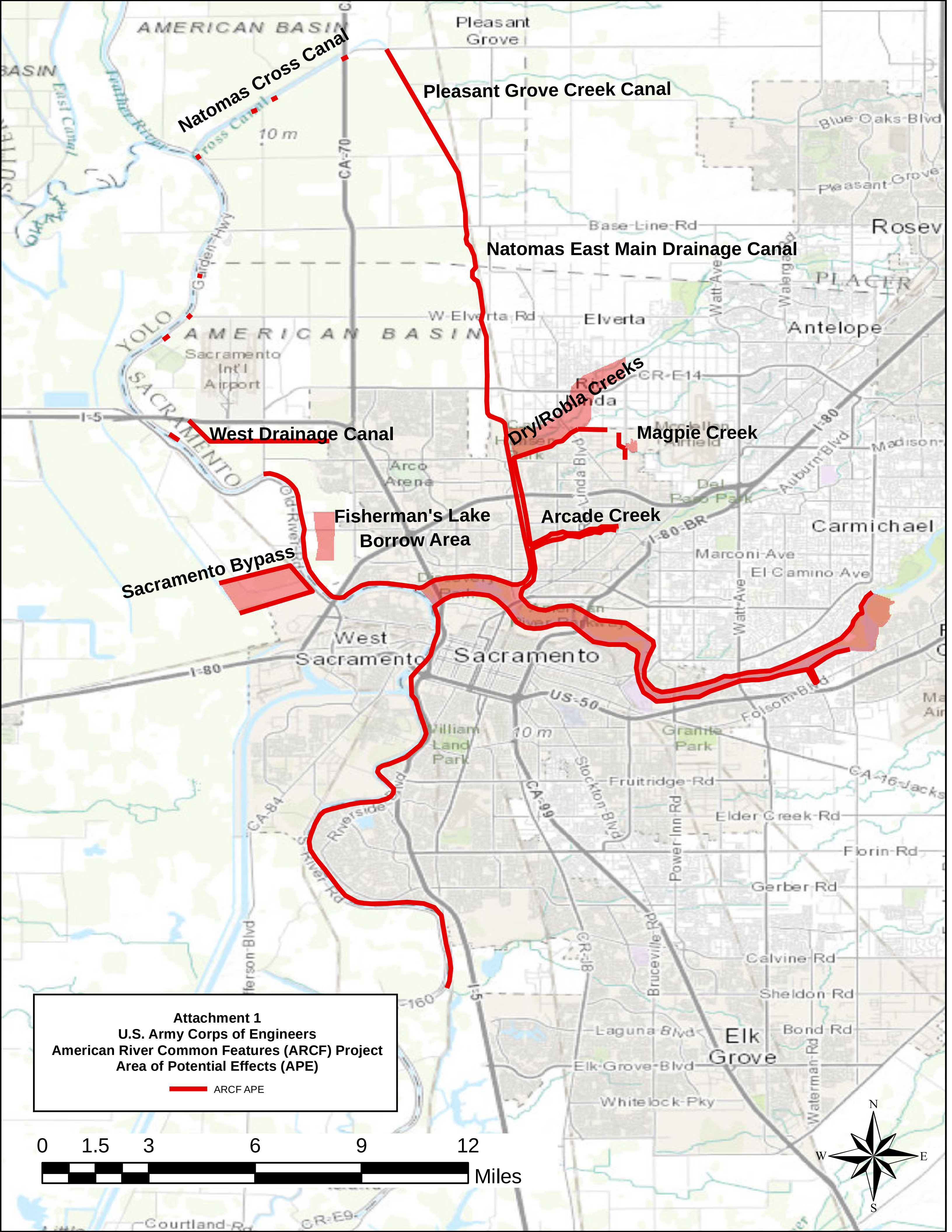
REGARDING THE AMERICAN RIVER COMMON FEATURES PROJECT,
SACRAMENTO, SACRAMENTO AND YOLO COUNTIES, CALIFORNIA

CONCURRING PARTIES:

BY:____DATE: ____________
Randy Yonemura



Attachment 1
U.S. Army Corps of Engineers
American River Common Features (ARCF) Project
Area of Potential Effects (APE)

Attachment 2

American River Common Features Project
Project Description
November 2014

The American River Common Features (ARCF) Project is being developed to provide flood risk reduction to the city of Sacramento, including the Natomas Basin, areas along the North and South banks of the American River, and areas along the East bank of the Sacramento River below the American River. The non-Federal sponsor for the ARCF Project is the State of California Central Valley Flood Protection Board (CVFPB). The Sacramento Area Flood Control Agency (SAFCA) has a Local Cooperation Agreement with the CVFPB. Authorized Local Cooperation Agreements include requirements to: 1) Provide lands, easements, and rights-of-way; 2) Modify or relocate utilities, roads, bridges (except railroad bridges), and other facilities where necessary for the construction of the project; 3) Cost share the project per applicable laws; and 4) Bear all costs of operation, maintenance, repair, rehabilitation and replacement of flood control facilities.

Location

The Sacramento River Watershed covers approximately 26,000 square miles in central and northern California. Shasta Dam impounds the upper Sacramento River Watershed. Major tributaries of the Sacramento River include the Feather, Yuba and American rivers. The American River Watershed covers about 2,100 square miles northeast of the city of Sacramento and includes portions of Placer, El Dorado, Alpine, and Sacramento counties. The American River Watershed includes Folsom Dam and Reservoir; inflowing rivers and streams, including the North, South, and Middle forks of the American River; and the American River downstream to its confluence with the Sacramento River in the city of Sacramento. The Sacramento and American rivers, in the Sacramento area, form a flood plain covering approximately 110,000 acres in their confluence. The flood plain includes most of the developed portions of the city of Sacramento and encompasses the boundaries of the study area. Figure 1 shows the ARCF study area.

Area of Potential Effects (APE)

While the overall ARCF Project study area covers a broad geographic area, the ARCF Project area of potential effects (APE) includes those areas where the project will have potential direct or indirect effects to the character or use of historic properties. The ARCF Project APE includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; the Sacramento Bypass and Sacramento Weir; approximately 4 miles of the Pleasant Grove Creek Canal; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal. The APE is shown in Figure 2.

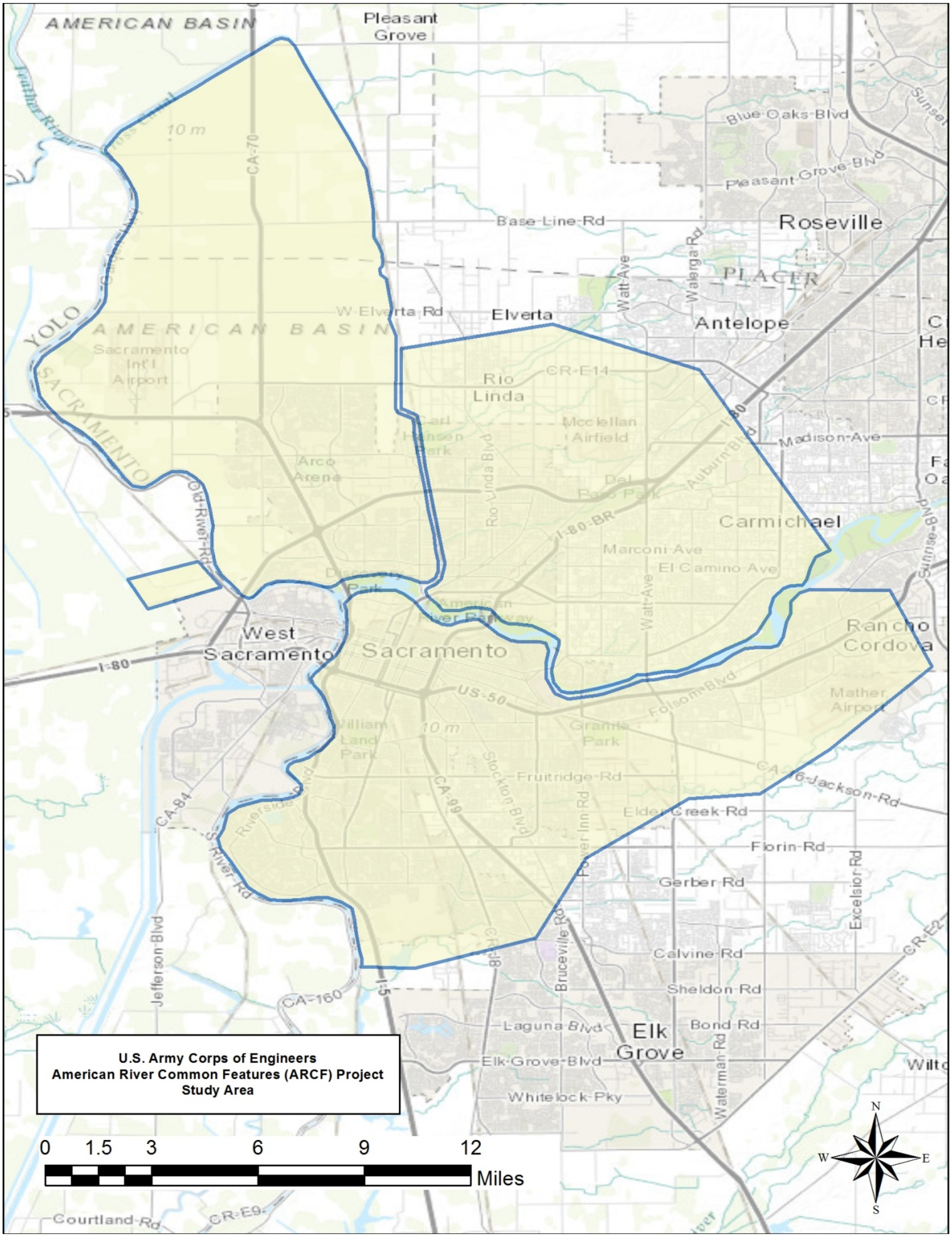


Figure 1. ARCF Project Study Area

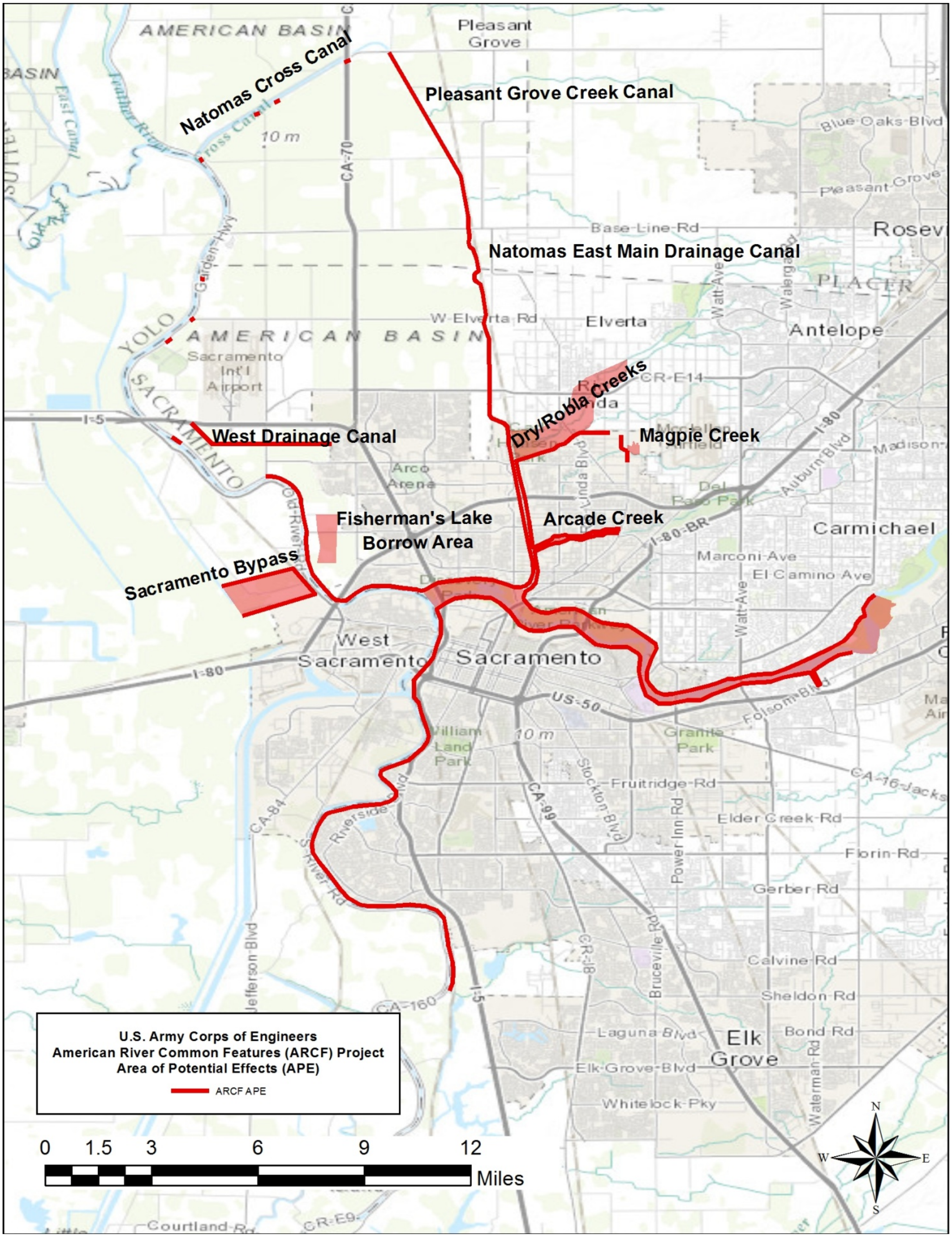


Figure 2. ARCF Project Area of Potential Effects

Project Authorization

The ARCF Project was authorized in the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. Significant changes to the project were approved via the Second Addendum to the Supplemental Information Report of March 2002. Additionally, the Energy and Water Development Appropriations Act of 2004 increased the authorized total cost of the project to $205,000,000. The current estimated cost of the authorized project is $277,563,000.

In the ARCF Project, authorized features are generally located in the Lower American River, Natomas Basin and Sacramento River. All Lower American River features authorized in WRDA 1996 and 1999 have been constructed or are scheduled for construction within the next three years. Construction of authorized Natomas features were deferred as a result of deep underseepage concerns raised after the 1997 flood event in the Sacramento Valley. In 1997, considerable deep underseepage occurred on the Sacramento River in areas that had previously undergone remediation after the 1986 flood event. The previous remediation consisted of shallow seepage cutoff walls and did not account for the deep underseepage problems revealed during the 1997 flood event. Significant seepage on the American River was also observed.

Because of the considerable cost increase of seepage remediation on the American River, all funds appropriated by Congress throughout the late 1990s and the early part of the 2000s were used for construction activities on the Lower American River instead of for design efforts in the Natomas Basin. Additionally, it was recognized that all work in the Natomas Basin would require significantly more features than was anticipated at the time of authorization. Additional levee improvements were also needed on the Sacramento River and the American River below Folsom Dam in order to truly capture the benefits of the Folsom Dam projects and the Common Features project already authorized and constructed. Therefore, the Corps decided that reevaluation studies would be required for the Natomas Basin and city of Sacramento portions of the ARCF Project. This reevaluation is now called the Common Features General Reevaluation Report (CFGRR).

Proposed Measures

In general, levees fail because of one of four reasons: seepage, slope stability, overtopping, and erosion. The CFGRR is looking at reducing the likelihood of having a levee failure in the city of Sacramento as a result of any of these reasons. Methods that were looked at to achieve this goal include, but are not limited to: seepage cutoff wall, seepage berm, levee slope flattening, relief wells, adjacent levee, stability berm, drained stability berm, levee raising, floodwall, bypass widening, riverbank erosion protection, and launchable rock erosion protection. These preliminary methods have been screened and refined to the following final array of measures. The ARCF Project is a single purpose flood risk management project with the measures shown in Table 1 below proposed for implementation. In addition to the measures listed in Table 1, the following measures would be implemented throughout the APE:

- Establish the Corps' standard levee footprint on all levees within the APE that are out of compliance, including a 10-foot-wide landside maintenance access easement.
- Bring utility encroachments, including pump stations, into compliance with Corps policy.
- Remove private encroachments.
- Relocate, as needed, irrigation canals within the Natomas Basin, to include the relocation of the West Drainage Canal south of the Airport Operations Area.
- Remediate the Highway 99/Natomas Cross Canal Bridge.

- Excavation of borrow materials at designated borrow sites, to include the South Fisherman's Lake Borrow Area and the West Lakeside School site in the Natomas Basin.

Table 1. Proposed Measures for the American River Common Features Project.

Waterway/Location	Extent of Action	Proposed Measure
American River	North and south levees from the confluence with the Sacramento River upstream for approximately 12 miles.	• Construct bank protection or launchable rock trenches
American River	North levee from the confluence with the Sacramento River upstream to approximately NEMDC.	• Flatten the levee slope • Install cutoff walls
Sacramento River	East levee from Power Line Road to the American River.	• Construct an adjacent levee with a flattened landside slope • Install cutoff walls • Construct seepage berms • Install relief wells • Construct levee raise • Establish compliance with Corps vegetation requirements for upper 2/3 slopes of the levee.
Sacramento River	East levee from the American River to Morrison Creek.	• Install cutoff walls • Construct bank protection • Construct levee raise • Establish compliance with Corps vegetation requirements for upper 2/3 slopes of the levee.
NEMDC	East levee from Dry/Robla Creek to the American River	• Install cutoff walls • Construct floodwalls • Establish compliance with Corps vegetation requirements.
NEMDC	West levee from Dry/Robla Creek to the American River	• Construct bank protection • Construct levee raise and flatten levee slope • Establish compliance with Corps vegetation requirements.
NEMDC	West levee from Sankey Road to Dry/Robla Creek	• Construct levee raise and flatten levee slope • Install cutoff walls • Establish compliance with Corps vegetation requirements.
Pleasant Grove Creek Canal	West levee	• Construct bank protection • Construct levee raise with a widened levee • Install cutoff walls • Upgrade or remove culverts

Waterway/Location	Extent of Action	Proposed Measure
		• Establish compliance with Corps vegetation requirements.
Arcade Creek	North and south levees from NEMDC to Marysville Boulevard	• Install cutoff walls • Raise floodwalls • Establish compliance with Corps vegetation requirements.
Dry/Robla Creek		• Raise floodwalls • Establish compliance with Corps vegetation requirements.
Magpie Creek Diversion Canal	Upstream of Raley Boulevard	• Construct floodwalls • Establish compliance with Corps vegetation requirements.
Magpie Creek area	South of Raley Boulevard	• Construct new levee
Magpie Creek area	East of Raley Boulevard	• Acquire property to create a flood detention basin • Widen the Raley Boulevard/Magpie Creek bridge and raise the elevation of the roadway • Remove the Don Julio Creek culvert
Sacramento Weir and Bypass	North bypass levee to 1,500 feet north.	• Widen the Sacramento Weir and Bypass by approximately 1,500 feet • Construct a new section of weir and levee • Remove the existing Sacramento Bypass north levee

Construction Activities

While the Corps began its reevaluation studies, SAFCA began final design and construction on certain areas in Natomas. A local sponsor or entity may request permission under Section 408 to alter a Federal project and a Section 404 permit to comply with the Clean Water Act. Generally a local sponsor or entity will request Section 408 permission and will move forward with the funding, planning, and constructing of the Federal project with the intention of seeking later credit under Section 104 for their share of an authorized Federal project. In 2008, the SAFCA requested consideration for a Section 104 credit, permission under Section 408, and requested a Section 404 permit for the Natomas Levee Improvement Project (NLIP). The Natomas Basin portions of the ARCF Project have been divided into a number of construction phases (Figure 3).

Shortly after receiving Section 408 permission and Section 404 approval, SAFCA, in cooperation with the California Department of Water Resources (DWR) and the CVFPB, implemented urgently needed improvements to the Federal project levee system around the Natomas Basin. SAFCA has completed construction for all of Phases 1, 2A, and 3 and is finishing construction of Phase 4a. When complete, SAFCA will have completed levee improvement construction on 18 miles of the 42 miles surrounding the Natomas Basin. The Corps will be constructing the remaining 24 miles of levee improvement once authorization and appropriations are received.

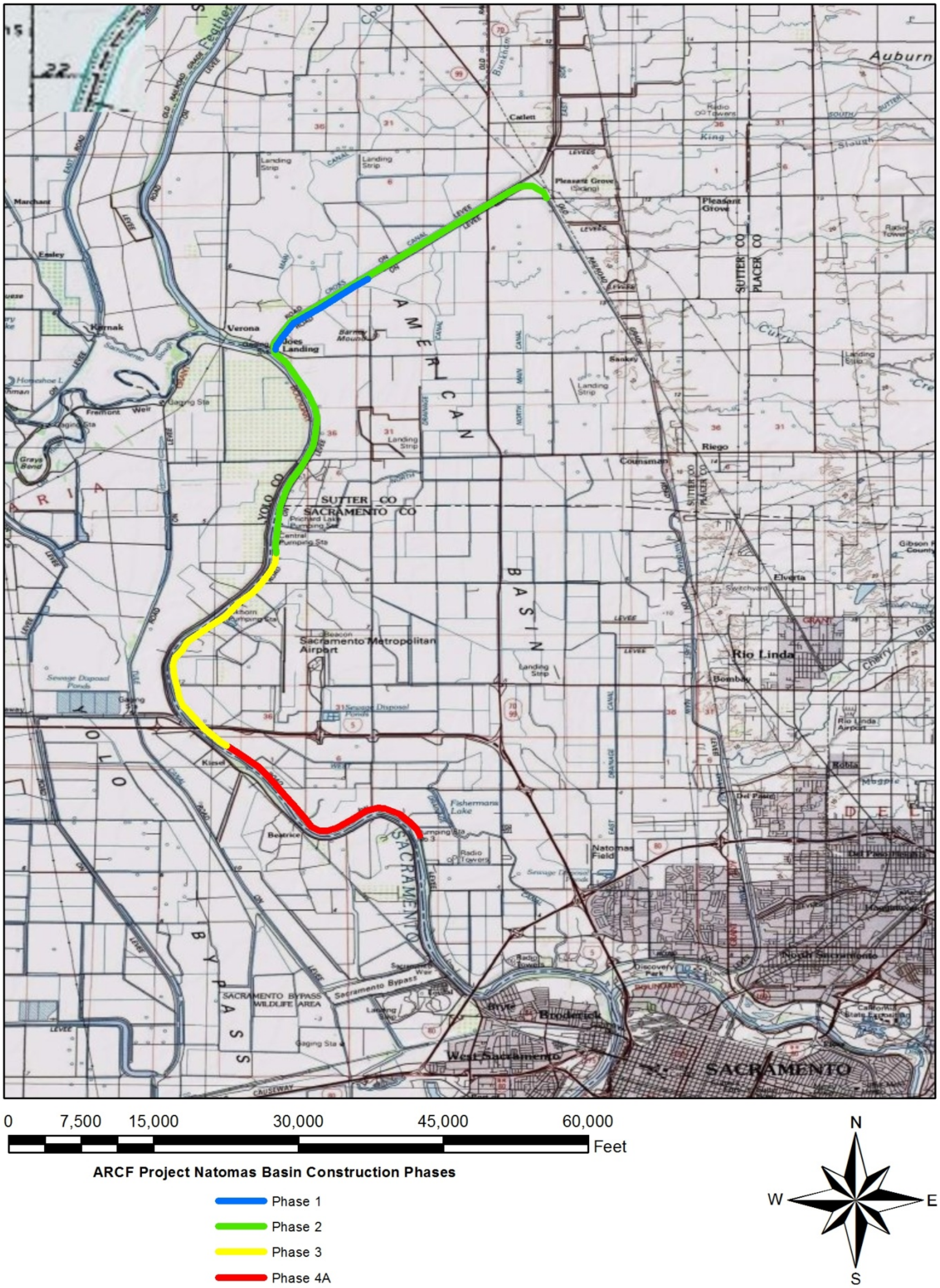


Figure 3. ARCF Project NLIP Construction Phases

Cultural Resources/NEPA Compliance

For NLIP Phases 1, 2, 3, and 4a, SAFCA, DWR and CVFPB were the lead decision makers on the planning, design, environmental and cultural resources compliance, and construction for NLIP. SAFCA contracted with EDAW (now AECOM) to complete EIS/EIRs for the overall Natomas Basin. In order to meet the requirements under the Section 404 permits and Section 408 permissions and because SAFCA planned to seek credit for their share of an authorized Federal project, SAFCA was required to comply with the National Environmental Policy Act of 1969 (NEPA) and the National Historic Preservation Act of 1966, as amended (NHPA).

Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertaking on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. The Code of Federal Regulations 36 CFR § 800 outlines the steps and guidelines a Federal agency must follow in order to comply with Section 106. The NEPA compliance effort in the NLIP Environmental Impact Statement/Environmental Impact Report (EIS/EIR), completed in 2007, provided an overview of the known cultural resources and historic properties within the Natomas Basin and the ARCF study area. The records and literature search identified 175 cultural resources and 285 surveys and inventories conducted within the ARCF study area.

Because of the size of the study area and because the assessment of effects to historic properties could not be completed prior to the signing of the Record of Decision for the EIS/EIR, an alternate method was required to ensure that the construction efforts within the Natomas Basin undertaken by
SAFCA would comply with Section 106 of the NHPA. When effects on historic properties cannot be fully determined prior to approval of an undertaking and when there may be potential adverse effects of a complex or phased project a programmatic agreement (PA) may be executed for the undertaking.

On May 1, 2008, a PA for NLIP was executed between the Corps, SAFCA and the SHPO. The NLIP PA only covered actions under the Section 408 permissions and Section 404 permits within the Natomas Basin for which SAFCA was the construction lead. By executing the PA the NLIP was then in compliance with Section 106 and the signatories to the NLIP PA (the Corps, SAFCA and the SHPO) had an agreed upon series of stipulations that fulfilled the requirements of 36.CFR § 800. The Corps had the responsibility of determining if the actions by SAFCA complied with Section 106 and coordinating concurrence with those determinations with the SHPO. All construction efforts for NLIP Phases 1, 2, 3, and 4a were funded entirely by SAFCA, DWR and CVFPB.

Prior to the construction of Phases 1, 2, 3, and 4a, a series of NEPA compliance documents were completed as supplements to the original EIS/EIR completed in 2007. Phase 1 was covered in an Environmental Assessment/Impact Statement dated November 2007. Phase 2 was covered in a supplement to the EIS/EIR completed in November 2008. Phase 3 was covered in an EIS/EIR completed May 2009. And Phase 4a was covered in a EIS/EIR completed November 2009.

Because construction of Phases 1, 2, 3, and 4a does not address all of the flood risk concerns in the Natomas Basin, it does not provide complete flood protection for the entire Natomas Basin. Due to funding constraints with SAFCA, DWR and CVFPB, construction of the remaining perimeter of the Natomas Basin will not be completed under the Section 408 permissions and Section 404 permits. Therefore, as part of our reevaluation efforts (CFGRR), the Corps is implementing completion of the remaining phases in the Natomas Basin, as well as the other portions of the ARCF Project as the Federal lead on the project. The remaining Natomas construction was covered under NEPA/CEQA in the NLIP Phase 4b EIS/EIR in October 2010. The Corps will also be preparing a NEPA/CEQA document for the CFGRR for those activities not covered in the previous NEPA/CEQA documents.

Although the NLIP PA covered Section 106 compliance for the entirety of possible construction activities in the Natomas Basin, the roles and responsibilities of the NLIP PA designated SAFCA as responsible for the execution of inventories, surveys, recordation of sites, determinations of eligibility, and development of historic properties treatment plans and mitigation measures. The NLIP PA includes the Corps and SAFCA in roles as regulatory authority but with no involvement in the production of technical studies or determinations of effect.

The previously completed EIS/EIRs are applicable for overall NEPA compliance for the Natomas Basin. However, in order for the Corps to be in compliance with Section 106 of the NHPA, and due to the changing roles and responsibilities and authorities, a new PA will need to be developed and executed for the remaining construction activities the Corps will undertake in the Natomas Basin as well as the other authorized project features for the rest of the ARCF Project.

Similar to the NLIP PA, the ARCF PA will outline the steps the Corps, as the lead Federal agency for NEPA, will take in order to comply with Section 106 of the NHPA. The ARCF PA must be executed in advance of any construction activities the Corps may undertake for the ARCF Project.

Attachment 3

Historic Properties Management Plan

Historic Properties Management Plan (HPMP) shall include:

I. Introduction and Description of the Undertaking
   a. Overview and Executive Summary
   b. Purpose and Application of the HPMP
   c. Regulatory context
   d. Description of the Undertaking

II. General Standards and Procedures
   a. Professional Qualifications
   b. Documentation Standards
   c. Dissemination and Confidentiality of Information
   d. Permits and Rights of Entry
   e. Curation

III. Background Information
   a. Records and Literature Search
   b. Archaeological Sensitivity Assessment Procedure
   c. Correspondence with Knowledgeable Individuals and Groups
   d. American Indian Outreach

IV. Historic Context
   a. Prehistoric Resource Types
   b. Historic Resource Types
   c. Environmental Context
      i. Regional Surface Geology
      ii. Regional Geomorphology
      iii. Climate
      iv. Flora and Fauna
   d. Cultural Context
      i. Prehistoric Archaeology
      ii. Ethnographic Context
      iii. Historic Context

V. Identification of Historic Properties
   a. General Methods
   b. Evaluation
   c. Documentation

VI. American Indian Consultation Procedures
   a. American Indians and Organizations as Concurring Parties
   b. American Indians and Organizations as Non-Concurring Parties

VII. Assessment of Effects
   a. Criteria of Adverse Effect
   b. Finding of Effect

Attachment 4

Property Types Exempt from Evaluation

This attachment defines categories of properties that do not warrant evaluation pursuant to Stipulation IV.B of this Agreement. Only individuals meeting the Secretary of the Interior's Professional Qualification Standards pursuant to Stipulation VII.A of this agreement are authorized to determine whether properties meet the requirements of this attachment and are therefore exempt from evaluation and consultation with SHPO. Exempted properties may be documented, if documentation is warranted, at a level commensurate with the nature of the property (e.g., DPR 523 Primary Form, Location Map, memo). The Corps Cultural Resources staff shall make any final determinations on level of documentation required under this agreement.

Exempt Property Type 1: Archaeological Property Types and Features

1. Isolated prehistoric finds consisting of fewer than three items per 100 m^2
2. Isolated historic finds consisting of fewer than three artifacts per 100 m^2 (several fragments from a single glass bottle, and similar vessels are to be counted as one artifact)
3. Refuse scatters less than 50 years old (scatters containing no material that can be dated with certainty as older than 50 years old)
4. Features less than 50 years old (those known to be less than 50 years old through map research, inscribed dates, etc.)
5. Isolated refuse dumps and scatters over 50 years old that lack specific associations
6. Isolated mining prospect pits
7. Placer mining features with no associated structural remains or archaeological deposits
8. Foundations and mapped locations of buildings or structures more than 50 years old with few or no associated artifacts or ecofacts, and with no potential for subsurface archaeological deposits

Exempt Property Type 2: Minor, Ubiquitous, or Fragmentary Infrastructure Elements

The following list does not apply to properties 50 years old or older that could be potentially important, nor does it apply to properties that may contribute to the significance of larger historic properties such as districts or cultural landscapes.

Water Conveyance and Control Features

- Natural bodies of water providing a water source, conveyance, or drainage
- Modified natural waterways

- Concrete-lined canals less than 50 years old and fragments of abandoned canals
- Roadside drainage ditches and secondary agricultural ditches
- Small drainage tunnels
- Flood storage basins
- Reservoirs and artificial ponds
- Levees and weirs
- Gates, valves, pumps, and other flow control devices
- Pipelines and associated control devices
- Water supply and waste disposal systems
- Rip-rap

Recent Transportation or Pedestrian Facilities

- Railroad grades converted to other uses, such as roads, levees, or bike paths
- Bus shelters and benches
- Vista points and rest stops
- Bike paths, off-road vehicle trails, equestrian trails, and hiking trails
- Parking lots and driveways

Highway and Roadside Features

- Isolated segments of bypassed or abandoned roads
- Retaining walls
- Highway fencing, soundwalls, guard rails, and barriers
- Drains and culverts, excluding culverts assigned a Caltrans bridge number
- Cattle crossing guards
- Roadside landscaping and associated irrigation systems
- Signs and reflectors
- Telecommunications services, including towers, poles, dishes, antennas, boxes, lines, cables, transformers, and transmission facilities
- Utility services, including towers, poles, boxes, pipes, lines, cables, and transformers
- Oil and gas pipelines and associated control devices

Adjacent Features

- Fences, walls, gates, and gateposts

- Isolated rock walls and stone fences
- Telephone booths, call boxes, mailboxes, and newspaper receptacles
- Fire hydrants and alarms
- Markers, monuments, signs, and billboards
- Fragments of bypassed or demolished bridges
- Temporary roadside structures, such as seasonal vendors' stands
- Pastures, fields, crops, and orchards
- Corrals, animal pens, and dog runs
- Open space, including parks and recreational facilities
- Building and structure ruins and foundations less than 50 years old

Movable or Minor Objects

- Movable vehicles
- Stationary vehicles less than 50 years old or moved within the last 50 years
- Agricultural, industrial and commercial equipment and machinery
- Sculpture, statuary, and decorative elements less than 50 years old or moved within the last 50 years

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 2

Section 106 Consultation Record

American River Common Features Project SHPO, ACHP, Sponsor Consultation Record*

***May not include all communication for project.**

12/31/15

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
2/1/2012	Outgoing Letter	ACHP	Reid Nelson	Inform ACHP of proposed project, process to be followed, ask for participation in PA.
2/1/2012	Outgoing Letter	SHPO	Milford Donaldson	Request comments on APE, proposed efforts to identify historic properties, plan to develop PA.
4/11/2012	Outgoing Email	State of CA	Erin Brehmer, Mary Hadden	Transmittal of draft PA for sponsor review, request comments.
4/13/2012	Incoming Email	State of CA	Erin Brehmer	Acknowledgement of receipt of PA and will sent to CVFPP and DWR cultural staff.
5/22/2012	Outgoing Email	State of CA	Erin Brehmer	Request timeframe for CVFPP and DWR review of PA.
6/13/2012	Incoming Email	State of CA	Erin Brehmer	Transmittal that DWR had no comments on PA and CVFPP transmittal of comments.
6/20/2012	Outgoing Phone Call	CVFPP	James Herota	Discussed CVFPP comments on PA, explained that CEQA specific language would not be included.
6/20/2012	Outgoing Email	State of CA	Erin Brehmer	Responses to CVFPP PA comments.
6/21/2012	Incoming Email	CVFPP	James Herota	Receipt of additional Native American contacts from CVFPP.
7/16/2012	Outgoing Letter	SHPO	Milford Donaldson, Susan Stratton, Dwight Dutsche	Letter transmitting PA for review and comment, determination of the APE, potential adverse effects, resolution of adverse effects through a PA, suggest meeting.
7/16/2012	Outgoing Letter	ACHP	Reid Nelson	Letter transmitting PA for review and comment, request notification if ACHP plans to participate in the PA.
7/16/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche	Email transmittal of 7/16/12 formal letter.
7/16/2012	Outgoing Email	ACHP	Tom McCulloch	Email transmittal of 7/16/12 formal letter.
7/27/2012	Incoming Email	ACHP	Tom McCulloch	Acknowledgement of receipt of 7/16/12 letter, ask if ACHP participation is needed, ask if comments on PA needed.
7/27/2012	Outgoing Email	ACHP	Tom McCulloch	Request any comments from the ACHP on PA, ACHP participation in PA probably not needed unless ACHP thinks so after reading submitted information.
8/7/2012	Incoming Letter	ACHP	Raymond Wallace	ACHP decline to participate in PA, request final signed and executed PA once completed.
8/7/2012	Outgoing Email	ACHP	Tom McCulloch	Request for any comments on PA, acknowledge letter from ACHP declining to participate.
8/14/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche	Follow up to 7/16/12 formal letter and email requesting comments on PA, proposing a meeting, transmittal of ACHP declining to participate.
9/17/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche	Follow up to 7/16/12 formal letter, follow up emails on 7/16/12 and 8/14/12 requesting comments on PA and date for when comments would be available.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
10/10/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche	Email request for consultation meeting with SHPO to include PDT (Dan Tibbitts and Sara Schultz) to discuss project and PA.
10/23/2012	Consultation Meeting	SHPO	Susan Stratton, Dwight Dutsche, Dan Tibbitts, Melissa Montag	Consultation meeting to discuss project and PA, SHPO provided comments on the PA.
10/25/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche	Email addressing comments from 10/23/12 meeting, transmittal of revised PA, request concurrence on PA acceptability, propose meeting in November.
10/29/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche, Brendan Greenaway, Dan Tibbitts, Melissa Montag	Email request for follow up consultation meeting to 10/23/12 meeting and 10/25/12 email and changes/revisions to PA.
11/5/2012	Consultation Meeting	SHPO	Susan Stratton, Dwight Dutsche, Brendan Greenaway, Dan Tibbitts, Sara Schultz, Melissa Montag	Consultation meeting to discuss project and PA, SHPO requested a Historic Properties Management Plan be included in PA.
11/7/2012	Outgoing Email	SHPO	Susan Stratton, Dwight Dutsche, Brendan Greenaway, Dan Tibbitts, Sara Schultz	Transmittal of current draft of PA after incorporating comments from 11/5/12 meeting, communication of project schedule and long term phasing, requested comments on draft PA by 12/31/12.
1/14/2013	Outgoing Email	SHPO	Brendan Greenaway	Email transmittal of draft PA sent 11/7/12, request comments from SHPO.
1/14/2013	Incoming Email	SHPO	Brendan Greenaway	Acknowledgement of 1/14/13 transmittal, no comments from SHPO yet. Will review, suggested sending draft PA to concurring parties.
1/14/2013	Outgoing Email	SHPO	Brendan Greenaway	Acknowledgement of 1/14/13 email from SHPO.
1/30/2013	Outgoing Email	SHPO	Susan Stratton, Brendan Greenaway	Transmittal of draft HPMP for SHPO review and comment.
2/11/2013	Outgoing Email	DWR	Jacqueline Wait	Transmittal of draft PA to sponsor, provided project information, CVFPP comments from 2012, requested comments on draft PA.
2/11/2013	Outgoing Email	SAFCA	Peter Buck	Email to inquire who at SAFCA would review PA.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
2/12/2013	Incoming Email	SAFCA	Peter Buck	Acknowledgement of 2/11/12, request PA be sent to Mr. Buck.
2/12/2013	Outgoing Email	SAFCA	Peter Buck	Transmittal of draft PA for SAFCA review.
3/14/2013	Incoming Email	SHPO	Brendan Greenaway	Acknowledgement of draft HPMP sent 1/30/13, agreed document was acceptable.
3/19/2013	Incoming Email	SAFCA	Peter Buck	Email informing Corps that draft PA is still being reviewed by SAFCA counsel.
4/10/2013	Outgoing Email	DWR	Jacqueline Wait	Follow up email to 2/11/13 email transmitting electronic documents again and requesting comments on draft PA by 5/20/13.
4/11/2013	Incoming Email	SAFCA	Peter Buck	Transmittal of SAFCA comments on draft PA.
6/13/2013	Incoming Email	SHPO	Brendan Greenaway	Queried status of PA.
6/13/2013	Outgoing Email	SHPO	Brendan Greenaway	Informed SHPO that the PA is undergoing additional review by Native Americans, ACHP has declined to participate and Corps would appreciate any comments SHPO may have on draft PA. Told SHPO of general project schedule.
6/13/2013	Incoming Email	SHPO	Brendan Greenaway	Acknowledgment of 6/13/13 email.
9/19/2013	Outgoing Email	DWR	Erin Brehmer, Jacqueline Wait	Transmittal of EIS Cultural Resources section for State/Sponsor CEQA review.
9/19/2013	Outgoing Email	DWR	Jacqueline Wait	Transmittal of Archaeological Sensitivity Analysis for State/Sponsor review.
6/12/2014	Outgoing Email	DWR	Brehmer, David Martasian, Wait	Transmittal of updated EIS/EIR Cultural Resources appendix and current version of final draft of the PA.
6/13/2014	Outgoing Email	SHPO	Brendan Greenaway	Transmittal of final draft of PA for SHPO review, summarized consultation efforts with DWR, ACHP, and tribes so far.
6/13/2014	Incoming Email	SHPO	Brendan Greenaway	Acknowledgement of 6/13/14 email transmittal. Stated SHPO will review once current draft of PA has been circulated to tribes. Asked for the review period for tribes on the current draft.
6/13/2014	Outgoing Email	SHPO	Brendan Greenaway	Response to SHPO email above, stating current review of draft PA for tribes is 30 days and that the tribes received the draft PA for a 45 day review period in 2013.
6/13/2014	Incoming Email	SHPO	Brendan Greenaway	Restated SHPO will review following the current 30 day review period. Asked to provide any response to the 30 day review period once it has passed.
6/13/2014	Outgoing Letter	SHPO	Brendan Greenaway	Outgoing letter (hand delivered) to SHPO. Requests that the SHPO concur on the Corps' determination of the APE, plans to identify cultural resources through sensitivity assessment, and provide comments on the final draft of the PA.
6/13/2014	Outgoing Letters	DWR, ACHP	Jacqueline Wait, Reid Nelson	Copy furnished (with enclosures) 6/13/14 letter to SHPO for DWR and ACHP files.
6/16/2014	Outgoing Email	SHPO	Brendan Greenaway	Response to 6/13/14 email, mentioned the Corps would like to execute the PA this fall, offered to arrange for site visit or hold a meeting to provide additional information that could help with SHPO's review.
6/17/2014	Incoming Email	SHPO	Brendan Greenaway	Response to 6/16/14 email that a field trip might be a good idea, asked for what and where the field trip could cover.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
6/17/2014	Outgoing Email	SHPO	Brendan Greenaway	Response to 6/17/14 email that the field trip could cover four locations where the Corps is proposing work to show the scope of the effort, provide information on the construction, as well as future efforts to identify cultural resources in accordance with the PA. Requested three available dates to schedule a site visit.
6/17/2014	Incoming Email	SHPO	Brendan Greenaway	Will check schedules for attendance for site visit to include Jessica Tudor and Susan Stratton.
6/26/2014	Outgoing Email	SHPO	Brendan Greenaway	Follow up to email from 6/17/14 to suggest 7/31/14 for a field visit, possibly to include stops for West Sac Project as well.
7/2/2014	Incoming Email	SHPO	Jessica Tudor	Ms. Tudor requested list of comments from Mr. Dutsche on the draft PA, and what comments may have been addressed, or not.
7/3/2014	Outgoing Email	SHPO	Jessica Tudor	Response to 7/2/14 email, provided Ms. Tudor with email from Ms. Montag to SHPO on 10/25/12 that addressed comments from SHPO and provided a new draft of the PA. Provided information that no written comments have been received, though the SHPO did suggest the development of a HPMP as an attachment to the PA, to be developed later. Also suggested the field visit, possibly for 7/31/14.
7/3/2014	Incoming Email	SHPO	Jessica Tudor	Requested information on proposed field trip on 7/31/14, as well as the timeline for the review of the draft PA, APE, and historic properties identification efforts.
7/3/2014	Outgoing Email	SHPO	Jessica Tudor	Response to 7/3/14 email, provided logistical information on proposed field trip, that the review of the draft PA can take place in a few weeks but preferably prior to field trip on 7/31/14, and the Corps' plan to release the draft PA with the draft EIS/EIR in mid-August, preferably with comments from SHPO incorporated and comments from tribes considered (if they have been received).
7/3/2014	Incoming Email	SHPO	Jessica Tudor	Ms. Tudor said she is available for field visit on 7/31/14, will check with Ms. Stratton and Mr. Greenaway on their availability.
7/3/2014	Outgoing Email	SHPO	Jessica Tudor	Forwarded 7/31/14 field visit meeting request to Ms. Tudor.
7/3/2014	Incoming Email	SHPO	Jessica Tudor	Accepted 7/31/14 field visit meeting request.
7/22/2014	Outgoing Email	DWR	Erin Brehmer, David Martasian, Jacqueline Wait	Sent email to let DWR that UAIC has requested to meet with the Corps regarding the project and PA. Asked that DWR check and confirm availability on August 4th or 5th. Asked for a response ASAP.
7/22/2014	Incoming Email	DWR	David Martasian	Acknowledged 7/22/14 email, said would check and respond ASAP.
7/22/2014	Outgoing Email	DWR	David Martasian	Acknowledged 7/22/14 email from Mr. Martasian.
7/25/2014	Incoming Email	DWR	Erin Brehmer	Response to 7/22/14 email, Ms. Wait has recommended that Anecita Agustinez attend the meeting for DWR and is available on August 5th.
7/28/2014	Incoming Phone Call	DWR	Erin Brehmer	Ms. Brehmer called to follow up to 7/25/14 email, left voice message.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
7/29/2014	Outgoing Phone Call	DWR	Erin Brehmer	Ms. Montag called Ms. Brehmer to discuss the potential meeting on August 5th, asked if Ms. Wait was planning to attend since much of the discussion may center on the project PA and Section 106 requirements. Ms. Brehmer said it was recommended that Ms. Agustinez attend for DWR.
7/29/2014	Outgoing Meeting Request	DWR	Erin Brehmer, David Martasian, Jacqueline Wait, Anecita Agustinez	Sent placeholder meeting request for 8/5/14 meeting with DWR and UAIC.
7/29/2014	Outgoing Email	SHPO	Jessica Tudor	Email to Ms. Tudor that field visit on 7/31/14 has to be cancelled due to logistical reasons. Asked for availability the week of August 11th or 18th.
7/29/2014	Incoming Email	SHPO	Jessica Tudor	Response to 7/29/14 email that those dates are generally open for Ms. Tudor.
7/31/2014	Outgoing Email	SHPO	Jessica Tudor	Asked Ms. Tudor if 8/13/14 or 8/14/14 would work better for the field visit.
7/31/2014	Incoming Email	SHPO	Jessica Tudor	Ms. Tudor responded that either date would work.
7/31/2014	Outgoing Meeting Request	SHPO	Jessica Tudor, Susan Stratton, Brendon Greenaway	Sent meeting request for field visit on 8/13/14.
7/31/2014	Incoming Email	SHPO	Jessica Tudor	Accepted 8/13/14 field visit request.
7/31/2014	Incoming Email	SHPO	Susan Stratton	Declined 8/13/14 field visit request.
7/31/2014	Incoming Email	SHPO	Jessica Tudor	Requested Word version of final draft of PA.
8/1/2014	Outgoing Email	SHPO	Jessica Tudor	In response to 7/31/14 email, sent Word version of final draft of PA.
8/1/2014	Outgoing Email	DWR	Erin Brehmer, David Martasian, Jacqueline Wait, Anecita Agustinez	Revised placeholder meeting sent on 7/29/14 to meeting times for meeting with UAIC on 8/5/14.
8/1/2014	Incoming Email	DWR	David Martasian	Accepted 8/5/14 meeting request.
8/4/2014	Incoming Email	DWR	Erin Brehmer	Accepted 8/5/14 meeting request.
8/4/2014	Incoming Email	DWR	Jacqueline Wait	Accepted 8/5/14 meeting request.
8/4/2014	Incoming Email	DWR	Anecita Agustinez	Declined 8/5/14 meeting request.
8/5/2014	Consultation Meeting	Corps, DWR, Tribes	David Martasian, Erin Brehmer, Jacqueline Wait	Consultation meeting held with UAIC and SSBMI.
8/8/2014	Incoming Email	SHPO	Jessica Tudor, Susan Stratton	Comments provided on draft PA sent 8/1/14.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
9/2/2014	Outgoing Email	DWR	David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez	Sent link to Doodle poll to schedule next meeting with UAIC and SSBMI for late October/early November. Requested response to poll by 9/17/14. Welcomed receiving any comments on the draft programmatic agreement.
9/4/2014	Incoming Email	DWR	David Martasian	Responded to Doodle poll.
11/17/2014	Outgoing Email	SHPO	Jessica Tudor	Sent track changes version of draft PA responding to comments sent 8/8/14, included additional language and current version of PA that will be included with draft EIS/EIR to be released to the public in mid-December. Suggested a face-to-face meeting to resolve any lingering issues before moving to a final draft of PA.
12/10/2014	Outgoing Email	DWR	David Martasian, Erin Brehmer, Jacqueline Wait	Sent current versions of cultural resources sections from the EIS/EIR to ask if DWR has any comments or changes needed in order to comply with CEQA because the EIS/EIR will be going to the CVFPB in January for approval for public release. Stated that comments would be needed in early January to make any changes.
7/1/2015	Outgoing Email	SHPO	Jessica Tudor	Sent an updated version of the PA with comments addressed (similar to 11/17/14 version) as well as merged changes as a result of consultation with tribes. Suggested a meeting to discuss and that the Corps would like to execute the PA around September.
8/6/2015	Outgoing Email	SHPO	Jessica Tudor, Anmarie Medin	Transmittal of updated clean draft of the PA with comments addressed. Suggested meeting to go over changes and edits, if needed, as the Corps is working to execute the PA in September.
9/10/2015	Meeting	SHPO	Anmarie Medin, Julianne Polanco	Signing and execution of final PA for ARCF Project.
10/30/2015	Outgoing Email	ACHP	Brian Lusher	Transmittal of signed and executed PA to the ACHP.
10/30/2015	Outgoing Email	SHPO	Jessica Tudor, Anmarie Medin	Transmittal of list of potential concurring parties to transmit notice of PA, requested a response from SHPO within two weeks.
11/2/2015	Incoming Letter	ACHP	Brian Lusher	Acceptance and acknowledgement of the PA by the ACHP.
11/9/2015	Incoming Email	SHPO	Jessica Tudor	In response to 10/30/15 email, Ms. Tudor suggested adding the Society for California Archaeology and potential historical societies/museums to the mailing list of possible concurring parties.
11/17/2015	Outgoing Email	SHPO	Jessica Tudor, Anmarie Medin	In response to 11/9/15 email, Ms. Montag stated the Society of California Archaeology and several historical societies have been added as potential concurring parties to the PA and if SHPO thinks of any additional parties to let the Corps know.
11/30/2015	Incoming Email	SHPO	Jessica Tudor	Acknowledgement of 11/17/15 email.

American River Common Features Project Native American Consultation Record*

*****May not include all communication for project.

12/31/15

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
5/4/2011	Outgoing Letters	Mechoopda Indian Tribe of Chico Rancheria (MITCR), Shingle Springs Bank of Miwok Indians (SSBMI), Strawberry Valley Rancheria (SVR), Tsi-Akim Maidu (TAM), United Auburn Indian Community (UAIC), Wilton Rancheria (WR), Nashville-El Dorado Miwok (NEDM), Ione Band of Miwok Indians (IBMI), El Dorado Miwok Tribe (EDMT), Enterprise Rancheria of Maidu Indians (ERMI), Buena Vista Rancheria (BVR)	Various	Letter to Native American tribes with potential interest in the American River Common Features (ARCF) Project area of potential effects (APE) informing them of upcoming geotech borings and upcoming Programmatic Agreement (PA).
5/9/2011	Incoming Letter	MITCR	Mike DeSpain	Response letter from 5/4/11 letter expressing tribe's concerns about possible cultural resources sites, unaware of sites within the project area. Requested that is cultural resources are found that a funded tribal monitor be put in place.
6/2/2011	Incoming Letter	UAIC	Marcos Guerrero	Response letter from 5/4/11 letter expressing tribe's concerns about possible cultural resources sites impacted by development. Requested copies of archeological reports produced for the project, future environmental documents, and opportunity for UAIC consultants to accompany Corps during field surveys. Request to set up a field visit and concurring party status on
6/24/2011	Incoming Email	UAIC	Marcos Guerrero	Request initiation of Native American consultation for Natomas Levee Improvements Project (NLIP) and American River Common Features (ARCF) Project. Request environmental and cultural reports.
9/13/2011	Incoming Phone Call	SSBMI	Angela Rivera	Phone call requesting additional information on geotechnical investigations mentioned in 5/4/11 letter.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
9/13/2011	Outgoing Email	SSBMI	Angela Rivera	Follow up to 9/13/11 phone call, email transmittal of information on geotechnical investigations, committed to sending PA for comments when draft is ready.
9/19/2013	Incoming Email	SSBMI	Angela Rivera	Acknowledgement of 9/13/11 email transmittal, expressed interest in PA.
1/31/2012	Incoming Email	UAIC	Marcos Guerrero	Request construction schedule for NLIP Phase 4 and ARCF Project.
2/1/2012	Outgoing Email	UAIC	Marcos Guerrero	Clarification that NLIP Phase 4 will be pulled into ARCF Project and that construction schedule will be after environmental process, executing a PA, signed Chief's report, and Congressional authorization.
2/2/2012	Incoming Email	UAIC	Marcos Guerrero	Acknowledge receipt of information from 2/2/12 email, request to meet regarding ARCF and the PA.
4/3/2012	Incoming Letter	SSBMI	Daniel Fonseca	Request to meet regarding the project, to be added as a consulting party to identify TCPs in APE, and requested environmental and cultural reports.
4/25/2012	Outgoing Letter	SSBMI	Daniel Fonseca	Acknowledgement of 4/3/12 letter and plan to contact for a meeting and consult with the SSBMI on the ARCF Project.
4/25/2012	Outgoing Letter	UAIC	Gregory Baker, Marcos Guerrero	Acknowledgement of 5/9/11 request that UAIC be included survey efforts, as a concurring party to agreement documents, copies of reports, and to schedule a meeting.
4/25/2012	Outgoing Email	UAIC	Gregory Baker, Marcos Guerrero	Email transmittal of 4/25/12 letter and to schedule a tribal consultation meeting.
4/25/2012	Outgoing Email	SSBMI	Daniel Fonseca, Crystal Dilworth	Email transmittal of 4/25/12 letter and to schedule a tribal consultation meeting, suggested dates.
4/26/2012	Incoming Email	UAIC	Marcos Guerrero	Acknowledgment of 4/25/12 email and dates for meeting.
4/27/2012	Outgoing Email	UAIC	Marcos Guerrero	Follow up to 4/26/13 email, suggested dates for meeting.
4/30/2012	Outgoing Email	UAIC	Marcos Guerrero, Greg Baker	Sent meeting request for UAIC consultation meeting on 6/12/12.
4/30/2012	Outgoing Email	SSBMI	Daniel Fonseca, Crystal Dilworth	Sent meeting request for SSBMI consultation meeting on 6/14/12.
5/11/2012	Outgoing Letter	UAIC, SSBMI, EDMT, ERMI, NEDM, IBMI, TAM, SVR, WR, Mechoopda, BVR		Letter informing of planned geotechnical investigations, request for information, , request tribes to inform Corps if they are interested in additional Section 106 compliance efforts.

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6/12/2012	Consultation Meeting	UAIC	Marcos Guerrero, Melodi McAdams, Danny Rey, Melissa Montag, Dan Tibbitts, Sara Schultz, Jane Rinck	Consultation meeting with the UAIC to discuss project, upcoming schedule, description of work, plan for PA. Tribe requested the PA to review when it is ready.
6/14/2012	Consultation Meeting	SSBMI	Daniel Fonseca, Andrew Godsey, Melissa Montag, Jane Rinck, Dan Tibbitts	Consultation meeting with the SSBMI to discuss project, upcoming schedule, description of work, plan for PA. Tribe requested the PA to review when it is ready. Tribe was open to creative mitigation measures for sites Corps is unable to avoid during construction or unknown affected sites.
6/21/2012	Incoming Letter	BVR	Roselynn Lwenya	Response letter to 5/11/12 letter indicating interest in consultation on the project, Request additional information of proposed geotechnical investigations, schedule, site visit, copies of records and literature search, involvement in developing scopes, sampling strategy, research designs, field investigations, laboratory analysis, report writing, and consideration for a tribal monitor during
7/12/2012	Outgoing Letter	BVR	Roselynn Lwenya	Response letter to 6/21/12 letter informing tribe that geotechnical investigations mentioned in 5/11/12 letter would not be occurring, informing tribe of upcoming PA, and proposing a meeting to discuss Section 106 consultation efforts.
8/15/2012	Outgoing Phone Call	BVR	Roselynn Lwenya	Called to follow up from 6/21/12 and 7/12/12 letters. Spoke to Ms. Lwenya to discuss a meeting to address concerns in 6/21/12 letter. Ms. Lwenya stated she would respond with dates for a meeting.
8/15/2012	Outgoing Email	BVR	Roselynn Lwenya	Follow up to 8/15/12 phone call reiterating that geotech investigations mentioned in 5/11/12 letter would not be occurring, but requested the tribe's involvement in development of the PA for the project.
8/22/2012	Incoming Email	BVR	Roselynn Lwenya	Acknowledgement of 8/15/12 email, will follow up with available meeting dates.
8/22/2012	Outgoing Email	BVR	Roselynn Lwenya	Acknowledgement of 8/22/12 email.
11/1/2012	Outgoing Email	BVR	Roselynn Lwenya	Follow up email to 8/15/12 requesting available dates for the BVR to meet to discuss project.
1/8/2013	Incoming Email	BVR	Roselynn Lwenya	Request to set up tribal meeting with proposed dates.
1/9/2013	Outgoing Email	BVR	Roselynn Lwenya	Response to 1/8/13 email with suggested alternate dates.
1/22/2013	Outgoing Email	BVR	Roselynn Lwenya	Follow up to 1/9/13 email to request setting up a tribal meeting, provided dates.
1/22/2013	Incoming Email	BVR	Roselynn Lwenya	Acknowledgement of 1/22/13 email, will reply with proposed dates in the future.
1/24/2012	Incoming Email	BVR	Roselynn Lwenya	Email proposing tribal meeting on 2/22/13.

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1/25/2012	Outgoing Email	BVR	Roselynn Lwenya	Follow up to 1/24/13 email communicating Corps not available to meet on 2/22/13, suggested alternate dates before and after.
2/15/2013	Outgoing Email	BVR	Roselynn Lwenya	Follow up email to 1/25/13 email to request setting up a tribal meeting, suggested meeting dates in March.
4/5/2013	Outgoing Letter	MITCR, SSBMI, SVR, TAM, UAIC, WR, NEDM, IBMI, EDMT, ERMI, BVR, Cachil DeHe Band of Wintun Indians (Cachil DeHe), Mooretown Rancheria of Maidu Indians (MRMI)		Letter providing project information, determination of possible affects, transmittal of PA for tribal review and comment, request for involvement and review within 45 days.
4/19/2013	Incoming Voicemail	IBMI	Andrew Raimey	Received call from Andrew Raimey to coordinate Ione Band participation in PA with Randy Yonemura.
4/22/2013	Outgoing Phone Call	IBMI	Randy Yonemura	As requested in 4/19/13 voicemail, contacted Randy to discuss Ione Band concerns, participation in PA. Conversation and follow up communication efforts were documented in a telephone conversation log.
4/22/2013	Outgoing Email	IBMI	Randy Yonemura	Follow up email to 4/22/13 phone call to discuss Ione Band concerns, suggested several dates for possible meetings.
4/23/2013	Outgoing Email	BVR	Roselynn Lwenya	Follow up email to 2/15/13 email to request setting up a tribal meeting, emailed electronic versions of PA and supporting documents.
4/29/2013	Outgoing Email	IBMI	Randy Yonemura	As requested in 4/19/13 voicemail, contacted Randy to discuss Ione Band concerns, participation in PA. Follow up from 4/22/13 email.
5/6/2013	Incoming Email	UAIC	Marcos Guerrero	Requested updated signature page for the UAIC to sign the PA.
5/9/2013	Outgoing Email	UAIC	Marcos Guerrero	Response to 5/6/13 email letting Mr. Guerrero that the PA will not be ready for signature until fall/winter. Committed to continuing to keep the UAIC informed as the PA and EIS move forward.
5/13/2013	Outgoing Phone Call	IBMI	Randy Yonemura	As requested in 4/19/13 voicemail, contacted Randy to discuss Ione Band concerns, participation in PA. Follow up from 4/22/13 and 4/29/13 emails. Left
5/15/2013	Outgoing Phone Call	BVR	Roselynn Lwenya	Called to follow up from 4/5/13 letter, was directed to speak to Roselynn and call back the next day.
5/15/2013	Outgoing Phone Call	EDMT		Called to follow up from 4/5/13 letter, no answer.
5/15/2013	Outgoing Phone Call	ERMI	Cindi Smith	Called to follow up from 4/5/13 letter, was directed to speak to Cindi Smith. Cindi Smith was out.
5/15/2013	Outgoing Phone Call	IBMI	Yvonne Miller	Called to follow up from 4/5/13 letter, was told to reach Ms. Miller by email.
5/15/2013	Outgoing Phone Call	NEDM	Cosme Valdez	Called to follow up from 4/5/13 letter, no answer.
5/15/2013	Outgoing Phone Call	SSBMI	Daniel Fonseca	Called to follow up from 4/5/13 letter, no answer.

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5/15/2013	Outgoing Phone Call	SSBMI	Angela Rivera	Called to follow up from 4/5/13 letter, spoke with Ms. Rivera who said she would call back.
5/15/2013	Outgoing Phone Call	SVR	Cathy Bishop	Called to follow up from 4/5/13 letter, no option to leave a voicemail message.
5/15/2013	Outgoing Phone Call	WR	Mary Daniels-Tarango	Called to follow up from 4/5/13 letter, no answer.
5/15/2013	Outgoing Phone Call	MRMI	Guy Taylor	Called to follow up from 4/5/13 letter, no answer.
5/16/2013	Outgoing Email	IBMI	Yvonne Miller	Emailed Ms. Miller to follow up from 4/5/13 letter and 5/16/13 phone call, no answer.
5/16/2013	Outgoing Phone Call	EDMT		Called to follow up from 4/5/13 letter, left message.
5/16/2013	Outgoing Phone Call	NEDM	Cosme Valdez	Called back from 5/15/13 call, spoke with Mr. Valdez. He stated no comments on the PA, does not want to meet with the Corps.
5/16/2013	Outgoing Phone Call	ERMI	Cindi Smith	Call back from 5/15/13 call, left message with Ms. Smith's voicemail.
5/16/2013	Outgoing Phone Call	SSBMI	Daniel Fonseca	Call back from 5/15/13 call, left message with Mr. Fonseca's voicemail.
5/16/2013	Outgoing Phone Call	BVR	Roselynn Lwenya	Call back from 5/15/13 call, Roselynn said she received materials from 4/5/13 letter, will speak with the tribal committee and get back to the Corps.
5/16/2013	Outgoing Phone Call	SVR	Cathy Bishop	Call back from 5/15/13 call, no option to leave a voicemail message.
5/16/2013	Outgoing Phone Call	WR	Mary Daniels-Tarango	Call back from 5/15/13 call, left message with Ms. Daniels-Tarango's voicemail.
5/16/2013	Outgoing Phone Call	MITCR	Dennis Ramirez, Mike DeSpain	Called to follow up from 4/5/13 letter, called in AM, Mr. Ramirez and Mr. DeSpain were not available. Called in PM, no answer, left messages.
5/16/2013	Outgoing Phone Call	MRMI	Guy Taylor	Call back from 5/15/13 call, left message with Mr. Taylor's voicemail.
5/16/2013	Outgoing Phone Call	Cachil DeHe	Ambar Mohammed	Called to follow up from 4/5/13 letter, left message.
5/17/2013	Incoming Voicemail	MITCR	Mike DeSpain	Requested further information on project and asked if Cachil DeHe and UAIC had been contacted.
5/17/2013	Incoming Voicemail	IBMI	Randy Yonemura	Voicemail requesting to set up meeting between Corps and Ione Band.
5/17/2013	Incoming Voicemail	SSBMI	Andrew Godsey	Received voicemail from Mr. Godsey indicating the SSBMI would like the chance to comment on the PA.
5/20/2013	Outgoing Email	MITCR	Mike DeSpain	Provided information on project, consultation with Cachil DeHe, UAIC, offered to meet with Mechoopda and/or provide more information.
5/20/2013	Incoming Email	MITCR	Mike DeSpain	Recommended UAIC as the contact for the Section 106 for the project.
5/20/2013	Outgoing Email	IBMI	Randy Yonemura	Follow up email to 5/17/13 email requesting available dates for a tribal meeting.
5/20/2013	Outgoing Phone Call	TAM	Eileen Moon	Called to follow up from 4/5/13 letter, no answer.
5/20/2013	Outgoing Email	BVR	Roselynn Lwenya	Email request for tribal consultation meeting with BVR on 5/29/13.
5/23/2013	Outgoing Email	SSBMI	Andrew Godsey, Daniel Fonseca, Angela Rivera	Follow up to voice mail message from 5/17/13 providing electronic version of the PA for review and comment, requested comments from SSBMI.
5/23/2013	Incoming Email	SSBMI	Andrew Godsey	Acknowledgement of receipt of 5/23/13 email from Corps.

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5/29/2013	Consultation Meeting	BVR	Roselynn Lwenya, Rhonda Pope, Jeanette Simmons, Christy, Richard, Jane Rinck, Dan Tibbitts, Melissa Montag	Tribal consultation meeting to discuss project, Section 106 compliance, project schedule, draft PA, tribal involvement.
5/29/2013	Outgoing Phone Call	IBMI	Randy Yonemura	As requested in 4/19/13 voicemail, contacted Randy to discuss Ione Band concerns, participation in PA. Follow up from 4/22/13 and 4/29/13 emails and 5/13/13 voicemail. Left voicemail.
6/3/2013	Outgoing Email	BVR	Roselynn Lwenya	Email follow up to 5/29/13 tribal consultation meeting requesting comments from tribe by 6/28/13, providing additional project information.
6/5/2013	Outgoing Email	SSBMI	Andrew Godsey, Daniel Fonseca, Angela Rivera	Follow up to 5/23/13 providing electronic version of the PA for review and comment, requested comments by 6/28/13.
6/6/2013	Outgoing Letters	ERMI, WR, SVR, Kesner Flores, Cortina Band of Wintun Indians (CBWI), Marshall McKay, Yocha DeHe Wintun Nation, Rose Enos, Randy Yonemura, April Moore, Colfax-Todds Valley Consolidated Tribe (CTVCT), IBMI, SSBMI, TAM	Various	After receipt of additional Native American contacts from the NAHC, a second mailing of the 4/5/13 letter. Letter providing project information, determination of possible affects, transmittal of PA for tribal review and comment, request for involvement and review within 45 days.
6/13/2013	Incoming Letter	BVR	Rhonda Pope	Letter received 6/20/13 communicating the BVR comments on the draft PA, concerns about aspects of the PA and past tribal consultation efforts.
6/14/2013	Incoming Email	BVR	Roselynn Lwenya	Transmittal of attendee list requested in 6/3/13 email, noted postal mailing of comments from BVR on the PA.
6/18/2013	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Acknowledge receipt of 6/14/13 email, responded to request for records and literature searches by noting confidentiality agreements with CHRIS.
6/19/2013	Incoming Phone Call	TAM	Grayson Coney	Mr. Coney called to express the interest of the T'Si-akim Maidu in the ARCF PA. He asked to be included in future EIS correspondence and said the tribe would be interesting in signing the PA as a concurring party. He also expressed that the tribe feels it would be the MLD for the project and that tribal monitors may be required. Conversation was documented in a telephone

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7/9/2013	Incoming Letter	Yocha Dehe Wintun Nation	Marshall McKay	Letter received 7/12/13 in response to 6/6/13 letter to tribes asking for comments on draft PA. The tribe reviewed the project and concluded it is not within the aboriginal territories of the tribe and declined comment on the project or the PA.
7/15/2013	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Outgoing email in response to receipt of 6/13/13 letter from the tribe. Acknowledged receipt, plan to address comments from tribe, and request dates to meet to consult on project again at a later date.
9/13/2013	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Requested dates to meet with Buena Vista in late October/early November regarding ARCF Project, PA, continuing consultation with the tribe.
9/18/2013	Incoming Email	UAIC	Marcos Guerrero	Contacted the Corps in regard to the Common Features Remaining Sites construction project and asked about status of the ARCF GRR PA.
9/18/2013	Outgoing Email	UAIC	Marcos Guerrero	Reply to 9/18/13 email, provided information that the PA is still in draft form, EIS is expected to be out for public review in the fall (UAIC and Shingle Springs will receive the EIS and draft PA for additional review) and PA is not expected to be signed until 2014, with construction to come in following years.
10/9/2013	Outgoing Phone Call		Rose Enos	Called regarding 6/6/13 letter and was told Ms. Enos was not available and to call back later.
10/9/2013	Outgoing Phone Call		April Wallace Moore	Called regarding 6/6/13 letter and spoke to Ms. Moore. She requested that a monitor be present during construction and to be kept up to date on the project.
10/9/2013	Outgoing Phone Call	CTVCT	Judith Marks	Called and left message regarding 6/6/13 letter.
10/9/2013	Outgoing Phone Call	CTVCT	Pamela Cubbler	Called regarding 6/6/13 letter, Ms. Cubbler indicated she would like to meet, suggested possible dates in late October.
10/9/2013	Outgoing Phone Call	IBMI	Anthony Burris	Called regarding 6/6/13 letter, message on phone said "the number is not assigned yet," unable to leave message.
10/9/2013	Outgoing Phone Call	SSBMI	Sam Daniels	Called regarding 6/6/13 letter, left message.
10/9/2013	Outgoing Phone Call	WR	Andrew Franklin	Called regarding 6/6/13 letter, was told to email Andrew Franklin.
10/9/2013	Outgoing Email	WR	Andrew Franklin	Emailed regarding 6/6/13 letter and as directed from 10/9/13 phone call to Mr. Franklin.
10/9/2013	Outgoing Email	WR	Steven Hutchason	Emailed regarding 6/6/13 letter.
10/9/2013	Outgoing Phone Call	ERMI	Art Angle	Called regarding 6/6/13 letter, was told to email Ren Reynolds.

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10/9/2013	Outgoing Email	ERMI	Ren Reynolds	Emailed regarding 6/6/13 and as directed from 10/9/13 phone call to Mr. Angle.
10/9/2013	Outgoing Email	SVR	Cathy Bishop	Emailed regarding 6/6/13 letter.
10/9/2013	Outgoing Email		Kesner Flores	Emailed regarding 6/6/13 letter.
10/9/2013	Outgoing Email	CBWI		Emailed regarding 6/6/13 letter.
10/10/2013	Outgoing Email		Randy Yonemura	Sent email regarding 6/6/13 letter and regarding project and comments on the PA.
10/10/2013	Outgoing Phone Call		Rose Enos	Called regarding 6/6/13 letter and following up from 10/9/13 call and was told Ms. Enos was not available and to call back later.
10/16/2013	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Follow up to 9/13/13 email requesting dates to meet with Buena Vista in late October/early November regarding ARCF Project, PA, continuing consultation with the tribe.
10/18/2013	Outgoing Phone Call	CTVCT	Pamela Cubbler	Follow up to 10/9/13 phone call to schedule a meeting with the CTVCT and Ms. Cubbler. Left message.
10/18/2013	Outgoing Email	IBMI	Randy Yonemura, Yvonne Miller, IMBI Cultural Heritage	Follow up to previous attempts (last 5/20/13) to set up a meeting with the IBMI. Follow up to emails 5/20/13, 4/29/13, 4/22/13.
10/18/2013	Outgoing Phone Call		Rose Enos	Called following up from 6/6/13 letter and 10/9/13 and 10/10/13 phone calls. Ms. Enos stated she is concerned about burials and construction and asked to be kept on our mailing list and to be informed as the project moves forward. She did not want to meet with the Corps at this time.
10/18/2013	Outgoing Phone Call	BVR	Roselynn Lwenya	Follow up to 10/16/13 email requesting dates to meet with Buena Vista regarding the project, PA, continuing consultation with the tribe.
10/18/2013	Outgoing Phone Call	CTVCT	Judith Marks	Follow up to 6/6/13 letter and 10/9/13 phone call message.
10/18/2013	Outgoing Phone Call	IMBI	Anthony Burris	Follow up to 6/6/13 letter and 10/9/13 phone call, unable to leave message because message said "the number is not assigned yet."
10/18/2013	Outgoing Phone Call	SSBMI	Sam Daniels	Follow up to 6/6/13 letter and 10/9/13 phone call message, left message asking for SSBMI to contact the Corps if they have comments, concerns, or would like to meet.
10/18/2013	Outgoing Phone Call	WR	Steven Hutchason	Follow up to 10/9/13 email, Mr. Hutchason expressed interest in commenting on the PA, asked for a Word version to provide track changes. Ms. Montag committed to sending a Word version of the PA after current OC review and asked the WR to contact the Corps with any additional comments, concerns, or requests to meet.

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10/18/2013	Outgoing Phone Call	SVR	Cathy Bishop	Follow up to 6/6/13 letter and 10/9/13 email to try and leave a phone call message. Voice message on phone would not allow leaving a message.
10/18/2013	Outgoing Phone Call		Kesner Flores	Follow up to 6/6/13 letter and 10/9/13 email, Mr. Flores expressed an interest in reviewing the project area to determine if it is within his interest area. Ms. Montag committed to sending a Word version of the PA for review after current OC review is completed and a new draft is ready.
10/18/2013	Outgoing Phone Call	CBWI	Charlie Wright	Follow up to 6/6/13 letter and 10/9/13 email, left voice message with Chairman Charlie Wright.
11/15/2013	Incoming Phone Call	IBMI	Randy Yonemura	Phone call requesting that the Corps meet with the Bureau of Indian Affairs (Gerald Jones) regarding the Common Features Project and general requirements the Corps may have on water projects.
11/15/2013	Outgoing Phone Call	Bureau of Indian Affairs (BIA)	Gerald Jones	Spoke with Gerald Jones to get clarification on the proposed Corps/BIA/Ione Band meeting. Requested proposed agenda for proper coordination with Corps management.
11/19/2013	Outgoing Email	IBMI, BIA	Yonemura, Jones	Follow up to phone conversations on 11/15/13, requested agenda or discussion topics, proposed dates for a meeting. Provided contact information for Jane Rinck and Mark Gilfillan to coordinate if needed.
5/7/2014	Incoming Email	UAIC	Marcos Guerrero	Asked if the Corps has an electronic version of the Common Features PA.
5/13/2014	Outgoing Email	UAIC	Marcos Guerrero	Response to 5/7/14 email that a current draft of the Common Features PA is still being worked on, taking into account comments received so far and that Ms. Montag will be in touch when that draft is available for review.
6/5/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	As requested in emails dated 9/18/13 and 5/7/14, provided the draft PA and attachments in electronic form for review and comment. Mentioned an official letter will be transmitted soon with a review period in that letter. Asked to provide any questions or concerns, or interest in scheduling a meeting.
6/5/2014	Outgoing Email	WR	Steven Hutchason	As requested phone call on 10/18/13, provided the draft PA and attachments in electronic form for review and comment. Mentioned an official letter will be transmitted soon with a review period in that letter. Asked to provide any questions or concerns, or interest in scheduling a meeting.

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6/5/2014	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Follow up to most recent email on 10/18/13, provided the draft PA and attachments in electronic form for review and comment. Mentioned an official letter will be transmitted soon with a review period in that letter. Asked to provide any questions or concerns, or interest in scheduling a meeting. Asked for three available dates in June and July to schedule a meeting.
6/5/2014	Outgoing Email		Kesner Flores	As requested phone call on 10/18/13, provided the draft PA and attachments in electronic form for review and comment. Mentioned an official letter will be transmitted soon with a review period in that letter. Asked to provide any questions or concerns, or interest in scheduling a meeting.
6/5/2014	Outgoing Email	WR	Steven Hutchason	Follow up to 6/5/14 email, earlier email did not attach PA attachments. Resent with PA attachments.
6/5/2014	Outgoing Email	BVR	Roselynn Lwenya, Rhonda Pope	Follow up to 6/5/14 email, earlier email did not attach PA attachments. Resent with PA attachments.
6/5/2014	Outgoing Email		Kesner Flores	Follow up to 6/5/14 email, earlier email did not attach PA attachments. Resent with PA attachments.

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6/12/2014	Outgoing Letters	SVR, IMBI, UAIC, TAM, CTVCT, SSBMI, WR, MITCR, EDMT, ERMI, BVR, Cachil DeHe, MRMI, NEDM, CBWI	Cathy Bishop, Anthony Burris, Jason Camp, Grayson Coney, Pamela Cubbler, Sam Daniels, Mary Daniels-Tarango, Michael DeSpain, Rose Enos, Kesner Flores, Daniel Fonseca, Nicholas Fonseca, Andrew Franklin, Reno Franklin, Marcos Guerrero, Steven Hutchason, Roselynn Lwenya, Judith Marks, Yvonne Miller, Ambar Mohammed, Eileen Moon, April Wallace Moore, Glenda Nelson, Rhonda Morningstar Pope, Dennis Ramirez, Guy Taylor, Cosme Valdez, Gene Whitehouse, Charlie Wright, Randy Yonemura	Letters providing final draft of PA, summarized previous actions to consult in April/June 2013, provided sensitivity assessment for review/comment, detailed previous Section 106 consultation efforts with SHPO, ACHP, CVFPP DWR, and tribes, communication with the public via letter, requested involvement in the PA as a potential concurring party, requested comments for consideration for the final PA, interest in scheduling a meeting, and to inform the Corps if there is interest in signing the PA as a Concurring Party and any edits to signature block.
6/20/2014	Incoming Email	UAIC	Marcos Guerrero	In response to 6/5/14 email, Mr. Guerrero asked if an MOA or addendum for sites within the APE with a high potential for adverse effects could be included with the PA, as well as if a map with sensitivity areas UAIC would like to have monitored could be included.

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6/23/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Response to 6/20/14 email to iterate that the PA is the Corps' planned process to comply with Section 106, identify historic properties, and determine adverse effects once the project is authorized and that an MOA or addendum would be premature since historic properties have not yet been identified. Further iterated that the Corps welcomes UAIC's assistance identifying sensitive areas and would appreciate any information the tribe is willing to share.
6/26/2014	Outgoing Letters	BVR	Rhonda Pope, Roselynn Lwenya	Received 6/12/14 letters back as undeliverable. Re-dated letters to 6/26/14 and sent by mail again.
6/30/2014	Outgoing Email		Kesner Flores	Received hard copy of 6/12/14 letter back as unclaimed. Sent email to ask Mr. Flores for an address to re-send the hard copies to. Provided electronic copies of the documents (Letter to Mr. Flores, letter to SHPO, Word version of draft PA) sent in 6/12/14 postal mailing.
7/1/2014	Incoming Email	UAIC	Marcos Guerrero	Requested to meet regarding the project to share UAIC maps and to start to identify the need to ground truth locations. Requested to meet the week of July 21st.
7/1/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Replied to 7/1/14 email from Mr. Guerrero that Ms. Montag is not available the week of the 21st, but would be available the week of the 14th, or the 28th or 29th. Or could scheduled for August. Also requested that UAIC let Ms. Montag know if they would like other Corps personnel to attend meeting.
7/14/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Follow up to email sent on 7/1/14 to inquire if Mr. Guerrero would still like to schedule a meeting. Provided July 16-18, 28, 29, August 4-6 as available, or could schedule for later in August.
7/15/2014	Incoming Email	UAIC	Marcos Guerrero, Jason Camp	Response to 7/14/14 email, suggested 7/29/14 to meet.
7/15/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Confirmed 7/29/14 would likely work, asked who from the Corps UAIC would like to have present at the meeting so Ms. Montag can coordinate.
7/15/2014	Incoming Email	UAIC	Marcos Guerrero, Jason Camp	Mr. Guerrero suggested the Corps PM and those in charge at SAFCA attend the 7/29/14 meeting.
7/15/2014	Returned Mailing	TAM	Grayson Coney	Received 6/12/14 letters back as unclaimed.
7/15/2014	Outgoing Phone Call	TAM	Grayson Coney	Called Mr. Coney to confirm mailing address, he confirmed the correct mailing and was out of town.
7/15/2014	Outgoing Letter	TAM	Grayson Coney	Resent 6/12/14 letter and draft PA.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
7/15/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Reply to 7/15/14 email that Corps PM is not available on 7/29/14, suggested 8/1 or 8/4-8/6. Also explained that DWR is the non-Federal sponsor the ARCF Project and offered to coordinate their attendance at meeting, depending on UAIC's preference.
7/16/2014	Returned Mailing		Randy Yonemura	Received 6/12/14 letters back as unclaimed.
7/16/2014	Outgoing Phone Call		Randy Yonemura	Called and left message that 6/12/14 letter was returned and requested a current address to send the letter and final draft PA to.
7/16/2014	Outgoing Email		Randy Yonemura	Sent 6/12/14 letter, enclosures, and copy of 6/12/14 SHPO letter by email to email addresses on file. Asked if Mr. Yonemura has any questions or would like to discuss to contact Ms. Montag.
7/18/2014	Incoming Email		Randy Yonemura	Mr. Yonemura asked that the document be re-sent to him on 7/24/14. Prefers a hard copy be sent.
7/18/2014	Incoming Phone Call		Randy Yonemura	Mr. Yonemura asked that the document be re-sent to him on 7/24/14. Ms. Montag confirmed it will be sent by mail on 7/24/14. Mr. Yonemura said he would review the documentation and get back in touch with Ms. Montag.
7/22/2014	Incoming Email	UAIC	Marcos Guerrero	Reply to 7/15/14 email, suggested 8/4/14 or 8/5/14 for a meeting with the Corps and UAIC, agreed that DWR should be invited to attend.
7/22/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Andrew Godsey	Reply to 7/22/14 email, Ms. Montag said she would coordinate with DWR for availability for a 8/4/14 or 8/5/14 meeting. Noted that Mr. Guerrero included Mr. Godsey on his 7/22/14 and asked if UAIC is requesting a joint meeting with SSBMI invited to attend.
7/24/2014	Outgoing Letter		Randy Yonemura	Re-sent via USPS 6/12/14 mailing as Mr. Yonemura requested during phone call on 7/18/14 be sent on 7/24/14.
7/24/2014	Outgoing Email		Randy Yonemura	Followed up with email to Mr. Yonemura letting him know the 6/12/14 letter was re-sent in today's mail, as he requested.
7/28/2014	Incoming Email	UAIC	Marcos Guerrero	Email from Mr. Guerrero asking if there was still a meeting scheduled for 7/29/14 (which had been previously discussed to be moved to either 8/4/14 or 8/5/14).
7/29/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Andrew Godsey	Response to 7/28/14 email that Ms. Montag thought the 8/4/14 or 8/5/14 were the meeting dates being discussed. Suggested 8/5/14 and asked Mr. Guerrero to respond with an available time.
7/31/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Andrew Godsey	Follow up to 7/29/14 email to ask if 8/5/14 will work for a meeting, and the time UAIC would like to meet.
8/1/2014	Incoming Email	UAIC	Marcos Guerrero	Response to 7/31/14 email suggesting 10AM for meeting on 8/5/14.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
8/1/2014	Outgoing Meeting Request	UAIC, SSBMI	Marcos Guerrero, Jason Camp, Andrew Godsey	Sent meeting request for 8/5/14 for 10AM-12PM at UAIC offices in Auburn. Suggested the Corps would bring information on the project, the PA, and that DWR is planning to attend. Requested that UAIC indicate if there is specific information they are interested in or agenda items they want to discuss that they let Ms. Montag known.
8/1/2014	Incoming Email	UAIC	Marcos Guerrero	Accepted 8/5/14 meeting request.
8/4/2014	Incoming Email	UAIC	Melodi McAdams	Requested GIS shape files for APE to prepare for meeting on 8/5/14.
8/4/2014	Outgoing Email	UAIC	Melodi McAdams, Marcos Guerrero, Jason Camp	Sent GIS shape files of APE as requested, emphasized that the APE is very approximate and will be refined during planning and design for construction and potentially as a result of future environmental and cultural resources investigations.
8/4/2014	Incoming Email	UAIC	Melodi McAdams	Acknowledgement of receipt of 8/4/14 email with GIS shape files.
8/5/2014	Incoming Email	UAIC	Marcos Guerrero	Requested that Ms. Montag bring archeological site maps and a brief overview of cultural resources in the APE. Indicated UAIC's interest in discussing site eligibility, burial plans, and potential adverse effects.
8/5/2014	Consultation Meeting	UAIC, SSBMI, USACE, DWR	Peter Wakeland, Jason Camp, Melodi McAdams, Marcos Guerrero, Josh Stewart, Donald Rey, Andrew Godsey, Kara Perry, Dan Tibbitts, Melissa Montag, David Martasian, Erin Brehmer, Jacqueline Wait	Meeting with UAIC and SSBMI to discuss concerns of the tribes regarding the ARCF Project including treatment of burials, efforts to identify cultural resources of significance to the tribes, tribal monitors, the draft programmatic agreement. All parties agreed regular scheduled meetings would help ease the process along, comments on the programmatic agreement were requested from the tribes by late September for consideration in the version included in the draft EIS/EIR.
8/5/2014	Outgoing Email	SSBMI	Andrew Godsey, Kara Perry	As requested during consultation meeting with UAIC and SSBMI on 8/5/14, transmitted electronic version of the PA and attachments. The previous draft version of the PA was also transmitted via email on 5/23/13 and 6/5/13.
8/5/2014	Outgoing Email	UAIC	Melodi McAdams, Marcos Guerrero, Jason Camp	Requested meeting attendee list from 8/5/14 meeting with UAIC, SSBMI, Corps and DWR.
8/6/2014	Outgoing Email	SSBMI	Andrew Godsey, Kara Perry	Re-send of 8/5/14 email with draft PA attachments. Email sent on 8/5/14 did not attach the PA attachments correctly.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
8/7/2014	Incoming Email	UAIC	Melodi McAdams	Reply to 8/5/14 email request, sent meeting attendees list from 8/5/14 meeting.
8/19/2014	Incoming Letter	UAIC	Marcos Guerrero	(Letter received 10/16/14) Follow up letter from 8/5/14 consultation meeting requesting the Corps and DWR provide UAIC with: pre-burial plan, confidentiality and data sharing agreement, tribal signatory status on PA, tribal preference on scientific analysis, contractor selection, compensation for tribal monitors and information from tribes.
9/2/2014	Outgoing Email	UAIC, SSBMI	Marcos Guerrero, Jason Camp, Andrew Godsey	Sent link to Doodle poll to schedule next meeting with UAIC and SSBMI for late October/early November. Requested response to poll by 9/17/14. Welcomed receiving any comments on the draft programmatic agreement.
9/3/2014	Incoming Email	UAIC	Marcos Guerrero	Responded with available dates for next meeting, asked when comments on PA are due.
9/3/2014	Outgoing Email	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Dan Tibbitts, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez	Replied to 9/3/14 email from Mr. Guerrero that the last comment review period for the draft of the PA closed July 12, 2014, but that review of the draft is still open. The draft EIS/EIR will include comments received up to August 2014.
9/3/2014	Incoming Email	SSBMI	SSBMI	Responded to Doodle poll with available dates.
9/4/2014	Outgoing Email	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Dan Tibbitts, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez	Asked potential meeting attendees to double check their available dates since to date with six respondents there is not a date that lines up for a meeting from October 31-November 19.
9/24/2014	Outgoing Meeting Request	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Dan Tibbitts, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez	Sent meeting request for 11/3/14 10:00-12:00 meeting at Corps offices.
9/24/2014	Incoming Email	DWR	David Martasian	Declined 11/3/14 meeting request.
9/24/2014	Incoming Email	DWR	Anecita Agustinez	Accepted 11/3/14 meeting request.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
9/24/2014	Incoming Email	UAIC	Marcos Guerrero	Accepted 11/3/14 meeting request.
9/24/2014	Incoming Email	DWR	Erin Brehmer	Accepted 11/3/14 meeting request.
10/1/2014	Incoming Email	DWR	Jacqueline Wait	Declined 11/3/14 meeting request.
10/28/2014	Outgoing Email	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Dan Tibbitts, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez	Sent DRAFT meeting agenda for 11/3/14, requested any additional topics for discussion ASAP.
10/31/2014	Incoming Email	SSBMI	Kara Perry	Accepted 11/3/14 meeting request.
10/31/2014	Incoming Email	SSBMI	Cynthia Franco	Accepted 11/3/14 meeting request.
11/3/2014	Consultation Meeting	UAIC, SSBMI, DWR	Marcos Guerrero, Kara Perry, Cynthia Franco, Erin Brehmer, Anecita Agustinez	Consultation meeting to discuss ongoing ARCF project schedule and activities, outstanding topics: pre-burial plan, confidentiality and data sharing agreement, tribal signatory status on PA, tribal preference on scientific analysis, contractor selection, compensation for tribal monitors and information from tribes. Proposed a field visit of Natomas area in January.
11/6/2014	Incoming Email	UAIC	Marcos Guerrero	Asked to be sent the RFP for ARCF cultural services, asked if the tribe would be able to submit a bid and asked to be integrated into this process.
11/7/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Josh Garcia	In response to 11/6/14 email, Ms. Montag stated cultural resources work under the ARCF PA is not moving forward for several months or longer, will likely be awarded under the Planning IDIQ. Provided information that a new Planning IDIQ is likely to be advertised in the next 30-60 days, that the Corps is looking for a firm to address multiple disciplines (planning, environmental, economics, cultural), to check https://www.fbo.gov/ for listings of federal contracts, and further information cannot be provided because it could be perceived as providing a potential contractor an unfair advantage. For further information, suggested contacting Josh Garcia as the Planning IDIQ COR.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
11/7/2014	Outgoing Meeting Request	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Kara Perry, Cynthia Franco, Dan Tibbitts, Sara Schultz, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez, Mark Gilfillan	Sent meeting request for 1/6/15 field visit to Natomas Basin.
11/7/2014	Outgoing Meeting Request	UAIC, SSBMI, DWR	Jason Camp, Marcos Guerrero, Andrew Godsey, Kara Perry, Cynthia Franco, Dan Tibbitts, Sara Schultz, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez, Mark Gilfillan	Sent backup meeting request for 1/13/15 field visit to Natomas Basin.
11/7/2014	Incoming Email	SSBMI	Kara Perry	Accepted 1/6/15 and 1/13/15 meeting requests.
11/7/2014	Incoming Email	DWR	Jacqueline Wait	Accepted 1/6/15 and 1/13/15 meeting requests.
11/7/2014	Incoming Email	USACE	Sara Schultz	Accepted 1/6/15 and 1/13/15 meeting requests.
11/7/2014	Incoming Email	USACE	Dan Tibbitts	Accepted 1/6/15 and 1/13/15 meeting requests.
11/7/2014	Incoming Email	UAIC	Marcos Guerrero	Accepted 1/6/15 and 1/13/15 meeting requests.
11/7/2014	Incoming Email	USACE	Mark Gilfillan	Accepted 1/6/15 meeting, declined 1/13/15 meeting.
11/10/2014	Incoming Email	SSBMI	Cynthia Franco	Accepted 1/6/15 meeting request.
11/12/2014	Incoming Email	DWR	Erin Brehmer	Accepted 1/6/15 and 1/13/15 meeting requests.
11/12/2014	Incoming Email	DWR	Anecita Agustinez	Accepted 1/6/15 and 1/13/15 meeting requests.
12/1/2014	Incoming Email	SSBMI	Daniel Fonseca	Accepted 1/6/15 meeting request.
12/17/2014	Incoming Email	UAIC	Marcos Guerrero	In response to 6/5/14 email transmittal of electronic version of draft PA, UAIC submitted track changes of comments on the document.
12/18/2014	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams, Donald Rey	In response to 12/17/14 email, thanked Mr. Guerrero for providing UAIC comments on the draft PA.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
12/29/2014	Outgoing Email		Jason Camp, Marcos Guerrero, Andrew Godsey, Kara Perry, Cynthia Franco, Dan Tibbitts, Sara Schultz, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez, Mark Gilfillan	Sent updated meeting request for 1/6/15 field visit. Included meeting location, information on weather, tentative agenda.
12/29/2014	Incoming Email	UAIC	Marcos Guerrero	Accepted 1/6/15 meeting request.
1/5/2015	Incoming Email	UAIC	Jason Camp	Accepted 1/6/15 meeting request.
1/6/2015	Field Visit	UAIC, SSBMI, DWR, RD1000	Melissa Montag, Dan Tibbitts, Jason Camp, Marcos Guerrero, Donald Rey, Melodi McAdams, Kara Perry, Cynthia Franco, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez, Paul Devereux	Field visit of Natomas Basin, beginning south on Garden Highway with stops at San Juan Road, at pump station, Natomas Cross Canal, Pleasant Grove Creek Canal, Natomas East Main Drain Canal. Corps staff provided information on past NLIP work completed, types of alternatives being considered for Natomas, plans for compliance with Section 106.
1/6/2015	Outgoing Email	UAIC, SSBMI, DWR, RD1000	Melissa Montag, Dan Tibbitts, Jason Camp, Marcos Guerrero, Donald Rey, Melodi McAdams, Kara Perry, Cynthia Franco, David Martasian, Erin Brehmer, Jacqueline Wait, Anecita Agustinez, Paul Devereux	Ms. Montag transmitted the meeting attendance sheet for the 1/6/15 meeting and stated she would look to April to schedule the next quarterly meeting. Provided the general information that the draft EIS/EIR for the ARCF GRR will be released for public review soon and UAIC and SSBMI are on the mailing list to receive copies. Ms. Montag asked that if there is anything to discuss before the next meeting to please get in contact with her.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
1/8/2015	Consultation Meeting	SSBMI	Kara Perry, Cynthia Franco	Met with SSBMI representatives to specifically address Natomas Reach H borings, but also touched on overall ARCF GRR topics. Ms. Perry requested an electronic copy of the draft PA (previously emailed to Andrew Godsey 5/23/13 and Mr. Godsey and Ms. Perry on 8/61/14).
1/8/2015	Outgoing Email	SSBMI	Kara Perry, Cynthia Franco, Mark Gilfillan	Email transmittal of ARCF draft PA and PA attachments as requested in 1/8/15 consultation meeting. Explained that the PA covers Natomas activities, as well as future work in other basins, welcomed comments from the tribe.
1/8/2015	Outgoing Email	SSBMI	Kara Perry, Cynthia Franco, Mark Gilfillan	Resent 1/8/15 email with PA attachments only.
1/8/2015	Incoming Phone Call	BVR	Roselynn Lwenya	Ms. Lwenya returned a phone call regarding work for the ARCF Reach H project. Included in the conversation, Ms. Montag expressed that if BVR would like to meet to discuss the ARCF projects or any other Corps projects to notify the Corps. Ms. Lwenya stated she would provide this information to the BVR board and would respond to Ms. Montag if the tribe would like to meet.
3/17/2015	Outgoing Email	BVR, IBMI, SSBMI, UAIC, WR, MITCR, CWEPA, TAM, ERMI, NEDM,	Anthony Burris, Jason Camp, Grayson Coney, Michael DeSpain, Kesner Flores, Daniel Fonseca, Nicholas Fonseca, Reno Franklin, Marcos Guerrero, Steven Hutchason, Roselynn Lwenya, Yvonne Miller, Rhonda Morningstar Pope, Dennis Ramirez, Cosme Valdez, Randy Yonemura	Transmitted link to webpage where draft EIS/EIR and GRR are available for review from March 20 to May 4. Provided information on public workshop meetings. Sent by email to those addresses available, stated a letter and CD would also be sent by mail.
3/17/2015	Incoming Email		Kesner Flores	3/17/15 email to Mr. Flores returned as undeliverable.
3/17/2015	Incoming Email	ERMI	ERMI	3/17/15 email to main info address for ERMI returned as undeliverable.
3/17/2015	Incoming Email	NEDM	Cosme Valdez	3/17/15 email to Mr. Valdez returned as undeliverable.
3/17/2015	Incoming Email	TAM	TAM	3/17/15 email to main info address for TAM returned as undeliverable.
3/17/2015	Incoming Email	UAIC	Marcos Guerrero	In response to 3/17/15 email, requested the confidential cultural resources appendix and any survey, inventory, or evaluation reports.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
3/19/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In reply to 3/17/15, stated there is not confidential information in the cultural resources appendix relating to cultural resources and that the Corps has not yet conducted any survey, inventory or evaluation for the Common Features Project. Transmitted the archaeological sensitivity assessment.
3/19/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	Transmitted GIS shape files as was requested in February 2015 UAIC Outreach Day. These GIS shape files were previously sent 8/4/15.
3/19/2015	Incoming Email	UAIC	Melodi McAdams	In reply to 3/19/15, acknowledged receipt of GIS shape files.
3/23/2015	Incoming Email	UAIC	Marcos Guerrero	Asked for the MMRP for the Common Features and Marysville Ring Levee Projects.
3/24/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In reply to 3/23/15 email, asked for definition of MMRP.
3/24/2015	Incoming Email	UAIC	Marcos Guerrero	MMRP is Mitigation and Monitoring Report Plan, as part of EIR.
3/24/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Provided contact information for DWR staff POCs for Common Features and Marysville Ring Levee Projects.
4/13/2015	Outgoing Email and Poll	UAIC, SSBMI, DWR	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Kara Perry, Cynthia Franco	Email request to set up next quarterly meeting with UAIC and SSBMI in May. Proposed five different days/times to possibly meet, asked for any agenda topics to be forwarded.
4/13/2015	Incoming Poll Response	SSBMI		Responded with availability in poll.
4/14/2015	Incoming Poll Response	UAIC	Marcos Guerrero	Responded with availability in poll.
4/16/2015	Incoming Email	UAIC	Marcos Guerrero	Email with comments from UAIC on the DEIS/DEIR.
4/17/2015	Outgoing Meeting Request	UAIC, SSBMI, DWR	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Kara Perry, Cynthia Franco	Sent meeting request for meeting on 5/19/15 from 10AM-12PM for next quarterly meeting with UAIC and SSBMI. Agenda to come.
4/17/2015	Incoming Email	SSMBI	Cynthia Franco, Kara Perry	Accepted meeting request for 5/19/15 meeting.
4/17/2015	Incoming Email	UAIC	Marcos Guerrero	Accepted meeting request for 5/19/15 meeting.
4/17/2015	Incoming Email	UAIC	Marcos Guerrero	Received comments on DEIS/DEIR from UAIC.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
4/20/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Acknowledged receipt of comments from 4/17/15.
4/20/2015	Incoming Email	UAIC	Marcos Guerrero	Asked when the comment period for DEIS/DEIR ends.
4/20/2015	Outgoing Email	UAIC	Marcos Guerrero	Responded to 4/20/15 email that comment period for DEIS/DEIR ends 5/4/15.
4/20/2015	Incoming Email	UAIC	Jason Camp	Accepted meeting request for 5/19/15 meeting.
4/21/2015	Incoming Email	UAIC	Marcos Guerrero	Asked if UAIC can be an invited signatory to the PA.
4/21/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	Replied to 4/21/15 email that Ms. Montag would have to get back to Mr. Guerrero regarding this question.
4/29/2015	Outgoing Email	UAIC	Marcos Guerrero	Provided information that comment review period on the DEIS/DEIR has been extended two weeks until 5/18/15.
5/15/2015	Outgoing Email	UAIC, SSBMI, DWR	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Kara Perry, Cynthia Franco	Sent draft meeting agenda for 5/15/15, requested any additional topics for discussion.
5/18/2015	Incoming Letter	UAIC	Gene Whitehouse	Letter to Colonel Farrell requesting Government to Government consultation, notification to the Corps about sites of importance to the tribe in the project area, requesting signatory party status on the PA.
5/19/2015	Consultation Meeting	UAIC, SSBMI, DWR	Marcos Guerrero, Jason Camp, Melodi McAdams, Kara Perry, Cynthia Franco	Scheduled consultation meeting. Topics included an update on the EIS/EIR, draft PA. Requested to know if the tribes have any information on sites or areas of interest within the project area. Tribes expressed concerns about sharing information on sites with the Corps, and with indicating any information on sites of importance. Asked about the project phasing and construction. Corps staff reiterated that phases in Natomas Basin are at early stages of design and suggested those designs could be shared with the tribes so they could determine what concerns the tribes may have. Shape files for current design phases will be sent to tribes and a follow up meeting in July or August to discuss those phases. Mr. Guerrero and Mr. Camp asked if UAIC will be invited as a signatory, Ms. Montag stated that decision is still being considered by the Corps.
5/27/2015	Incoming Email	UAIC	Marcos Guerrero	Email requesting maps of areas currently being consulted on and designed for the project in the Natomas area. Stated UAIC would like to schedule a follow up meeting and field visit to show areas they are most concerned with and to discuss TCPs and historic properties.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
5/27/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp	In reply to 5/27/15 email, stated that GIS shape files have been requested internally but not received and will be forwarded on as soon as they are available. Stated the Corps is very interested in hearing the concerns from UAIC and continuing to discuss TCPs and historic properties.
6/16/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	Provided PDF of project areas for Natomas Reach I, shape files for project areas, and information/description on those areas. Requested potential dates to meet in July, who the tribe would like present at the meeting.
6/16/2015	Outgoing Email	SSBMI	Kara Perry, Cynthia Franco, Daniel Fonseca	Provided PDF of project areas for Natomas Reach I, shape files for project areas, and information/description on those areas. Requested potential dates to meet in July, who the tribe would like present at the meeting.
6/26/2015	Incoming Email	UAIC	Marcos Guerrero	In reply to 6/16/15 email, Mr. Guerrero suggested 7/6/15 as a possible meeting date and expressed concerns about the proposed APE. Stated no other tribes needed to be in attendance at meeting on 7/6/15.
6/26/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	In reply to 6/26/15 email, Ms. Montag stated she would coordinate the 7/6/15 date and would get back to UAIC.
6/30/2015	Outgoing Meeting Request	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	Sent meeting request for site visit for Natomas Reach I for 7/6/15.
7/1/2015	Incoming Email	UAIC	Marcos Guerrero	Accepted 7/6/15 meeting request.
7/1/2015	Incoming Email	UAIC	Jason Camp	Accepted 7/6/15 meeting request.
7/7/2015	Outgoing Letter	UAIC	Gene Whitehouse	Letter requesting additional details and specific information regarding comments from UAIC in 4/16/15 email.
8/6/2015	Consultation Meeting	UAIC/Corps	Bill Welsh, Mike Kynett (Corps), Mark Boedker (Corps), Robin Rosenau (Corps), Marcos Guerrero, Melodi McAdams (UAIC), Donald Skip Rey (UAIC)	Staff-to-staff level consultation meeting regarding Natomas Reach I project and ARCF DEIS/DEIR, sites of concern to the tribe, construction activities of concern to the tribe. Additional topics included involvement of the tribe in surveying and monitoring, reporting, preferences on data recovery and curation, professional qualifications.
8/10/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	Sent comment responses to DEIS/DEIR and requested clarification/correction on notes taken during 8/6/15 consultation meeting with UAIC. Requested responses by 8/14/15.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
8/17/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Melodi McAdams	Transmitted meeting minutes from 8/6/15 meeting, attached email and document from 8/10/15 and requested any comments no later than 8/19/15.
8/24/2015	Outgoing Letter	UAIC	Gene Whitehouse	In response to 5/18/15 letter from UAIC, committed to continuing Government to Government consultation through Corps' Tribal Liaison, invited UAIC be be a concurring party on the PA.
11/30/2015	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero asked if the Corps would still accept comments from UAIC on the draft EIS/EIR, despite comments being due 5/18/15.
12/7/2015	Outgoing Letters	Cortina Wintun, SVR, WR, CVTCT, Cachil Dehe, Mooretown Rancheria, Mechoopda, UAIC, TAM, SSBMI, NEDM, IBMI, ERMI, EDM, BVR, interested Native Americans	Various chairpersons, as well as Kesner Flores, Randy Yonemura, Rose Enos.	Letter transmitting the signed and executed PA and requesting parties to sign as concurring parties if they choose to.
12/31/2015	Outgoing Email	UAIC	Marcos Guerrero, Jason Camp, Courtney Coyle, Melodi McAdams, Jane Rinck, Mark Gilfillan	In response to 11/30/15 email, Ms. Montag stated that although the comment review period on the draft EIS/EIR is closed and the final document is being prepared, the Corps welcomes any comments from the tribe at any time, and anticipates extensive interactions with tribes for cuture environmental compliance efforts and while executing the stipulations of the PA.

American River Common Features Project Public Involvement Consultation Record*

*****May not include all communication for project.

12/31/15

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
4/5/2013	Outgoing Letter	Various Historic Societies/Groups of Interest	To all interested parties	Letter providing project description and map, requesting any information on significant cultural resources.
4/8/2013	Incoming Email	Center for Sacramento History	Pat Johnson	Acknowledgement of 4/5/13 letter.
4/22/2013	Returned Letter	California Historical Building Safety Board		4/5/13 letter returned marked as "Not Deliverable as Addressed, Unable to Forward."
4/22/2013	Returned Letter	California Institute for Rural Studies		4/5/13 letter returned marked as "Attempted Not Known."
4/22/2013	Returned Letter	Discovery Museum of Sacramento		4/5/13 letter returned marked as "Not Deliverable as Addressed, Unable to Forward."
4/22/2013	Returned Letter	West Sacramento Museum and Visitor Center		4/5/13 letter returned marked as "Not Deliverable as Addressed, Unable to Forward."
11/19/2013	Returned Letter	Association for Northern California Records and Research		4/5/13 letter returned marked as "Return to Sender."
12/7/2015	Outgoing Letter	Society for California Archaeology, Yolo County Historical Society, West Sacramento Historical Society, Sutter County Historical Society, Golden Gate State Museum, Fair Oaks Historical Society, Sacramento County Historical Society, Central Valley Flood Protection Board		Letter transmitting the signed and executed PA and requesting parties to sign as concurring parties if they choose to.

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 3

Consultation with the SHPO

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

FEB 01 2012

Mr. Milford Wayne Donaldson
State Historic Preservation Officer
Office of Historic Preservation
P.O. Box 942896
Sacramento, California 94296-0001

Dear Mr. Donaldson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project near Sacramento, California. The ARCF Project is being developed to reduce flood risk to the City of Sacramento, including the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River. The ARCF Project is a part of the Common Features General Reevaluation Report. The non-Federal sponsor for the ARCF Project is the State of California Central Valley Flood Protection Board.

Pursuant to 36 CFR Part 800.3 we are initiating the Section 106 process for the ARCF Project and we are asking for your concurrence with our determination of the area of potential effects (APE) for the ARCF Project in accordance with 36 CFR Part 800.4(a)(1). We are also asking for your comments on our proposed efforts to identify historic properties pursuant to 36 CFR Part 800.4. We are also proposing to develop a programmatic agreement (PA) for the ARCF Project in accordance with 36 CFR Part 800.14(b).

The Corps has undertaken or has been the regulatory agency for multiple efforts to reduce flood risk in the region and the Sacramento and American River watersheds. Many of these efforts have resulted from authority given in the Water Resources Development Acts of 1996 and 1999. Because of the complex nature of these different studies and efforts, we have prepared a short summary document describing the authorizations for the projects in the region, what has been constructed, what agency or partner completed the construction, previous compliance with the National Historic Preservation Act of 1966, as amended, and the National Environmental Policy Act of 1969, and the planned future activities within the watersheds (Enclosure 1).

The APE for the ARCF Project includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; approximately 18 miles of the east bank of the Sacramento River immediately downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; approximately 5 miles of the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; approximately 8 miles of the Natomas East Main Drainage Canal; approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison

Creek; approximately 1.5 miles of the north and south banks of Dry/Robla Creeks; and approximately 2 miles of the north and south banks of Arcade Creek. The APE is shown in Enclosure 2.

We have completed a records and literature search of the APE at the North Central Information Center at California State University, Sacramento and at the Northeast Information Center at California State University, Chico in 2008. The records and literature search identified 136 cultural resources and 285 surveys and inventories conducted within and nearby the ARCF Project APE. Portions of the APE have been previously surveyed but the majority of the APE has not been intensively surveyed for cultural resources in the last ten years.

Because the APE for the ARCF Project covers a large geographic area and is largely located along rivers, which have been shown to be sensitive for buried resources, we are developing two predictive models to extrapolate archaeological sensitivity over un-surveyed portions of the APE. The first model will be a general model of site locations that will anticipate the likelihood that any one or more spots in the study area will be in an archaeological site. The second model will highlight portions of the study area where we would be more or less likely to find buried archaeological materials. Once the predictive models have been completed we plan to demonstrate their accuracy through field testing. Ultimately we plan to use the predictive models to assist with planning and evaluating alternatives to avoid adverse effects to cultural resources whenever and wherever possible.

A number of possible measures may be considered in order to reduce the flood risk to the City of Sacramento. The measures under consideration are described in Enclosure 1. Because the ARCF Project will be a complex undertaking that may be constructed in multiple phases and may result in adverse effects to historic properties, we are proposing to develop a PA to govern the implementation of our compliance efforts. We are working on a draft PA and plan to coordinate the execution of the PA with you and other potential signatory and concurring parties.

We obtained a list of potentially interested Native Americans from the Native American Heritage Commission and contacted them in letters dated May 4, 2011 to inquire if they have knowledge of locations of archeological sites, or areas of traditional cultural value or concern in or near the ARCF Project APE. Both the United Auburn Indian Community of the Auburn Rancheria and the Mechoopda Indian Tribe of Chico Rancheria have contacted us and expressed interest in the ARCF Project. We plan to continue to communicate with those tribes, as well as others that may have an interest in the ARCF Project as we comply with Section 106 and develop a PA.

Pursuant to 36 CFR Part 800.4(a)(1), we request your comments on our preliminary determination of the APE for the ARCF Project. We also request any comments your office may have of our proposed efforts to identify historic properties under 36 CFR Part 800.4 and our plan to develop a PA in accordance with 36 CFR Part 800.14(b). We would like to schedule a meeting to meet with you and your staff to discuss the ARCF Project and answer any questions your may have about the project or our proposed Section 106 compliance efforts.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Milford Wayne Donaldson
State Historic Preservation Officer
Office of Historic Preservation
P.O. Box 942896
Sacramento, California 94296-0001

JUL 16 2012

Dear Mr. Donaldson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to transmit a draft programmatic agreement (PA) for the proposed American River Common Features (ARCF) Project near Sacramento, California. The ARCF Project is being developed to reduce flood risk to the City of Sacramento, including the Natomas Basin, areas along the north and south banks of the American River, and the east bank of the Sacramento River. The ARCF Project is a part of the Common Features General Reevaluation Report. The non-Federal sponsor for the ARCF Project is the State of California Central Valley Flood Protection Board.

We previously contacted you in a letter dated February 1, 2012, asking for your concurrence with our determination of the area of potential effects (APE), for your comments on our proposed efforts to identify historic properties, and to inform you of our proposed plan to develop a PA for the ARCF Project (Enclosure 1). The ARCF Project will be a complex undertaking that may be constructed in multiple phases, the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and it may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a PA to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 2).

Included as attachments to the PA are a map of the APE (Enclosure 2, Attachment 1) and a project description for the ARCF Project (Enclosure 2, Attachment 2). We have also contacted the Advisory Council on Historic Preservation to ask for their comments on the proposed ARCF Project. They have also received the draft PA for their review and comment.

On several prior occasions we have been in contact with potentially interested Native Americans, asking for their participation in the Section 106 compliance efforts for the ARCF Project. We have met with the United Auburn Indian Community of the Auburn Rancheria and Shingle Springs Band of Miwok Indians on the ARCF Project. As we develop the PA and comply with Section 106, we will continue to involve these tribes, as well as other tribes identified by the Native American Heritage Commission as having an interest in the APE.

Pursuant to 36 CFR § 800.14(b)(2)(i), we request your involvement in the development of the PA for the ARCF Project. We ask that you review the enclosed PA and provide us with comments within 45 days. Additionally, we would like to schedule a time to meet with you and your staff to discuss the ARCF Project and answer any questions you may have about the project or our proposed Section 106 compliance efforts.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Dr. Carol Roland-Nawi
State Historic Preservation Officer
Department of Parks and Recreation
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 94296-0001

Dear Dr. Roland-Nawi:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), we are writing to continue consultation on the American River Common Features (ARCF) Project near Sacramento, California. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We have previously contacted your office in letter dated February 1, 2012, which documented our determination of the area of potential effects (APE), and requested comments on our efforts to identify historic properties and our plan to develop a programmatic agreement (PA). In a letter July 16, 2012, we transmitted the draft PA for review and requested comments, provided an update of consultation with the Advisory Council on Historic Preservation (ACHP) and potentially interested Native American tribes, and requested to meet on the ARCF Project. Staff from my office met with Ms. Susan Stratton, Mr. Dwight Dutsche, and Mr. Brendan Greenaway of your office in meetings on October 29, 2012 and November 5, 2012 to discuss the ARCF Project and the planned efforts to comply with Section 106 of the NHPA. Previous consultation with your office on the ARCF Project is included in Enclosure 1.

Pursuant to 36 CFR Part 800.3 we are requesting your concurrence with our determination of the area of potential effects (APE) for the ARCF Project in accordance with 36 CFR Part 800.4(a)(1). We are also providing information on our efforts to identify historic properties pursuant to 36 CFR Part 800.4 and we are providing the most recent final draft of the PA for the ARCF Project for your final review and comment before we plan to execute the PA. The final draft of the PA is included in Enclosure 2.

The Corps has undertaken or has been the regulatory agency for multiple efforts to reduce flood risk in the region and the Sacramento and American River watersheds. Many of these efforts have resulted from authority given in the Water Resources Development Acts of 1996 and 1999. Because of the complex nature of these different studies and efforts, we have prepared a short summary document describing the authorizations for the projects in the region, what has been constructed, what agency or partner completed the construction, previous compliance with the National Historic Preservation Act of 1966, as amended, and the National Environmental Policy Act of 1969, and the planned future activities within the watersheds (Enclosure 2, Attachment 4).

We have determined that the APE for the ARCF Project includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; the Sacramento Bypass and Sacramento Weir; approximately 4 miles of the Pleasant Grove Creek Canal; approximately 8 miles of the Natomas East Main Drainage Canal; approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal. Most of the activities planned for the ARCF Project will be confined to the levees or the immediately adjacent river banks near the levees, however, the APE for the ARCF Project includes areas within the American River Parkway and along Dry and Robla Creeks because it is anticipated that there may be visual or landscape impacts to potential historic properties in those areas. The APE is shown in Enclosure 2, Attachment 3.

We have completed a records and literature search of the APE at the North Central Information Center at California State University, Sacramento and at the Northeast Information Center at California State University, Chico in 2006 and 2007, and updated in 2010 and 2013. The records and literature search identified 61 known cultural resources within and nearby the ARCF Project APE. Portions of the APE have been previously surveyed but the majority of the APE has not been intensively surveyed for cultural resources in the last ten years.

Because the APE for the ARCF Project covers a large geographic area and is mostly located along rivers, which have been shown to be sensitive for buried resources, we have developed two predictive models to extrapolate archaeological sensitivity over un-surveyed portions of the APE. The first model is a general model of site locations that anticipates the likelihood that any one or more spots in the study area will be in an archaeological site. The second model highlights portions of the APE where we would be more or less likely to find buried archaeological materials. Ultimately we plan to use the predictive models to assist with planning and evaluating alternatives to avoid adverse effects to cultural resources whenever and wherever possible. The models and detailed information on the archaeological sensitivity assessment are included in Enclosure 3. We request any comments you may have on the archaeological sensitivity assessment.

A number of possible measures may be considered in order to reduce the flood risk to the City of Sacramento. The measures under consideration are described in Attachment 4 of Enclosure 2. Because the ARCF Project will be a complex undertaking that may be constructed in multiple phases and may result in adverse effects to historic properties, we have developed a PA to govern the implementation of our compliance efforts. The PA has been provided to your office, the ACHP, CVFPP, Department of Water Resources (DWR), SAFCA, and potentially interested American Indian Tribes and interested American Indian individuals for review and comment. In a letter dated August 7, 2012, the ACHP declined to participate in consultation for the ARCF Project (Enclosure 2, Attachment 2). Comments were received from the CVFPP, DWR, SAFCA, and American Indian Tribes and have been considered in this current final draft of the PA.

In April 2013, letters to 100 historical societies, museums, state historic parks, associations with historic interests, local city and county groups, and groups of various prehistoric and historic interests were sent providing a description and map of the project and requesting information on cultural resources within the APE. One response, from the Center for Sacramento History, was received, noting they would keep our letter on file. In accordance with 36 CFR § 800.14(b)(2)(ii), we will also provide the final draft PA with the forthcoming Environmental Impact Statement/Environmental Impact Report which will be released for public review this summer.

We obtained a list of potentially interested American Indian tribes and interested American Indian individuals from the Native American Heritage Commission and contacted them in 2011, 2012, and 2013 to inquire if they have knowledge of locations of archeological sites, or areas of traditional cultural value or concern in or near the ARCF Project APE. The United Auburn Indian Community of the Auburn

Rancheria (UAIC), the Shingle Springs Band of Miwok Indians (SSBMI), the Mechoopda Indian Tribe of Chico Rancheria, the Ione Band of Miwok Indians, and the Buena Vista Rancheria (BVR) have contacted us and expressed interest in the ARCF Project. We have met with the UAIC, the SSBMI, and the BVR and we plan to continue to communicate with those tribes, as well as others that may have an interest in the ARCF Project as we execute the PA in compliance with Section 106 of the NHPA. A consultation log of communications with American Indian tribes and American Indian individuals for the ARCF Project is included as Enclosure 4.

Pursuant to 36 CFR Part 800.4(a)(1), we request your comments on our determination of the APE for the ARCF Project. We also request any comments your office may have of our efforts to identify historic properties under 36 CFR Part 800.4 and any comments you may have on the final draft of the PA for the ARCF Project which was developed in accordance with 36 CFR Part 800.14(b).

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

for ~~Al~~icia E. Kirchner
Chief, Planning Division

Enclosures

cc: (w/o enclosures)
Cathy Bishop, Chairperson, Strawberry Valley Rancheria, 1540 Strader Avenue, Sacramento, California 95815
Anthony Burris, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, California 95669
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, California 95713

Pamela Cubbler, Colfax-Todds Valley Consolidated Tribe, P.O. Box 734, Foresthill, California 95631
Sam Daniels, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Mary Daniels-Tarango, Chairperson, Wilton Rancheria, 7916 Farnell Way, Sacramento, California 95823
Michael D. DeSpain, Director of OEPP, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, California 95926
El Dorado Miwok Tribe, P.O. Box 711, El Dorado, California 95623
Rose Enos, 15310 Bancroft Road, Auburn, California 95603
Kesner Flores, P.O. Box 1047, Wheatland, California 95692
Daniel Fonseca, Tribal Historic Preservation Officer, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Nicholas Fonseca, Chairperson, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, California 95682
Andrew Franklin, Wilton Rancheria, 9300 W. Stockton Blvd, Suite 200, Elk Grove, California 95758
Reno Franklin, Tribal Historic Preservation Officer, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, California 95966
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Steven Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9300 W. Stockton Blvd, Suite 200, Elk Grove, California 95758
Roselynn Lwenya, Tribal Historic Preservation Officer, Buena Vista Rancheria, P.O. Box 162283, Sacramento, California 95816
Judith Marks, Colfax-Todds Valley Consolidated Tribe, 1068 Silverton Circle, Lincoln, California 95648
Yvonne Miller, Chairperson, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, California 95669
Ambar Mohammed, Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, 3730 State Highway 45 #B, Colusa, California 95932
Eileen Moon, Vice Chairperson, 760 South Auburn Street, Suite 2-C, Grass Valley, California 95945
April Wallace Moore, 19630 Placer Hills Road, Colfax, California 95713
Rhonda Morningstar Pope, Chairperson, Buena Vista Rancheria, P.O. Box 162283, Sacramento, California 95816
Glenda Nelson, Chairperson, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, California 95966

Dennis Ramirez, Chairperson, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, California 95926
Guy Taylor, Representative, Mooretown Rancheria of Maidu Indians, 31 Alverde Drive, Oroville, California, 95966
Cosme Valdez, Interim Chief Executive Officer, Nashville-El Dorado Miwok, P.O. Box 580986, Elk Grove, California 95758
Gene Whitehouse, Chairperson, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Charlie Wright, Chairperson, Cortina Wintun Environmental Protection Agency, P.O. Box 1630, Williams, California 95987
Randy Yonemura, 4305 39th Avenue, Sacramento, California 95824

cc: (w/enclosures)
Reid Nelson, Advisory Council on Historic Preservation, 401 F Street NW, Suite 308, Washington, DC 20001-2637
Jacqueline Wait, Department of Water Resources, Division of Environmental Services, Environmental Compliance & Evaluation Branch, Cultural, Recreation, and Environmental Planning Section, 3500 Industrial Boulevard, West Sacramento, California 95691

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 4

Consultation with the ACHP

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Reid Nelson
Advisory Council on Historic Preservation
Office of Federal Agency Programs
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 803
Washington, DC 20004

FEB 01 2012

Dear Mr. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), we are writing to inform you of the proposed American River Common Features (ARCF) Project near Sacramento, California, and to request your participation in the ARCF Project. The ARCF Project is being developed by the U.S. Army Corps of Engineers (Corps) to reduce flood risk to the city of Sacramento. The reaches of the ARCF project include the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River. The ARCF Project will be described in the Common Features General Reevaluation Report. The non-Federal sponsor for the ARCF Project is the State of California Central Valley Flood Protection Board (CVFPB).

Because the ARCF Project will be a complex undertaking that may be constructed in multiple phases; covers a large geographic area largely located along rivers, which has been shown to be sensitive for buried resources; and may result in adverse effects to historic properties, we are proposing to develop a programmatic agreement (PA) to govern the implementation of our compliance efforts. We want to make every effort to include all parties with an interest in the project and those agencies with responsibilities under Section 106 of the NHPA. We are writing to provide you with information on the proposed project, to inform you of the process we plan to follow, and to potentially include your participation in accordance with 36 CFR § 800.2(a)(4)(b)(1).

The Corps has undertaken, or has been the regulatory agency, for multiple efforts to reduce flood risk in the region and the Sacramento and American River watersheds. Many of these efforts have resulted from authority given in the Water Resources Development Acts of 1996 and 1999. Because of the complex nature of these different studies and efforts, we have prepared a summary document describing the authorizations for the projects in the region; what has been constructed, and by whom; previous compliance with the NHPA and the National Environmental Policy Act of 1969; and the planned future activities within the watersheds (Enclosure 1).

The area of potential effects (APE) for the ARCF Project includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; approximately 18 miles of the east bank of the

Sacramento River from immediately downstream of the Natomas Cross Canal (NCC) to the confluence with the American River; approximately 5 miles of the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; approximately 8 miles of the Natomas East Main Drainage Canal; approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately 1.5 miles of the north and south banks of Dry/Robla Creeks; and approximately 2 miles of the north and south banks of Arcade Creek. The APE is shown in Enclosure 2.

Because of the possible adverse effects, and due to the complex, multi-phase nature of the ARCF Project, we are developing a PA that will include stipulations for determination of the APE for different phases of the project, identification of historic properties, evaluation of historic properties, determination of effects to historic properties, preparation of historic properties treatment plans, public participation, and communication with Native Americans. Pursuant to 36 CFR § 800.6(a)(1) after the PA has undergone coordination with the non-Federal sponsor, the CVFPB, and the State Historic Preservation Office, we plan to send a draft of the PA to you and ask for your review and comment.

We invite any comments you may have on the proposed ARCF Project. Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

E. Scott Clark

for Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Reid Nelson
Advisory Council on Historic Preservation
Office of Federal Agency Programs
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 803
Washington, DC 20004

JUL 16 2012

Dear Mr. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to transmit a draft programmatic agreement (PA) for the proposed American River Common Features (ARCF) Project near Sacramento, California. The ARCF Project is being developed to reduce flood risk to the City of Sacramento, including the Natomas Basin, areas along the north and south banks of the American River, and the east bank of the Sacramento River. The ARCF Project is a part of the Common Features General Reevaluation Report. The non-Federal sponsor for the ARCF Project is the State of California Central Valley Flood Protection Board.

We previously contacted you in a letter dated February 1, 2012, inviting your comments on the proposed project and informing you of the proposed process we plan to follow, to include the development of a PA for the ARCF Project (Enclosure 1). The ARCF Project will be a complex undertaking that may be constructed in multiple phases, the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and it may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a PA to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 2).

Included as attachments to the PA are a map of the area of potential effects (APE) (Enclosure 2, Attachment 1) and a project description for the ARCF Project (Enclosure 2, Attachment 2). We have also contacted the California State Historic Preservation Officer to ask for their comments on the proposed ARCF Project. They have also received the draft PA for their review and comment.

On several prior occasions we have been in contact with potentially interested Native Americans, asking for their participation in the Section 106 compliance efforts for the ARCF Project. We have met with the United Auburn Indian Community of the Auburn Rancheria and Shingle Springs Band of Miwok Indians on the ARCF Project. As we develop the PA and comply with Section 106, we will continue to involve these tribes, as well as other tribes identified by the Native American Heritage Commission as having an interest in the APE.

Pursuant to 36 CFR § 800.14(b)(2)(i), we request your involvement in the development of the PA for the ARCF Project. We ask that you review the enclosed PA and provide us with comments within 45 days. Additionally, we ask you to notify us if you plan to formally participate in the execution of the PA.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Preserving America's Heritage

November 2, 2015

Ms. Melissa Montag
Historian/Senior Environmental Manager
U.S. Army Corps of Engineers
Cultural, Recreation & Social Assessment Section (CESPK-PD-RC)
1325 J Street
Sacramento, CA 95814-2922

Ref: *USACE American River Common Features Project*

Dear Ms. Montag:

The Advisory Council on Historic Preservation (ACHP) has received the Programmatic Agreement (PA) for the above referenced project. In accordance with Section 800.6(b)(1)(iv) of the ACHP's regulations, the ACHP acknowledges receipt of the PA. The filing of the PA, and execution of its terms, completes the requirements of Section 106 of the National Historic Preservation Act and the ACHP's regulations.

We appreciate your providing us with a copy of the PA and will retain it for inclusion in our records regarding this project. Should you have any questions or require additional assistance, please contact Brian Lusher at (202) 517-0221 or via e-mail at blusher@achp.gov.

Sincerely,

Artisha Thompson

Artisha Thompson
Historic Preservation Technician
Office of Federal Agency Programs

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 5

Consultation with American Indian Tribes and Individuals

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Mr. Dennis Ramirez, Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. Ramirez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

Enclosure 1 outlines the entire Common Features Project, including portions previously constructed by SAFCA. The Common Features Project is divided into three regions shown on Enclosure 1: the Natomas Basin (NAT) shown in yellow, American River North (ARN) shown in blue, and American River South (ARS) shown in purple. NAT Reaches C and D were entirely constructed by SAFCA, as well as a portion of NAT Reach B, some of which is presently still under construction.

As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Along NAT Reaches E, F, G, and H, a total of 45 CPTs at the PGCC and NEMDC levee toe and 16 geotechnical borings along the levee crown and in adjacent agricultural fields will be completed between May and October. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reaches E, F, G, and H are shown as blue and red dots on Enclosure 4. There are no known prehistoric resources located within the areas identified for borings and CPTs. Because the borings and CPTs are planned to occur within a heavily disturbed area along a manmade feature we do not plan to have an archeological monitor present during the geotechnical borings and CPTs along NAT Reaches E, F, G, and H.

Within ARN Reaches A and B and ARS Reaches A and B, three different types of geotechnical explorations are scheduled to be completed between August and September. These explorations include trenching, waterside berm borings, and in-channel borings. Enclosure 5 shows the probable locations of the various explorations along the American River. Shown as red lines in Enclosure 5, a total of 15 trenches will be dug to a maximum depth of 15 feet below the existing ground surface and a total linear footage of 150 feet at each location. Shown as red dots in Enclosure 5, a total of 10 waterside berm borings will be drilled to a maximum depth of 50 feet below the existing ground surface. And shown as blue dots in Enclosure 5, a total of 10 in-channel borings will be drilled to a maximum depth of 25 feet within the American River Channel.

There are no known prehistoric resources located within the areas identified for the trenching, waterside berm borings and in-channel borings. Prior to beginning the geotechnical explorations along Reaches A and B of ARN and ARS we will complete an archeological field investigation of the locations of the explorations. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. A qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil for the trenching and borings.

For all of the geotechnical explorations located at NAT A, B, E, F, G and H; ARN Reaches A and B; and ARS Reaches A and B, as well as for all future geotechnical explorations for the Common Features Project, in the event of an unanticipated discovery during the explorations all activity within the vicinity of the find would cease and a qualified archeologist would examine the find to determine treatment.

We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, or areas of traditional cultural interest or concern. If you are interested in further communication regarding exploratory efforts or our continuing efforts to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, we ask that you notify us. In accordance with 36 C.F.R. § 800.14 we plan to develop a Programmatic Agreement (PA) in order to initiate the Section 106 process early in the planning process for the Common Features Project and we will be contacting you in the future to determine your interest in involvement in the PA as a concurring party. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922.

We request that you reply within 30 days of receipt of this letter. If you have any questions of comments, please contact Ms. Montag, Historian, at (916) 557-7907.

Sincerely,

E. Scott Clark

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Mr. Nicholas Fonseca, Chairperson
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

Enclosure 1 outlines the entire Common Features Project, including portions previously constructed by SAFCA. The Common Features Project is divided into three regions shown on Enclosure 1: the Natomas Basin (NAT) shown in yellow, American River North (ARN) shown in blue, and American River South (ARS) shown in purple. NAT Reaches C and D were entirely constructed by SAFCA, as well as a portion of NAT Reach B, some of which is presently still under construction.

As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ms. Cathy Bishop, Chairperson
Strawberry Valley Rancheria
P.O. Box 667
Marysville, California 95901

Dear Ms. Bishop:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ms. Eileen Moon, Vice Chairperson
760 South Auburn Street, Suite 2-C
Grass Valley, California 95945

Dear Ms. Moon:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Mr. David Keyser, Chairperson
United Auburn Indian Community
Auburn Rancheria
Auburn, California 95603

Dear Mr. Keyser:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ms. Mary Daniels-Tarango, Chairperson
Wilton Rancheria
7916 Farnell Way
Sacramento, California 95823

Dear Ms. Daniels-Tarango:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Mr. Cosme Valdez, Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

Dear Mr. Valdez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

Enclosure 1 outlines the entire Common Features Project, including portions previously constructed by SAFCA. The Common Features Project is divided into three regions shown on Enclosure 1: the Natomas Basin (NAT) shown in yellow, American River North (ARN) shown in blue, and American River South (ARS) shown in purple. NAT Reaches C and D were entirely constructed by SAFCA, as well as a portion of NAT Reach B, some of which is presently still under construction.

As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95699

Dear Ione Band of Miwok Indians:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

Enclosure 1 outlines the entire Common Features Project, including portions previously constructed by SAFCA. The Common Features Project is divided into three regions shown on Enclosure 1: the Natomas Basin (NAT) shown in yellow, American River North (ARN) shown in blue, and American River South (ARS) shown in purple. NAT Reaches C and D were entirely constructed by SAFCA, as well as a portion of NAT Reach B, some of which is presently still under construction.

As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

Dear El Dorado Miwok Tribe:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ms. Glenda Nelson, Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monta Vista Avenue
Oroville, California 95966

Dear Ms. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

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As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

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REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 04 2011

Ms. Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria
P.O. Box 162283
Sacramento, California 95814

Dear Ms. Pope:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of proposed geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. The Sacramento Area Flood Control Agency (SAFCA) has implemented and constructed prior phases of the Common Features Project and the U.S. Army Corps of Engineers, Sacramento District (Corps) is now proceeding with future planned phases of the project. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal (NCC), the Pleasant Grove Cross Canal (PGCC), and the Natomas East Main Drain Canal (NEMDC).

Enclosure 1 outlines the entire Common Features Project, including portions previously constructed by SAFCA. The Common Features Project is divided into three regions shown on Enclosure 1: the Natomas Basin (NAT) shown in yellow, American River North (ARN) shown in blue, and American River South (ARS) shown in purple. NAT Reaches C and D were entirely constructed by SAFCA, as well as a portion of NAT Reach B, some of which is presently still under construction.

As part of the Corps' exploratory phase for the remaining reaches of the Common Features Project we are planning to complete a series of geotechnical explorations in the late spring, summer, and fall of 2011 along various project reaches. Along NAT Reach A, a total of 8 cone penetrometer tests (CPT) and 15 geotechnical borings at and adjacent to the Sacramento and American Rivers levees will be completed between May and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach A are shown red dots on Enclosure 2. Although there are no known prehistoric resources located within the areas identified for borings and CPTs, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil.

Within NAT Reach B, a total of 4 CPTs and 13 geotechnical borings along the Sacramento River levee crown and in adjacent agricultural fields will be completed between July and September. The maximum depth of the borings and CPTs would be 100 feet and all borings and CPTs would be backfilled. The boring locations and CPTs for NAT Reach B are shown as red dots on Enclosure 3. Although there are no known prehistoric resources located within the

Mechoopda Indian Tribe of Chico Rancheria

May 9, 2011

Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J. Street
Sacramento, CA. 95814-2922

Re: American River Common Features General Reevaluation Project

Dear Ms. Montag,

I am writing in response to your letter that we received on May 5th. This letter indicates that you are proposing geotechnical explorations for the American River Common Features General Reevaluation (Common Features) Project. This is said to take place in Sacramento and Sutter Counties.

The Tribe is very concerned with the preservation of any Native American Archaeological or Cultural Sites within the project area, or which may be impacted as a result of project activities (pursuant to 14 CCR § 895.1) These sites include, but are not limited to: village sites, camp sites, petroglyphs, prehistoric trails, quarries, milling stations, cemeteries, ceremonial sites, or traditional cultural sites and properties. We are not aware of any cultural resources in the planned project area. If during project activities any cultural resources are found, we ask you to stop activities and that a funded monitor be placed on site for the remainder of the project.

It is also the Tribe's position that extreme care be taken to preserve all watersheds, all Riparian Habitat Conservation Areas; and in general, the prohibition of any project activities which would diminish water quality.

We appreciate your notification. Please also contact Shingle Springs Rancheria and United Auburn Indian Community because this may also be their ancestral area. If there is any other assistance that I can provide during this process, please do not hesitate to contact me.

Thank you.

Michael D. DeSpain

Michael D. DeSpain
Director of OEPP
mdespain@mechoopda-nsn.gov

125 Mission Ranch Blvd. Chico, CA 95926 **ph.** (530) 899-8922 **fx.** (503) 899-8517

MIWOK
MAIDU

United Auburn Indian Community
of the Auburn Rancheria

David Keyser, Chairperson | Kimberly DuBach, Vice Chair | Gene Whitehouse, Secretary | Brenda Conway, Treasurer | Calvin Moman, Council Member

June 2, 2011

Melissa Montag
CESPK-PD-RC
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: The American River Common Features General Re-evaluation Project

Dear Ms. Montag,

Thank you for requesting information regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and ancestral territory spans into El Dorado, Nevada, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its aboriginal territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of sacred or ceremonial significance. We appreciate the opportunity to comment on this and other projects in your jurisdiction.

In order to ascertain whether or not the project could affect cultural resources that may be of importance to the UAIC, we would like to receive copies of any archaeological reports that have been, or will be, completed for the project. We also request copies of future environmental documents for the proposed project so that we have the opportunity to comment on potential impacts and proposed mitigation measures related to cultural resources. The UAIC would also like the opportunity to have our cultural consultants accompany you during the field survey. The information gathered will provide us with a better understanding of the project and cultural resources on site and is invaluable for consultation purposes.

The UAIC's preservation committee would like to set up a fieldvisit and consult about the proposed project. The UAIC would like to be concurring party on any sort of treatment plans, programmatic agreements, or memorandum of agreements. Thank you again for taking these matters into consideration, and for involving the UAIC early in the planning process. We look forward to reviewing the aforementioned documents as requested and setting up a meeting. Please contact Marcos Guerrero, cultural resources specialist, at (530) 883-2364 or email at mguerrero@auburnrancheria.com if you have any questions.

Sincerely,

Gregory S. Baker,
Tribal Administrator

CC: Marcos Guerrero, UAIC

SHINGLE SPRINGS RANCHERIA

Shingle Springs Band of Miwok Indians,
Shingle Springs Rancheria
(Verona Tract), California
5281 Honpie Road, Placerville, CA 95667
P.O. Box 1340, Shingle Springs, CA 95682
(530) 676-8010 Office (530)676-8033 Fax

April 3, 2012

Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

RE: American River Common Features Project in Sacramento County

Dear Alicia E. Kirchner

The Most likely Descendant, Daniel Fonseca would like to initiate consultation process with the Department of the Army for the American River Common Features project located in Sacramento County. Among other things, we would like this consultation to address the cultural and historic resource issues, pursuant to the regulations implementing Section 106 of the National Historic Preservation Act.

Prior to meeting we would like to request any and all completed record searches and or surveys that were done in or around the project area up to and including environmental, archaeological and cultural reports.

Please let this letter serve as a formal request for the Shingle Springs Band of Miwok Indians to be added as a consulting party in identifying any Traditional Cultural Properties (TCPs) that may exist within the project's Area of Potential Effects (APE).

Please contact Crystal Dilworth, Cultural Resource Office Manager at 530-698-1471 to schedule a consultation meeting pursuant to Section 106 of the NHPA.

Sincerely,

Daniel Fonseca
Cultural Resources Director

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 25 2012

Mr. Daniel Fonseca
Cultural Resources Director
Shingle Springs Band of Miwok Indians
Shingle Springs Rancheria
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation on the American River Common Features General Reevaluation (Common Features) Project. We previously contacted you in reference to geotechnical explorations for this Project in a letter dated May 4, 2011. The U.S. Army Corps of Engineers, Sacramento District (Corps) has previously authorized work under the American River Common Features Project and additional levee improvements are being evaluated as part of the Project. The State of California is the non-Federal partner on the Project. The overall Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Creek Canal, the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks (Enclosure).

We received your letter dated April 3, 2012, where you requested to meet with us on the project in order to address cultural and historic issues. You also requested to be formally added as a consulting party in identifying any Traditional Cultural Properties (TCPs) within the Project's Area of Potential Effect (APE), and you requested completed records searches, surveys, and environmental, archaeological and cultural reports.

We look forward to meeting with you on the Project. As you requested, Ms. Melissa Montag of my office will contact Ms. Crystal Dilworth to schedule a consultation meeting. We will make every effort to avoid archeological sites, TCPs, areas of traditional cultural value, interest, or concern and your input during the early stages of planning for the Project is valuable in our efforts to identify historic properties within the Project APE.

You may request previously completed records searches, surveys, and archaeological and cultural reports from within the APE from the Northeast Information Center at California State University, Chico for Sutter County and the North Central Information Center at California State University, Sacramento for Sacramento County. You may also make a Freedom of Information Act (FOIA) request for those documents within our agency records to SPK-FOIA@usace.army.mil. If you have questions about submitting a FOIA request, please contact Ms. Phyllis Svetich, FOIA/Privacy Act Officer, at (916) 557-7236 or Phyllis.M.Svetich@usace.army.mil. Also included with this letter is a disc that includes various available environmental documents for the Project APE. Many other related documents are available at http://www.safca.org/Programs_Natomas.html. We will add you to our mailing this to receive relevant future documents within the Project APE.

We will be contacting you soon with information on additional geotechnical explorations we are planning within the Project APE. In accordance with 36 CFR § 800.14 we are developing a Programmatic Agreement (PA) in order to initiate the Section 106 process early in the planning process for the Project and we will be contacting you to determine your interest in involvement in the PA as a consulting or concurring party. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or comments, please contact Ms. Montag, Historian, at (916) 557-7907. For specific Project questions please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

CF (w/enclosures):
Ms. Crystal Dilworth, Cultural Resources Office Manager, Shingle Springs Band of Miwok Indians, Shingle Springs Rancheria, P.O. Box 1340, Shingle Springs, California 95682

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Gregory S. Baker
Tribal Administrator
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

APR 25 2012

Dear Mr. Baker:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation on the American River Common Features General Reevaluation (Common Features) Project. We previously contacted you in reference to geotechnical explorations for this Project in a letter dated May 4, 2011. The U.S. Army Corps of Engineers, Sacramento District (Corps) has previously authorized work under the American River Common Features Project and additional levee improvements are being evaluated as part of the Project. The State of California is the non-Federal partner on the Project. The overall Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Creek Canal, the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks (Enclosure).

We received your request for future environmental documents and we will add you to our mailing list to receive those documents as they are distributed to the public. You asked to have the opportunity to have your cultural consultants accompany us during future field surveys for the Project and you asked to set up a field visit to consult on the Project. Additionally, you requested to be a concurring party on any treatment plans, programmatic agreements, or memorandum of agreements for the Project, and you requested completed records searches, surveys, and environmental, archaeological, and cultural reports within the Project's Area of Potential Effect (APE).

We look forward to meeting with you on the Project. As you requested, Ms. Melissa Montag of my office will contact Mr. Marcos Guerrero to schedule a consultation meeting. We will make every effort to avoid archeological sites, traditional cultural properties, areas of traditional cultural value, interest, or concern and your input during the early stages of planning for the Project is valuable in our efforts to identify historic properties within the Project APE. For future field survey efforts we will contact you to determine if your cultural consultants are able to accompany us during the field survey. We will be contacting you soon with information on additional geotechnical explorations we are planning within the Project APE.

You may request previously completed records searches, surveys, and archaeological and cultural reports from within the APE from the Northeast Information Center at California State University, Chico for Sutter County and the North Central Information Center at California State

University, Sacramento for Sacramento County. You may also make a Freedom of Information Act (FOIA) request for those documents we have as a part of our agency records to SPK-FOIA@usace.army.mil. If you have questions about submitting a FOIA request, please contact Ms. Phyllis Svetich, FOIA/Privacy Act Officer, at (916) 557-7236 or Phyllis.M.Svetich@usace.army.mil.

In accordance with 36 CFR § 800.14 we are developing a Programmatic Agreement (PA) in order to initiate the Section 106 process early in the planning process for the Project and we will be contacting you to determine your interest in involvement in the PA and subsequent treatment plans and agreement documents as a consulting or concurring party. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or comments, please contact Ms. Montag, Historian, at (916) 557-7907. For specific Project questions please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372.

Sincerely,

E Scott Clark

Alicia E. Kirchner
Chief, Planning Division

Enclosure

CF (w/enclosures):
Mr. Marcos Guerrero, Cultural Resources Specialist, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Ms. Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria
P.O. Box 162283
Sacramento, California 95816

Dear Ms. Pope :

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

Additionally, 12 of the locations will include a second boring using the air rotary cased hammer method to collect undisturbed samples. Trenching will consist of excavating an area 15 feet deep and 150 feet long to perform a visual verification of the soil patterns. The maximum depth for borings will not exceed 80 feet and all borings and trenches will be backfilled upon completion. Enclosed is a map of the proposed locations for the geotechnical borings (shown as blue and white dots) and trenching (outlined in red) testing locations.

A comparison between the records search and the map of the boring/testing locations indicates that there are no known sites at any of these locations. An archaeological field investigation of the specific geotechnical exploration locations will be completed prior to any ground disturbing activities. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. Although there are no known prehistoric resources located within the areas identified for borings and testing locations, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil at every testing location.

For all the geotechnical explorations located on the American River, as well as for all future geotechnical explorations for the Common Features Project, in the event of an unanticipated discovery during the explorations all activity within the vicinity of the find would cease and a qualified archeologist would examine the find to determine treatment.

We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, or areas of traditional cultural interest or concern within the locations identified for the borings and testing. If you are interested in further communication regarding exploratory efforts or our continuing efforts to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, we ask that you notify us. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Mr. Dennis Ramirez, Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. Ramirez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

Additionally, 12 of the locations will include a second boring using the air rotary cased hammer method to collect undisturbed samples. Trenching will consist of excavating an area 15 feet deep and 150 feet long to perform a visual verification of the soil patterns. The maximum depth for borings will not exceed 80 feet and all borings and trenches will be backfilled upon completion. Enclosed is a map of the proposed locations for the geotechnical borings (shown as blue and white dots) and trenching (outlined in red) testing locations.

A comparison between the records search and the map of the boring/testing locations indicates that there are no known sites at any of these locations. An archaeological field investigation of the specific geotechnical exploration locations will be completed prior to any ground disturbing activities. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. Although there are no known prehistoric resources located within the areas identified for borings and testing locations, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil at every testing location.

For all the geotechnical explorations located on the American River, as well as for all future geotechnical explorations for the Common Features Project, in the event of an unanticipated discovery during the explorations all activity within the vicinity of the find would cease and a qualified archeologist would examine the find to determine treatment.

We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, or areas of traditional cultural interest or concern within the locations identified for the borings and testing. If you are interested in further communication regarding exploratory efforts or our continuing efforts to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, we ask that you notify us. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosure

Copy Furnished (w/enclosure):
Mr. Michael D. DeSpain, Director of OEPP, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, California 95926

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Ms. Mary Daniels-Tarango, Chairperson
Wilton Rancheria
7916 Farnell Way
Sacramento, California 95823

Dear Ms. Daniels-Tarango:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Mr. Gregory Baker, Tribal Administrator
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Baker:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

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We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, or areas of traditional cultural interest or concern within the locations identified for the borings and testing. If you are interested in further communication regarding exploratory efforts or our continuing efforts to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, we ask that you notify us. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosure

Copy Furnished (w/enclosure):
Mr. Marcos Guerrero, Cultural Resources Specialist, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Ms. Eileen Moon, Vice Chairperson
760 South Auburn Street, Suite 2-C
Grass Valley, California 95945

Dear Ms. Moon:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

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A comparison between the records search and the map of the boring/testing locations indicates that there are no known sites at any of these locations. An archaeological field investigation of the specific geotechnical exploration locations will be completed prior to any ground disturbing activities. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. Although there are no known prehistoric resources located within the areas identified for borings and testing locations, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil at every testing location.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Ms. Cathy Bishop, Chairperson
Strawberry Valley Rancheria
P.O. Box 667
Marysville, California 95901

Dear Ms. Bishop:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

Additionally, 12 of the locations will include a second boring using the air rotary cased hammer method to collect undisturbed samples. Trenching will consist of excavating an area 15 feet deep and 150 feet long to perform a visual verification of the soil patterns. The maximum depth for borings will not exceed 80 feet and all borings and trenches will be backfilled upon completion. Enclosed is a map of the proposed locations for the geotechnical borings (shown as blue and white dots) and trenching (outlined in red) testing locations.

A comparison between the records search and the map of the boring/testing locations indicates that there are no known sites at any of these locations. An archaeological field investigation of the specific geotechnical exploration locations will be completed prior to any ground disturbing activities. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. Although there are no known prehistoric resources located within the areas identified for borings and testing locations, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil at every testing location.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Mr. Daniel Fonseca
Cultural Resources Director
Shingle Springs Band of Miwok Indians
Shingle Springs Rancheria
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

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A comparison between the records search and the map of the boring/testing locations indicates that there are no known sites at any of these locations. An archaeological field investigation of the specific geotechnical exploration locations will be completed prior to any ground disturbing activities. In the event that cultural resources are identified during the archeological field investigation, we will relocate those explorations to avoid possible sites. Although there are no known prehistoric resources located within the areas identified for borings and testing locations, a qualified archeological monitor will be present during ground disturbing activities for the first 20 feet of previously undisturbed soil at every testing location.

For all the geotechnical explorations located on the American River, as well as for all future geotechnical explorations for the Common Features Project, in the event of an unanticipated discovery during the explorations all activity within the vicinity of the find would cease and a qualified archeologist would examine the find to determine treatment.

We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, or areas of traditional cultural interest or concern within the locations identified for the borings and testing. If you are interested in further communication regarding exploratory efforts or our continuing efforts to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, we ask that you notify us. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

Copy Furnished (w/enclosure):
Ms. Crystal Dilworth, Cultural Resources Office Manager , Shingle Springs Band of Miwok Indians, Shingle Springs, P.O. Box 1340, Shingle Springs, California 95682

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Mr. Cosme Valdez
Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

Dear Mr. Valdez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

Additionally, 12 of the locations will include a second boring using the air rotary cased hammer method to collect undisturbed samples. Trenching will consist of excavating an area 15 feet deep and 150 feet long to perform a visual verification of the soil patterns. The maximum depth for borings will not exceed 80 feet and all borings and trenches will be backfilled upon completion. Enclosed is a map of the proposed locations for the geotechnical borings (shown as blue and white dots) and trenching (outlined in red) testing locations.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAY 11 2012

Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95669

Dear Ione Band of Miwok Indians:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Glenda Nelson, Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monta Vista Avenue
Oroville, California 95966

MAY 11 2012

Dear Ms. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

MAY 11 2012

Dear El Dorado Miwok Tribe:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued geotechnical exploration work for the American River Common Features Project (Common Features) following our initial consultation with you in a letter dated May 4, 2011. The overall Common Features Project is located in Sacramento and Sutter Counties along the Sacramento River, the American River, the Natomas Cross Canal, the Pleasant Grove Cross Canal, and the Natomas East Main Drain Canal, Arcade Creek, and Dry/Robla Creeks.

As part of the U.S. Army Corps of Engineers' (Corps) exploratory phase for the Common Features Project, we are completing a series of geotechnical explorations. The work will consist of soil testing to depths of 80 feet, soil surface testing of erodibility, in-channel borings, trenching, and various geophysical surveys. The geotechnical borings will occur at 23 locations along the American River between river miles 0.0 and 22.4 while the trenching will occur at five locations between river miles 5 and 14. The borings will be taken in various locations along the toe and bench within the American River Parkway. The sonic drilling method will be used to collect continuous samples for geologic and engineering characteristics at all sites.

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June 21, 2012

Ms Melissa Montag (CESPK-PD-RC)
U.S Army Corps of Engineers,
1325 J Street, Sacramento CA 95814-2922

Dear Ms Melissa Montag,

We are in receipt of a letter dated May 11, 2012 from Alicia E. Kirchner, Chief, Planning Division informing us of the continued geotechnical exploration work for the American River Common Features Project.

As per your request, Buena Vista Rancheria is interested in continued consultation with U.S Army Corps of Engineers pursuant to Section106 of the National Historic Preservation Act of 1966. In order for us to better understand the project we would like to request additional information on the full range of proposed project activities for which the drilling and trenching is being proposed, including detail project descriptions with maps and photographs. We also request the schedule for the proposed borings and trenching, and a site visit. Buried archeological deposits and other cultural resources could be present at some drilling and trenching sites that could potentially be impacted by proposed project activities.

In addition, Buena Vista Rancheria would like to review the results of your records search concerning cultural resources including archeological sites and other resources of interest and concern to American Indians. The Tribe requests to be involved in developing the scope of work, sampling strategy and research design, as well as field investigations, laboratory analysis, and report writing for the proposed archeological investigations Please provide a schedule for your proposed cultural resources studies. A site visit to the proposed study area is requested, as well.

Buena Vista Rancheria is pleased that the Department of the Army plans to have a qualified archaeologist on site during geotechnical exploration excavations. We request that you consider having the Tribe's Cultural Monitors present during the borings and trenching and all related activities involving substantial ground disturbing actions, in addition to the field investigations mentioned above.

We look forward to receiving additional project information from you to review prior to a site visit, as well as working with you to develop the studies to investigate cultural resources of interest and concern to the American Indian people in the project area of potential effect.

If you have any questions regarding this letter feel free to call me at telephone number (916) 491-0011.

Respectfully,

Roselynn Lwenya, PhD
Tribal Historic Preservation Officer and
Environmental Resources Director

P.O. BOX 162283 Sacramento, CA 95816
TEL: 916.491.0011 FAX: 916.491.0012
www.buenavistatribe.com

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Roselynn Lwenya, THPO
Buena Vista Rancheria Me-Wuk Indians
P.O. Box 162283
Sacramento, California 95816

JUL 12 2012

Dear Ms. Lwenya:

In response to your letter dated June 21, 2012 and in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to keep you informed of our continued work for the American River Common Features General Reevaluation (Common Features) Project. The area of potential effects for the Common Features Project is shown on Enclosure 1. The geotechnical borings, for which we originally consulted with you back in May, will no longer be occurring as planned. However, we are still moving forward with the Section 106 consultation process for the overall Common Features Project and we would like to keep you informed of our upcoming efforts on the project.

A draft programmatic agreement will be available soon. In accordance with 36 CFR Part 800.14(b)(2)(i), you will be invited to review this document as a concurring party. Additionally, in accordance with 36 CFR Part 800.2, we would like to propose the prospect of setting up a meeting with you to discuss our current and future Section 106 compliance efforts for the Common Features Project. We will be contacting you soon to schedule a consultation meeting.

We are sensitive to traditional cultural properties and sacred sites, and make every effort to avoid them. If you have any questions or concerns, please feel free to contact us. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814-2922. For specific project questions please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372.

Sincerely,

Alicia E Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria
P.O. Box 162283
Sacramento, California 95816

Dear Ms. Pope:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area the Sacramento and American rivers form a flood plain covering roughly 110,000 acres in their confluence. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

The ARCF Project is a single purpose flood risk management project with the measures described in Enclosure 2 proposed for implementation. The ARCF Project APE is within an area known to be sensitive for prehistoric and historic cultural resources. The Corps has determined that ARCF Project will be a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 3).

Included as attachments to the draft PA are a map of the APE (Enclosure 3, Attachment 1) and a draft project description for the ARCF Project (Enclosure 3, Attachment 3). We have contacted the Advisory Council on Historic Preservation and the State Historic Preservation Officer to ask for their comments on the proposed ARCF Project. They have also received the draft PA for their review and comment.

Pursuant to 36 CFR § 800.14(b)(2)(i), we request your involvement in the development of the PA for the ARCF Project. We ask that you review the enclosed draft PA and provide us with comments within 45 days. Additionally, if you would like to meet with us so that we may answer any questions you may have about ARCF Project, our proposed Section 106 compliance efforts, or the draft PA, we ask that you contact us to schedule a meeting.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation for the ARCF Project, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Mr. Ambar Mohammed
Cachil DeHe Band of Wintun Indians of the
Colusa Indian Community of the Colusa Rancheria
3730 State Highway 45 # B
Colusa, California 95932

Dear Mr. Mohammed:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area the Sacramento and American rivers form a flood plain covering roughly 110,000 acres in their confluence. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

The ARCF Project is a single purpose flood risk management project with the measures described in Enclosure 2 proposed for implementation. The ARCF Project APE is within an area known to be sensitive for prehistoric and historic cultural resources. The Corps has determined that ARCF Project will be a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 3).

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Guy Taylor, Representative
Mooretown Rancheria of Maidu Indians
31 Alverde Drive
Oroville, California 95966

APR 05 2013

Dear Mr. Taylor:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area the Sacramento and American rivers form a flood plain covering roughly 110,000 acres in their confluence. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Mr. Michael D. DeSpain, Director of OEPP
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. DeSpain:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Mr. Dennis Ramirez, Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. Ramirez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
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1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Mary Daniels-Tarango, Chairperson
Wilton Rancheria
7916 Farnell Way
Sacramento, California 95823

Dear Ms. Daniels-Tarango:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Mr. Danny Rey, Tribal Historic Preservation Officer
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Rey:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Mr. Marcos Guerrero, Cultural Resources Specialist
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Guerrero:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Eileen Moon, Vice Chairperson
760 South Auburn Street, Suite 2-C
Grass Valley, California 95945

Dear Ms. Moon:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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1325 J STREET
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REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Cathy Bishop, Chairperson
Strawberry Valley Rancheria
P.O. Box 667
Marysville, California 95901

Dear Ms. Bishop:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Angela Rivera
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Ms. Rivera:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
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REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Daniel Fonseca, Cultural Resources Director
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

APR 05 2013

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Cosme Valdez, Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

APR 05 2013

Dear Mr. Valdez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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1325 J STREET
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REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Yvonne Miller, Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95669

APR 05 2013

Dear Ms. Miller:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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CORPS OF ENGINEERS
1325 J STREET
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REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Glenda Nelson, Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monta Vista Avenue
Oroville, California 95966

APR 05 2013

Dear Ms. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

Dear El Dorado Miwok Tribe:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 05 2013

Ms. Roselynn Lwenya
Tribal Historic Preservation Officer
Buena Vista Rancheria
P.O. Box 162283
Sacramento, California 95816

Dear Ms. Lwenya:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area the Sacramento and American rivers form a flood plain covering roughly 110,000 acres in their confluence. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

The ARCF Project is a single purpose flood risk management project with the measures described in Enclosure 2 proposed for implementation. The ARCF Project APE is within an area known to be sensitive for prehistoric and historic cultural resources. The Corps has determined that ARCF Project will be a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 3).

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Art Angle
Enterprise Rancheria of Maidu Indians
2133 Monta Vista Avenue
Oroville, California 95966

JUN 06 2013

Dear Mr. Angle:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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Included as attachments to the draft PA are a map of the APE (Enclosure 3, Attachment 1) and a draft project description for the ARCF Project (Enclosure 3, Attachment 3). We have contacted the Advisory Council on Historic Preservation and the State Historic Preservation Officer to ask for their comments on the proposed ARCF Project. They have also received the draft PA for their review and comment.

Pursuant to 36 CFR § 800.14(b)(2)(i), we request your involvement in the development of the PA for the ARCF Project. We ask that you review the enclosed draft PA and provide us with comments within 45 days. Additionally, if you would like to meet with us so that we may answer any questions you may have about ARCF Project, our proposed Section 106 compliance efforts, or the draft PA, we ask that you contact us to schedule a meeting.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation for the ARCF Project, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Steven Hutchason
Wilton Rancheria
9300 W. Stockton, Suite 200
Elk Grove, California 95758

JUN 06 2013

Dear Mr. Hutchason:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Cathy Bishop, Chairperson
Strawberry Valley Rancheria
1540 Strader Avenue
Sacramento, California 95815

JUN 06 2013

Dear Ms. Bishop:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Kesner Flores
P.O. Box 1047
Wheatland, California 95692

JUN 06 2013

Dear Mr. Flores:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Cortina Wintun Environmental Protection Agency
P.O. Box 1630
Williams, California 95987

JUN 06 2013

To Whom It May Concern:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Marshall McKay
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, California 95606

JUN 06 2013

Dear Mr. McKay:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Leland Kinter
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, California 95606

JUN 06 2013

Dear Mr. Kinter:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Cynthia Clarke
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, California 95606

JUN 06 2013

Dear Ms. Clarke:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Rose Enos
15310 Bancroft Road
Auburn, California 95603

JUN 06 2013

Dear Ms. Enos:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Randy Yonemura
4305 39th Avenue
Sacramento, California 95824

JUN 06 2013

Dear Mr. Yonemura:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. April Wallace Moore
19630 Placer Hills Road
Colfax, California 95713

JUN 06 2013

Dear Ms. Moore:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Judith Marks
Colfax-Todds Valley Consolidated Tribe
1068 Silverton Circle
Lincoln, California 95648

JUN 0[illegible] 2013

Dear Ms. Marks:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area, the Sacramento and American rivers form a flood plain covering roughly 110,000 acres. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

The ARCF Project is a single purpose flood risk management project with the measures described in Enclosure 2 proposed for implementation. The ARCF Project APE is within an area known to be sensitive for prehistoric and historic cultural resources. The Corps has determined that ARCF Project will be a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties. As a result, pursuant to 36 CFR § 800.14(b), we have drafted a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project. The draft PA is enclosed for your review and comment (Enclosure 3).

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Pamela Cubbler
Colfax-Todds Valley Consolidated Tribe
P.O. Box 734
Foresthill, California 95631

JUN 06 2013

Dear Ms. Cubbler:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

In the Sacramento area, the Sacramento and American rivers form a flood plain covering roughly 110,000 acres. The flood plain includes most of the developed portions of the city of Sacramento. The ARCF Project area of potential effects (APE) includes approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; intermittent sites along the east bank of the Sacramento River downstream of the Natomas Cross Canal (NCC) down to the confluence with the American River; intermittent sites on the south bank of the NCC immediately upstream of the confluence with the Sacramento River; approximately 4 miles of the Pleasant Grove Creek Canal; the Sacramento Bypass and Sacramento Weir; approximately 8 miles of the Natomas East Main Drainage Canal (NEMDC); approximately 15 miles of the east bank of the Sacramento River downstream of the American River down to Morrison Creek; approximately ½ mile of the south bank of Dry/Robla Creeks; approximately 2 miles of the north and south banks of Arcade Creek; and approximately ½ mile of the Magpie Creek Diversion Canal (Enclosure 1).

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Anthony Burris
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95699

JUN 06 2013

Dear Mr. Burris:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Sam Daniels
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

JUN 06 2013

Dear Mr. Daniels:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Grayson Coney
Tsi-Akim Maidu
P.O. Box 1316
Colfax, California 95713

JUN 06 2013

Dear Mr. Coney:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Andrew Franklin
Wilton Rancheria
9300 W. Stockton, Suite 200
Elk Grove, California 95758

JUN 06 2013

Dear Mr. Franklin:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to inform you of the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to provide flood risk reduction to the City of Sacramento and the Natomas Basin pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

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June 13, 2013

Melissa Montag, Senior Environmental Manager/Historian
U.S. Army Corps of Engineers
Cultural, Recreation & Social Assessment Section (CESPK-PD-RC)
1325 J Street
Sacramento, CA 95814-2922

Re: American River Common Features Project - Draft Programmatic Agreement

Dear Ms. Montag:

I am writing on behalf of the Buena Vista Rancheria of Me-Wuk Indians (BVR) to express concerns and share comments about the enclosed American River Common Features Project Draft Programmatic Agreement (PA).

This draft PA requests tribal governments to concur with procedural documents that have not yet been prepared, such as the Historic Properties Management Plan (HPMP) and the Historic Properties Treatment Plans (HPTPs). This is problematic for a couple reasons. First, tribes were not involved in determining the area of potential effect (APE), the presence of historic properties, the effect of the undertaking on historic properties, or the identification of resources having spiritual and cultural significance to American Indians. Further, despite requests, BVR has been denied adequate information and documentation on known historic properties within the APE.

BVR believes that the draft PA was prepared with inadequate tribal government to government consultation, as required under Section 106 of the National Historic Preservation Act and Executive Order 13175. BVR has only received copies of letters sent to other agencies and letters of invitation to initiate consultation. Substantive government to government consultation at the earliest possible stage is crucial in order for consultation to be meaningful.

The meeting between representatives of the Army Corps and BVR, on May 29, 2013, is an example of how the process should work, and BVR looks forward to many more opportunities to consult with the U.S. Army Corps of Engineers on local projects.

If you have any questions regarding our comments please feel free to contact Roselynn Lwenya, Ph.D., Environmental Resources Director, at (916) 491-0011.

Respectfully,

Rhonda L. Morningstar Pope, Chairwoman
Buena Vista Rancheria of Me-Wuk Indians

P.O. BOX 162283 Sacramento, CA 95816
TEL 916 491 0011 FAX 916 491 0012

Tribal Council

Marshall McKay
Chairman

James Kinter
Secretary

Anthony Roberts
Treasurer

Mia Durham
Member

Matthew Lowell, Jr.
Member

July 9th, 2013

Melissa Montag
US Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

RE: ARCF Project

Dear Ms. Montag:

Thank you for your project notification letter and programmatic agreement (PA) dated, June 6th, 2013, regarding cultural information on or near the proposed ARCF project, Sacramento area, CA. We appreciate your effort to contact us.

The Cultural Resources Department has reviewed the project and concluded that it is not within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we respectively decline any comment on this project or the PA.

Should you have any questions, please feel free to contact the following individual:

Mr. James Sarmento
Cultural Resources Manager
Yocha Dehe Wintun Nation
Office: (530) 723-0452, Email: jsarmento@yochadehe-nsn.gov

Please refer to identification number YD-06202013-01 in any correspondences concerning this project.

Thank you for providing us with this notice and the opportunity to comment.

Sincerely,

Marshall McKay
Tribal Chairman

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Ms. Cathy Bishop
Chairperson
Strawberry Valley Rancheria
1540 Strader Avenue
Sacramento, California 95815

Dear Ms. Bishop:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated June 6, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

We are providing the most recent final draft of the PA for the ARCF Project for your final review and comment before we plan to execute the PA. The final draft of the PA is included in Enclosure 1. We have prepared a short summary document describing the authorizations for the projects in the region, what has been constructed, what agency or partner completed the construction, previous compliance with the National Historic Preservation Act of 1966, as amended, and the National Environmental Policy Act of 1969, and the planned future activities within the watersheds (Enclosure 1, Attachment 4). The APE for the ARCF Project is further described and shown in Enclosure 1, Attachment 3.

Because the APE for the ARCF Project covers a large geographic area and is mostly located along rivers, which have been shown to be sensitive for buried resources, we have developed two predictive models to extrapolate archaeological sensitivity over un-surveyed portions of the APE. The first model is a general model of site locations that anticipates the likelihood that any one or more spots in the study area will be in an archaeological site. The second model highlights portions of the APE where we would be more or less likely to find buried archaeological materials. Ultimately we plan to use the predictive models to assist with planning and evaluating alternatives to avoid adverse effects to cultural resources whenever and wherever possible. The models and detailed information on the archaeological sensitivity assessment are included in Enclosure 2. We request any comments you may have on the archaeological sensitivity assessment.

The PA has been provided to the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), CVFPP, Department of Water Resources (DWR), SAFCA, and potentially interested American Indian Tribes and interested American Indian individuals for review and comment. In a letter dated August 7, 2012, the ACHP declined to participate in consultation for the ARCF Project (Enclosure 1, Attachment 2). Comments were received from the CVFPP, DWR, SAFCA, and American Indian Tribes and have been considered in this current final draft of the PA. A consultation log of communications with American Indian tribes and American Indian individuals for the ARCF Project is included as Enclosure 3.

In April 2013, letters to 100 historical societies, museums, state historic parks, associations with historic interests, local city and county groups, and groups of various prehistoric and historic interests were sent providing a description and map of the project and requesting information on cultural resources within the APE. One response, from the Center for Sacramento History, was received, noting they would keep our letter on file. In accordance with 36 CFR § 800.14(b)(2)(ii), we will also provide potentially interested American Indian Tribes and interested American Indian individuals and the groups and agencies listed above the final draft PA with the forthcoming Environmental

Impact Statement/Environmental Impact Report which will be released for public review this summer.

Pursuant to 36 CFR § 800.14(b)(2)(i), we have requested your involvement in the development of the PA for the ARCF Project. As a potential Concurring Party to the PA, we ask that you review the enclosed final draft PA and archaeological sensitivity assessment and provide us with comments within 30 days. Any comments on the draft final PA received during the review period will be considered for the final PA. If you would like to meet with us so that we may answer any questions you may have about ARCF Project, our proposed Section 106 compliance efforts, or the draft PA, we ask that you contact us to schedule a meeting. Additionally, we request that you inform us if you are interested in signing the PA as a Concurring Party and if there are any required alterations to your signature page of the PA.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. If you have any questions or would like additional information about the Section 106 compliance and consultation for the ARCF Project, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

For Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Anthony Burris
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95699

Dear Mr. Burris:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated June 6, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Jason Camp
Tribal Historic Preservation Officer
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Camp:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted the United Auburn Indian Community of the Auburn Rancheria via a letter dated April 5, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Grayson Coney
Tsi-Akim Maidu
P.O. Box 1316
Colfax, California 95713

Dear Mr. Coney:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Ms. Pamela Cubbler
Colfax-Todds Valley Consolidated Tribe
P.O. Box 734
Foresthill, California 95631

Dear Ms. Cubbler:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Sam Daniels
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Daniels:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated June 6, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Ms. Mary Daniels-Tarango
Chairperson
Wilton Rancheria
7916 Farnell Way
Sacramento, California 95823

Dear Ms. Daniels-Tarango:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Michael D. DeSpain
Director of OEPP
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. DeSpain:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

To Whom It May Concern:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Ms. Rose Enos
15310 Bancroft Road
Auburn, California 95603

Dear Ms. Enos:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated June 6, 2013 wherein we:

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Kesner Flores
P.O. Box 1047
Wheatland, California 95692

Dear Mr. Flores:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Daniel Fonseca
Cultural Resources Director
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Nicholas Fonseca
Chairperson
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted the Shingle Springs Band of Miwok Indians via a letter dated April 5, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Andrew Franklin
Wilton Rancheria
9300 W. Stockton, Suite 200
Elk Grove, California 95758

Dear Mr. Franklin:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Reno Franklin
Tribal Historic Preservation Officer
The Enterprise Rancheria of Maidu Indians
2213 Monte Vista Avenue
Oroville, California 95966

Dear Mr. Franklin:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Marcos Guerrero
Cultural Resources Specialist
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Guerrero:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Steven Hutchason
Wilton Rancheria
9300 W. Stockton, Suite 200
Elk Grove, California 95758

Dear Mr. Hutchason:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Ms. Judith Marks
Colfax-Todds Valley Consolidated Tribe
1068 Silverton Circle
Lincoln, California 95648

Dear Ms. Marks:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Ms. Yvonne Miller
Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95669

Dear Ms. Miller:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Ambar Mohammed
Cachil DeHe Band of Wintun Indians of the
Colusa Indian Community of the Colusa Rancheria
3730 State Highway 45 # B
Colusa, California 95932

Dear Mr. Mohammed:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Ms. Eileen Moon
Vice Chairperson
Tsi-Akim Maidu
760 South Auburn Street, Suite 2-C
Grass Valley, California 95945

Dear Ms. Moon:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Ms. April Wallace Moore
19630 Placer Hills Road
Colfax, California 95713

Dear Ms. Moore:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated June 6, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Ms. Glenda Nelson
Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monte Vista Avenue
Oroville, California 95966

Dear Ms. Nelson:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Dennis Ramirez
Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. Ramirez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Guy Taylor
Representative
Mooretown Rancheria of Maidu Indians
31 Alverde Drive
Oroville, California 95966

Dear Mr. Taylor:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

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b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Cosme Valdez
Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

Dear Mr. Valdez:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Whitehouse:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted the United Auburn Indian Community of the Auburn Rancheria via a letter dated April 5, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

c. Provided the Corps' determination, pursuant to 36 CFR § 800.14(b), that a programmatic agreement (PA) to establish a framework for the resolution of potential adverse effects that may result from implementation of the ARCF Project would be the means for the Corps to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 1 2 2014

Mr. Charlie Wright
Chairperson
Cortina Band Wintun of Indians
P.O. Box 1630
Williams, California 95987

Dear Mr. Wright:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted the Cortina Band Wintun of Indians via a letter dated June 6, 2013 wherein we:

a. Provided the ARCF Project area of potential effects (APE) and project description.

b. Provided the Corps' determination that the ARCF Project is a complex undertaking that may be constructed in multiple phases, that the effects on historic properties cannot be fully determined prior to the approval of the undertaking, and that the ARCF Project may result in adverse effects to historic properties.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 12 2014

Mr. Randy Yonemura
4305 39th Avenue
Sacramento, California 95824

Dear Mr. Yonemura:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Ms. Rhonda Morningstar Pope
Chairperson
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95811

JUN 25 2014

Dear Ms. Pope:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

We most recently contacted you via a letter dated April 5, 2013 wherein we:

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JUN 2 5 2014

Roselynn Lwenya, Ph.D
Tribal Historic Preservation Officer
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95811

Dear Dr. Lwenya:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin and areas along the north and south banks of the American River as well as the east bank of the Sacramento River pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999. The ARCF Project is a part of the Common Features General Reevaluation Report. The State of California Central Valley Flood Protection Board (CVFPP), in cooperation with the Sacramento Area Flood Control Agency (SAFCA), is the non-Federal sponsor for the ARCF Project.

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d. Requested your involvement in the development of the PA for the ARCF Project.

e. Enclosed the ARCF Project draft PA for your review and comment.

MIWOK United Auburn Indian Community
MAIDU of the Auburn Rancheria

Gene Whitehouse, Chairman | John L. Williams, Vice Chairman | Danny Rey, Secretary | Brenda Adams, Treasurer | Calvin Moman, Council Member

August 19, 2014

Ms. Melissa Montag
U.S. Army Corp of Engineers
Sacramento District
1325 J Street
Sacramento California 95814-29922

Subject: American River Commons Features (ARCF) Project

Dear Melissa Montag,

Thank you for requesting information regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and whose service area includes El Dorado, Nevada, Placer, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its aboriginal territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of sacred or ceremonial significance. We appreciate the opportunity to comment on this and other projects in your jurisdiction.

In order to ascertain whether or not the project could affect cultural resources that may be of importance to the UAIC, we would like to receive copies of any archaeological reports that have been, or will be, completed for the project. We also request copies of future environmental documents for the proposed project so that we have the opportunity to comment on potential impacts and proposed mitigation measures related to cultural resources. Finally, we would like the opportunity to have our tribal monitors accompany you during the field survey. The information gathered will provide us with a better understanding of the project and cultural resources on site and is invaluable for consultation purposes.

Our preservation committee has identified many cultural resources within your project area and in close proximity, and would like to request a site visit to confirm their locations and meet with you regarding this project. In addition, we have several specific requests that arose out of your meeting with our committee members and staff on August 5, 2014. We ask that the USACE and DWR provide the UAIC with:

- A confidentiality and/or data sharing agreement;
- A burial plan;
- A Historic Properties Treatment Plan that is approved before ground disturbing activities begin;
- A confederacy agreement between the tribes that wish to consult on the project;
- Signatory status on the Programmatic Agreement.

Tribal Office 10720 Indian Hill Road Auburn, CA 95603 (530) 883-2390 FAX (530) 883-2380

Each of these is crucial to ensuring that the many cultural resources within your project area are protected and that any disturbance to the resources is minimized.

We will begin preparing comments to the PA and look forward to meeting with you again so that we can maintain an open dialogue. Thank you again for taking these matters into consideration, and for involving the UAIC early in the planning process. We look forward to reviewing the documents we requested. Please contact Marcos Guerrero, Cultural Resources Manager, at (530) 883-2364 or by email at mguerrero@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC: Marcos Guerrero, CRM

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Charlie Wright
Chairperson
Cortina Wintun Environmental Protection Agency
P.O. Box 1630
Williams, California 95987

Dear Mr. Wright:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

The geotechnical study consists of drilling thirty eight (38) soil borings within the levee prism, levee toe, waterside berm, or adjacent field along the American River and NEMDC. The borings will be performed by a truck mounted drill rig or hand auger. There will be a total of eleven (11) borings using a truck or track mounted drill rig and twenty-seven (27) hand augers taking place. The borings will be up to 8 inches in diameter and up to 80 feet deep, and the augers will be up to 8 inches in diameter and up to 15 feet deep. The main access and travel paths to the boring and auger locations would be from the existing levee roads, levee access ramps, bike paths, and adjacent streets. After boring and augering is complete all holes/excavations will be backfilled and the surface returned to pre-work conditions. Enclosed is a map of the proposed boring and augering locations and a table describing the activities (Enclosures 1 and 2).

A records search and archeological survey completed on October 14, 2014 revealed that the locations for the geotechnical study have been previously subjected to cultural resources inventory twice and that there are no known prehistoric resources located

within or adjacent to the locations for the geotechnical study. Although there are three previously recorded historic-era features (NEMDC west levee, Del Paso Road, and Northgate Boulevard) within the area, none will be affected by the geotechnical study. A recent archeological field verification of the boring and augering locations did not result in the identification of previously unknown prehistoric resources. A single, isolated, potentially historic-era feature was identified in the NEMDC channel just north of San Juan Road, but it is located outside the area planned for the geotechnical study. However, in the event of an unanticipated discovery during the borings or augering, all work at the location of the discovery would stop and both the State Historic Preservation Officer and tribes would be notified.

Previous consultation with Native American tribes on other Corps projects in the vicinity of the geotechnical study locations has noted the area is potentially sensitive for cultural resources. As a result, an archeological monitor meeting 36 CFR § 61 and the Secretary of the Interior's Professional Qualifications Standards for Archeology will inspect the available soil for the presence of cultural resources and will collect samples of organic matter from a variety of subsurface sediments for radiocarbon dating in order to better understand the age of alluvial deposits and inform the Corps' assessments of the probability of encountering buried archaeological sites.

We are sensitive toward the protection of traditional cultural properties and sacred sites, and make every effort to avoid them. Please let us know if you have knowledge of locations of archeological sites, sacred sites, or areas of traditional cultural value or concern in or near the locations identified for the borings and augering. Correspondence may be sent to: Ms. Melissa Montag (CESPK-PD-RC), U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814. If you have any questions or would like additional information, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Kesner Flores
P.O. Box 1047
Wheatland, California 95692

Dear Mr. Flores:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

The geotechnical study consists of drilling thirty eight (38) soil borings within the levee prism, levee toe, waterside berm, or adjacent field along the American River and NEMDC. The borings will be performed by a truck mounted drill rig or hand auger. There will be a total of eleven (11) borings using a truck or track mounted drill rig and twenty-seven (27) hand augers taking place. The borings will be up to 8 inches in diameter and up to 80 feet deep, and the augers will be up to 8 inches in diameter and up to 15 feet deep. The main access and travel paths to the boring and auger locations would be from the existing levee roads, levee access ramps, bike paths, and adjacent streets. After boring and augering is complete all holes/excavations will be backfilled and the surface returned to pre-work conditions. Enclosed is a map of the proposed boring and augering locations and a table describing the activities (Enclosures 1 and 2).

A records search and archeological survey completed on October 14, 2014 revealed that the locations for the geotechnical study have been previously subjected to cultural resources inventory twice and that there are no known prehistoric resources located within or adjacent to the locations for the geotechnical study. Although there are three previously recorded historic-era features (NEMDC west levee, Del Paso Road, and

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 2 0 2014

Ms. Rose Enos
15310 Bancroft Road
Auburn, California 95603

Dear Ms. Enos:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

To Whom It May Concern:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 2 0 2014

Ms. Cathy Bishop
Chairperson
Strawberry Valley Rancheria
1540 Strader Avenue
Sacramento, California 95815

Dear Ms. Bishop:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Andrew Franklin
Chairperson
Wilton Rancheria
9728 Kent Street
Elk Grove, California 95624

Dear Mr. Franklin:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Ambar Mohammed
Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria
3730 State Highway 45 # B
Colusa, California 95932

Dear Mr. Mohammed:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Ms. Yvonne Miller
Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95669

Dear Ms. Miller:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 2 0 2014

Ms. Judith Marks
Colfax-Todds Valley Consolidated Tribe
1068 Silverton Circle
Lincoln, California 95648

Dear Ms. Marks:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 2 0 2014

Ms. April Wallace Moore
19630 Placer Hills Road
Colfax, California 95713

Dear Ms. Moore:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 20 2014

Ms. Glenda Nelson
Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monte Vista Avenue
Oroville, California 95966

Dear Ms. Nelson:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 20 2014

Ms. Rhonda Morningstar Pope
Chairperson
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, California 95811

Dear Ms. Pope:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Dennis Ramirez
Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

Dear Mr. Ramirez:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 2 0 2014

Mr. Randy Yonemura
4305 39th Avenue
Sacramento, California 95824

Dear Mr. Yonemura:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 20 2014

Mr. Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Whitehouse:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

The geotechnical study consists of drilling thirty eight (38) soil borings within the levee prism, levee toe, waterside berm, or adjacent field along the American River and NEMDC. The borings will be performed by a truck mounted drill rig or hand auger. There will be a total of eleven (11) borings using a truck or track mounted drill rig and twenty-seven (27) hand augers taking place. The borings will be up to 8 inches in diameter and up to 80 feet deep, and the augers will be up to 8 inches in diameter and up to 15 feet deep. The main access and travel paths to the boring and auger locations would be from the existing levee roads, levee access ramps, bike paths, and adjacent streets. After boring and augering is complete all holes/excavations will be backfilled and the surface returned to pre-work conditions. Enclosed is a map of the proposed boring and augering locations and a table describing the activities (Enclosures 1 and 2).

A records search and archeological survey completed on October 14, 2014 revealed that the locations for the geotechnical study have been previously subjected to cultural resources inventory twice and that there are no known prehistoric resources located

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

NOV 2 0 2014

Mr. Cosme Valdez
Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

Dear Mr. Valdez:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch NOV 2 0 2014

Mr. Guy Taylor
Representative
Mooretown Rancheria of Maidu Indians
31 Alverde Drive
Oroville, California 95966

Dear Mr. Taylor:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch **NOV 2 0 2014**

Mr. Don Ryberg
Chairman
Tsi-Akim Maidu
1239 East Main Street
Grass Valley, California 95945

Dear Mr. Ryberg:

The U.S. Army Corps of Engineers (Corps), along with its non-Federal sponsors, the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA), are conducting geotechnical study as a part of the American River Watershed Common Features Project Natomas Basin, specifically Reach H, which extends from Northgate Boulevard to the Natomas East Main Drainage Canal (NEMDC) Stormwater Pump Station. Authorization for the Common Features project is provided by Section 7002 of Water Resources Reform and Development Act (WRRDA) (PL 113-121) of 2014. As part of these studies, soil borings will be performed to collect, classify, and test soil samples along the American River and NEMDC near Sacramento, California. Additionally, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR § 800.4, and as part of efforts to identify historic properties, the Corps will collect samples of organic matter (e.g. charcoal, wood) encountered during the studies for radiocarbon dating. This work is expected to occur between December 2014 and February of 2015.

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MIWOK United Auburn Indian Community
MAIDU of the Auburn Rancheria

Gene Whitehouse	John L. Williams	Danny Rey	Brenda Adams	Calvin Moman
Chairman	Vice Chairman	Secretary	Treasurer	Council Member

May 18, 2015

Colonel Michael Farrell, District Commander
U.S. Army Corps of Engineers
Sacramento District
1325 J Street, Room 1513
Sacramento, California 95814

RE: Formal Request for Government-to-Government Consultation, American River Watershed Common Features General Reevaluation Report, Draft Environmental Impact Statement/Environmental Impact Report, March 2015

Dear Colonel Farrell,

The United Auburn Indian Community (UAIC) is sending this letter to the U.S. Army Corps of Engineers (USACE) requesting formal Government-to-Government Consultation for the American River Common Features (ARCF) Project, located in Sacramento County. The primary purpose of government-to-government consultation as described in Federal Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments" is to ensure that the UAIC is given the opportunity to provide meaningful and timely input regarding proposed USACE actions that uniquely or significantly affect our burial and sacred sites and places.

With this letter, the UAIC is notifying the USACE that unique or significant historic properties will be adversely affected by your project-related planned and proposed levee improvements. Early identification of Tribal concerns will allow the USACE to consider alternatives to avoid and minimize potential impacts to our burial sites and cultural resources. The UAIC would like to be a signatory party to the Programmatic Agreement and be involved early and often as the project planning, alternatives, and documentation are developed and refined.

The UAIC understands and has concerns regarding the confidentiality of information on areas or resources of religious, traditional and cultural importance to the Tribe. We would be happy to discuss these concerns and develop procedures to ensure the confidentiality of such information is strictly maintained.

Your timely response will greatly assist us in being able to have our concerns incorporated into project planning and the Final EIR/EIS. Please contact Marcos Guerrero, Cultural Resources Manager, at (530) 883-2364 or email at mguerrero@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC:
Mark A. Gilfillan, USACE

Melissa L. Montag, USACE
Jason Camp, THPO
Danny Rey, Secretary

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO, CA 95814-2922

REPLY TO
ATTENTION OF

JUL 07 2015

Environmental Resources Branch

Mr. Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Whitehouse:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), we are writing to continue our consultation with you regarding the proposed American River Common Features (ARCF) Project. The U.S. Army Corps of Engineers (Corps) is authorized to reduce flood risk to the City of Sacramento and the Natomas Basin, and areas along the north and south banks of the American River, as well as the east bank of the Sacramento River, pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999 and the Water Resources Reform and Development Act of 2014. In addition to the work contained in these authorizations, a General Reevaluation Report is being prepared to identify the extent of Federal interest in additional levee improvements in the greater Sacramento area. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

As a result of your stated interest in the ARCF Project, and in compliance with Section 106 of the NHPA, we have been meeting with the United Auburn Indian Community of the Auburn Rancheria (UAIC) quarterly with the most recent meeting occurring on May 19, 2015. We also received your email dated April 16, 2015, wherein you provided several comments on the ARCF Draft Environmental Impact Statement/Draft Environmental Impact Report. Based on several of your comments we request any specific information the UAIC may be able to provide in order to ensure that the Corps completely and accurately understands the UAIC's issues and concerns with the ARCF Project:

a. Comment 1: What specific design features would the UAIC prefer be incorporated to reduce the potential for direct cultural impacts?

b. Comment 2: Please provide specific information on the tribal values the UAIC would like considered under construction timing, project and alternatives screening criteria, environmental commitments for cultural resources, social effects, and environmental justice.

c. Comment 2: Please provide specific information on how the UAIC should be identified as a viewer group for visual impacts.

d. Comment 5: Please provide specific information on tribal cultural values, sanctified cemeteries, and/or cultural landscapes that the Corps should consider.

e. Comment 7: Please provide specific information on how the UAIC believes there will be cumulative effects or effects to cultural resources and/or cultural landscapes across several phases or projects over wide geography.

f. Comment 11: Please provide information on how the UAIC believes vibration or compression effects on cultural resources should be considered.

g. Comment 11: Please provide specific information on the vegetation the UAIC considers to be native or cultural plants, their relationships to burial mounds or tribal cultural landscapes, and the impacts the UAIC believes should be considered.

h. Comment 11: Please provide information on traditional cultural properties and cultural landscapes and the importance of place, setting, and landscape to the UAIC.

We welcome your input on any of the subjects above, or any other information the UAIC would be willing to provide that the Corps may take into consideration while preparing the Final Environmental Impact Statement/Final Environmental Impact Report (FEIS/FEIR). If there is information you would like us to consider but not include in the FEIS/FEIR we welcome the opportunity to discuss accommodating those kinds of requests as well. In order to allow time to consider this information, please provide any responses within 15 calendar days of receipt of this letter.

Correspondence may be sent to Ms. Melissa Montag, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922.

If you have any questions or would like additional information about the Section 106 compliance and consultation for the ARCF Project, please contact Ms. Montag at (916) 557-7907 or by email at: Melissa.L.Montag@usace.army.mil. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

FOR Alicia E. Kirchner
Chief, Planning Division

CF:
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

AUG 24 2015

Mr. Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Whitehouse:

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) and the U.S. Army Corps of Engineers, Sacramento District (Corps), Tribal Consultation Policy (Nov. 1, 2012), we are writing to continue consultation with you regarding the proposed American River Common Features (ARCF) Project. The Corps is authorized to reduce flood risk to the City of Sacramento, the Natomas Basin, areas along the north and south banks of the American River, and the east bank of the Sacramento River, pursuant to the Water Resources Development Act (WRDA) of 1996 with additional authority provided in WRDA 1999 and the Water Resources Reform and Development Act of 2014. We are further pursuing additional authorization of levee and flow conveyance improvements. The State of California Central Valley Flood Protection Board, in cooperation with the Sacramento Area Flood Control Agency, is the non-Federal sponsor for the ARCF Project.

We received your letter dated May 18, 2015 in which you requested formal Government-to-Government Consultation, notified the Corps that historic properties will be adversely affected by the ARCF Project, and requested that the Corps invite the UAIC to sign the ARCF Project Programmatic Agreement (PA) as a signatory party. The Corps' Tribal Liaison, Mark Gilfillan, has been in contact with your staff to initiate formal Government-to-Government Consultation and to reiterate our commitment to working closely and openly with the UAIC to provide meaningful and timely input regarding the Corps' ARCF Project.

I have given your request careful consideration and would like to invite the tribe to join our PA as a concurring party. With the role as a concurring party, along with my staff working closely and cooperatively with yours, it is my sincere hope and intent to address our mutual concerns regarding any adverse effects to historic properties. As a concurring party, the tribe reserves the ability to object to the manner in which the PA is implemented, if at any point you believe that your voice is not being heard. My goal is that your ideas and concerns are addressed as part of implementation of the PA throughout this project. I share your concerns regarding potential adverse effects to historic properties, and I am committed to ensuring that our project avoids or minimizes to the maximum extent any adverse effects through implementation of the PA and throughout construction of the project.

We look forward to continuing consultation with the UAIC on the ARCF Project. Correspondence may be sent to Mr. Dan Tibbitts, Project Manager, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922. I am looking forward to meeting with you to further engage in Government-to-Government Consultation for the ARCF Project. Please contact Mark Gilfillan, Corps Tribal Liaison, at (970) 243-1199 x15, or by email at: Mark.A.Gilfillan@usace.army.mil to further coordinate a Government-to-Government Consultation meeting. Please contact Mr. Dan Tibbitts, Project Manager, at (916) 557-7372 with any specific project questions.

Sincerely,

Michael J. Farrell
Colonel, U.S. Army
District Commander

cc:
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Rhonda Morningstar Pope
Chairperson
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, California 95811

Dear Ms. Morningstar Pope:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

Please return an original signed copy of the appropriate signature page if you wish to participate in this agreement as a concurring party. The signed page and/or any questions or comments may be directed to Ms. Melissa Montag, CESPK-PD-RC, U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814; email at Melissa.L.Montag@usace.army.mil; or telephone at (916) 557-7907.

Sincerely,

Mark

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Ms. Roselynn Lwenya, Tribal Historic Preservation Officer, Buena Vista Rancheria, 1418 20th Street, Suite 200, Sacramento, California 95811

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Ambar Mohammed
Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria
3730 State Highway 45 # B
Colusa, California 95932

Dear Mr. Mohammed:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Judith Marks
Colfax-Todds Valley Consolidated Tribe
1068 Silverton Circle
Lincoln, California 95648

Dear Ms. Marks:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z[illegible]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Pamela Cubbler
Colfax-Todds Valley Consolidated Tribe
P.O. Box 734
Foresthill, California 95631

Dear Ms. Cubbler:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Charlie Wright
Chairperson
Cortina Wintun Environmental Protection Agency
P.O. Box 1630
Williams, California 95987

Dear Mr. Wright:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z[illegible]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

El Dorado Miwok Tribe
P.O. Box 711
El Dorado, California 95623

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Rose Enos
15310 Bancroft Road
Auburn, California 95603

Dear Ms. Enos:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Marc T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Glenda Nelson
Chairperson
Enterprise Rancheria of Maidu Indians
2133 Monte Vista Avenue
Oroville, California 95966

Dear Ms. Nelson:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. [signature]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Mr. Reno Franklin, Tribal Historic Preservation Officer, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, California 95669

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Kesner Flores
P.O. Box 1047
Wheatland, California 95692

Dear Mr. Flores:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Dr. Crystal Martinez
Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, California 95669

Dear Dr. Martinez:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Cultural Committee, Ione Band of Miwok Indians, PO Box 699, Plymouth, California 95669

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC

Mr. Dennis Ramirez
Chairperson
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Boulevard
Chico, California 95926

DEC 07 2015

Dear Mr. Ramirez:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Mr. Michael D. DeSpain, Director of OEPP, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, California 95926

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Guy Taylor
Representative
Mooretown Rancheria of Maidu Indians
31 Alverde Drive
Oroville, California 95966

Dear Mr. Taylor:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Cosme Valdez
Interim Chief Executive Officer
Nashville-El Dorado Miwok
P.O. Box 580986
Elk Grove, California 95758

Dear Mr. Valdez:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z[illegible]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Nicholas Fonseca
Chairperson
Shingle Springs Band of Miwok Indians
P.O. Box 1340
Shingle Springs, California 95682

Dear Mr. Fonseca:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Mr. Daniel Fonseca, Cultural Resources Director, Shingle Springs Band of Miwok Indians, PO Box 1340, Shingle Springs, California 95682
Mr. Hermo Olanio, Vice Chairperson, Shingle Springs Band of Miwok Indians, PO Box 1340, Shingle Springs, California 95682
Ms. Kara Perry, Administrative Assistant, Cultural Resources Department, Shingle Springs Band of Miwok Indians, PO Box 1340, Shingle Springs, California 95682

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Ms. Cathy Bishop
Chairperson
Strawberry Valley Rancheria
1540 Strader Avenue
Sacramento, California 95815

Dear Ms. Bishop:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Don Ryberg
Chairman
Tsi-Akim Maidu
1239 East Main Street
Grass Valley, California 95945

Dear Mr. Ryberg:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. [signature]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Ms. Eileen Moon, Vice Chairperson, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, California 95945
Mr. Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, California 95713

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

DEC 07 2015

Environmental Resources Branch

Mr. Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Dear Mr. Whitehouse:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. [signature]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Mr. Marcos Guerrero, Cultural Resources Specialist, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603
Mr. Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, California 95603

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Raymond Hitchcock
Chairperson
Wilton Rancheria
9728 Kent Street
Elk Grove, California 95642

Dear Mr. Hitchcock:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Cc: (w/enclosure)
Mr. Steven Hutchason, Wilton Rancheria, 9728 Kent Street, Elk Grove, California 95642

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Mr. Randy Yonemura
4305 39th Avenue
Sacramento, California 95824

Dear Mr. Yonemura:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

American River Common Features GRR

EIS Cultural Resources Appendix

Enclosure 6

Letters to the Interested Public

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

State of California Central Valley Flood Protection Board
Andrea Buckley
3310 El Camino Avenue, Room 151
Sacramento, California 95821

Dear Ms. Buckley:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Fair Oaks Historical Society
P.O. Box 2044
Fair Oaks, California 95628

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. [signature]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Golden Gate State Museum
1020 O Street
Sacramento, California 95814

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Sacramento County Historical Society
P.O. Box 160065
Sacramento, California 95816

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Society for California Archaeology
1692 Mangrove Avenue, #153
Chico, California 95926

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z[illegible]

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Sutter County Historical Society
P.O. Box 1004
Yuba City, California 95992

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

West Sacramento Historical Society
P.O. Box 1202
West Sacramento, California 95691

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

Environmental Resources Branch

DEC 07 2015

Yolo County Historical Society
P.O. Box 1447
Woodland, California 95776

Dear Sir or Madam:

We thank you for your interest in the American River Common Features Project (Project). The U.S. Army Corps of Engineers, Sacramento District (Corps), is proceeding to implement aspects of the Project as authorized in the Water Resources Development Act (WRDA) of 1996, as amended by the WRDA 1999 and the Energy and Water Development and Related Agencies Appropriations Act of 2008, and as authorized by Section 7002 of the Water Resources Reform and Development Act of 2014. At this time, we are submitting the signed Programmatic Agreement for your records and to invite you to sign the document as a concurring party.

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Sincerely,

Mark T. Z

for Alicia E. Kirchner
Chief, Planning Division

Enclosure

Air Quality Technical Appendix

AIR QUALITY

The air quality emissions analysis for the ARCF GRR was developed based on several interrelated assumptions and constraints:

- The project will require 14 separate years to construct the required features;
- Project funding will be limited to $100 million per construction year;
- The project will receive $100 million per construction year;
- In any given year, approximately 85% of the funding will be applied toward construction;
- A construction season is six months (April 15 to October 15);
- Construction will begin in 2015;
- All required administrative, legal, real estate and environmental clearances/approvals will be acquired prior to initiation of construction.
- All project plans and specifications will require that construction contractors use only off-road equipment that implements the Sacramento Metropolitan Air Quality Management Districts' (SMAQMD) Enhanced Exhaust Control Practices and only use on-road hauling equipment that was manufactured in 2010, or later.
- If the off-road equipment and on-road hauling specifications stated above are not met, it cannot be assured that the project air emissions can meet the Federal *de minimis* standards.

It was determined through internal discussions, as well as discussions with staff from the SMAQMD, that the most reasonable approach to determine if the project was to be in compliance with Federal and local standards was to base the evaluation on a "worst case scenario" construction year.

The project team determined that construction in the second year within Reach F of the American River South basin would be the construction season that would result in the most combined air emissions. Reach F was chosen because it is the single longest reach (5 miles) in the entire Common Features Project, and due to design, constructability and funding constraints, will take 3 1/3 years to construct. This would allow for 1.5 miles of construction in years 1 through 3, with the last 0.5 miles to be completed in the fourth year. The following construction activities are scheduled for this reach: clearing of trees and vegetation, degrading and excavation of the levee, construction of two types of seepage control slurry cutoff walls (conventional slot-trench and deep soil mixing), construction of a retaining wall to allow corrections to the levee height and width, reconstruction of the levee, relocation of utilities, and delivery and installation of rip-rap on the waterside slope. The second year of construction in Reach F was chosen because the slurry cutoff walls must be allowed to cure until the following construction season before the rip-rap is placed. Under this scenario, the rip-rap would be placed on the slopes of the segment completed in the first year of construction, while all other construction activities are being conducted in the second year segment. The staggering of construction years for the placement of rip-rap would continue until Reach F would be completed.

In close coordination with SMAQMD, the Corps uses their Road Construction Emissions Model (RCEM), as it was designed to calculate air emissions for linear projects. The construction activities listed above were broken out into 19 individual sub-tasks based on information developed by Corps engineering and cost-estimating staff. Using the RCEM, a model run was conducted for each sub-task, with one exception: the barging of rip-rap material to the project site. In this case, information for barging material was developed, in close coordination with SMAQMD staff, for similar activities being conducted for the Joint Federal Project (JFP). It was agreed that it is reasonable to use this information for the purposes of a feasibility-level study. Although calculations for the JFP involved smaller harbor craft than that assumed for the Common Features project, SMAQMD staff determined that it was reasonable to extrapolate the air emissions data by increasing the horsepower, daily hours and number of days in the JFP model to calculate specific emissions data (ROG, CO, NOx, PM and CO_2) for the Common Features project.

In order to provide a means of comparison for future decision-making purposes, the delivery and placement task was also calculated using the assumption that same amount of material to be barged to the project site, would be trucked to the site in the same period of time. Those results are shown in Tables 1a and 2a (calculated in pounds per day under local standards) and 1b and 2b (calculated in tons per construction project under Federal standards). Note that neither version of this scenario (barging or trucking rip-rap) would be able to perform consistently under the local standard for NOx (Tables 1a and 2a), however, the trucking alternative would require a lower overall mitigation fee cost. In the case of the Federal *de minimis* standards (Tables 1b and 2b) the alternative that involves trucking the rip-rap is within the Federal de minimis standard, even without mitigation, while the barging alternative would likely meet the standard using the mitigation provided by the implementation of Enhance Exhaust Control Practices for off-road equipment and only using on-road hauling equipment that was manufactured in 2010, or later.

Table 1a. Estimated Air Emissions for the American River Common Features Project (South) – Reach F (Year 2) (with Truck Rip-Rap Delivery)
Maximum Pounds per Day

Project Tasks	ROG	CO	NO_x	NO_x (*mitigated)	Mitigation Fee **	Total PM_{10}	Exhaust PM_{10}	Fugitive Dust PM_{10}	Total $PM_{2.5}$	ExhaustP $M_{2.5}$	Fugitive Dust $PM_{2.5}$	CO_2
1. Clear Vegetation (3 days)	4.5	22.7	194.3	159.1	$1,993.36	71.2	4.2	67.0	16.6	2.7	13.9	38,068
2. Tree Removal (11 days)	1.4	9.0	33.4	N/A		1.0	1.0	-	0.8	0.8	-	5,303
3. Strip to Stockpile (3 days)	10.5	51.7	129.2	104.3	$519.19	72.4	5.4	67.0	18.8	4.9	13.9	12,179
4. Strip to Spoils (1 day)	13.7	66.8	272.4	245.5	$1,439.20	75.4	8.4	67.0	20.7	6.8	13.9	40,202
5. Excavation to Stockpile (31 days)	11.2	55.5	139.6	112.7	$7,699.96	72.7	5.7	67.0	19.1	5.2	13.9	13,162
6. Excavation to Spoils (1 day)	18.3	89.6	335.9	298.5	$1,914.45	77.8	10.8	67.0	22.9	9.0	13.9	47,018
7. Import Sand (8 days)	6.2	27.7	167.0	158.6	$5,279.80	71.7	4.7	67.0	17.4	3.5	13.9	29,264
8. Import Cohesive Fill (5 days)	8.5	41.5	196.0	182.3	$4,362.45	72.8	5.8	67.0	18.4	4.5	13.9	32,565
9. Cutoff Wall SCB (34 days)	4.8	30.0	50.1	N/A		69.6	2.6	67.0	16.3	2.4	13.9	6,182
10. Cutoff Wall DSM (110 days)	16.9	100.5	155.6	124.5	$38,961.62	75.4	8.4	67.0	21.6	7.7	13.9	18,598
11a. Retaining Wall (Concrete) (2 days)	4.0	19.6	146.3	142.6	$1,033.00	70.6	3.6	67.0	16.3	2.4	13.9	28,259
11b. Retaining Wall (Forms/Steel) (32 days)	1.1	5.2	13.1	N/A		67.7	0.7	67.0	14.6	0.6	13.9	1,560
12. Fill from Stockpile (30 days)	4.5	24.0	56.3	N/A		69.4	2.4	67.0	16.1	2.2	13.9	6,281
13. Import Random Fill (7 days)	6.7	34.2	176.2	166.0	$5,084.29	71.8	4.8	67.0	17.5	3.6	13.9	30,691
14. Import Topsoil Fill (6 days)	5.9	29.9	148.9	139.7	$2,942.97	71.2	4.2	67.0	17.1	3.1	13.9	25,646
15. Surfacing (1 day)	14.5	64.3	331.0	309.7	$2,014.88	77.5	10.5	67.0	22.1	8.2	13.9	55,317
16. Import Rip-Rap (Truck) (80 days)	4.9	25.9	160.9	154.9	$50,143.46	71.0	4.0	67.0	16.8	2.8	13.9	30,116
17. Utilities #1 (3 days)	2.1	11.3	24.7	N/A		101.7	1.2	100.5	22.0	1.1	20.9	2,400
18. Utilities #2 (52 days)	1.1	5.1	11.7	N/A		101.2	0.7	100.5	21.5	0.6	20.9	1,264
Maximum (lbs/day)	**18.3**	**100.5**	**335.9**	**309.7**		**101.7**	**10.8**	**100.5**	**22.9**	**9.0**	**20.9**	**55,317**
SMAQMD thresholds (lbs/day)	**N/A**	**N/A**	**85**	**85**		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Total Estimated Mitigation Fee					**$123,388.63**							

Notes:
***** Values based on a 20% mitigation for off-road equipment
** Calculation of Mitigation Fee: (any mitigated value over the 85 lbs/day threshold) X (number of days the task is performed) X ($8.54/lb) X (5% Administrative Fee) (As of 12/18/2012)

Table 1b. Estimated Air Emissions for the American River Common Features Project (South) – Reach F (Year 2)
(with Barge Rip-Rap Delivery)
Maximum Pounds per Day

Project Tasks	ROG	CO	NO_x	NO_x (*mitigated)	Mitigation Fee **	Total PM_{10}	Exhaust PM_{10}	Fugitive Dust PM_{10}	Total $PM_{2.5}$	Exhaust $PM_{2.5}$	Fugitive Dust $PM_{2.5}$	CO_2
1. Clear Vegetation (3 days)	4.5	22.7	194.3	159.1	$1,993.36	71.2	4.2	67.0	16.6	2.7	13.9	38,068
2. Tree Removal (11 days)	1.4	9.0	33.4	N/A		1.0	1.0	-	0.8	0.8	-	5,303
3. Strip to Stockpile (3 days)	10.5	51.7	129.2	104.3	$519.19	72.4	5.4	67.0	18.8	4.9	13.9	12,179
4. Strip to Spoils (1 day)	13.7	66.8	272.4	245.5	$1,439.20	75.4	8.4	67.0	20.7	6.8	13.9	40,202
5. Excavation to Stockpile (31 days)	11.2	55.5	139.6	112.7	$7,699.96	72.7	5.7	67.0	19.1	5.2	13.9	13,162
6. Excavation to Spoils (1 day)	18.3	89.6	335.9	298.5	$1,914.45	77.8	10.8	67.0	22.9	9.0	13.9	47,018
7. Import Sand (8 days)	6.2	27.7	167.0	158.6	$5,279.80	71.7	4.7	67.0	17.4	3.5	13.9	29,264
8. Import Cohesive Fill (5 days)	8.5	41.5	196.0	182.3	$4,362.45	72.8	5.8	67.0	18.4	4.5	13.9	32,565
9. Cutoff Wall SCB (34 days)	4.8	30.0	50.1	N/A		69.6	2.6	67.0	16.3	2.4	13.9	6,182
10. Cutoff Wall DSM (110 days)	16.9	100.5	155.6	124.5	$38,961.62	75.4	8.4	67.0	21.6	7.7	13.9	18,598
11a. Retaining Wall (Concrete) (2 days)	4.0	19.6	146.3	142.6	$1,033.00	70.6	3.6	67.0	16.3	2.4	13.9	28,259
11b. Retaining Wall (Forms/Steel) (32 days)	1.1	5.2	13.1	N/A		67.7	0.7	67.0	14.6	0.6	13.9	1,560
12. Fill from Stockpile (30 days)	4.5	24.0	56.3	N/A		69.4	2.4	67.0	16.1	2.2	13.9	6,281
13. Import Random Fill (7 days)	6.7	34.2	176.2	166.0	$5,084.29	71.8	4.8	67.0	17.5	3.6	13.9	30,691
14. Import Topsoil Fill (6 days)	5.9	29.9	148.9	139.7	$2,942.97	71.2	4.2	67.0	17.1	3.1	13.9	25,646
15. Surfacing (1 day)	14.5	64.3	331.0	309.7	$2,014.88	77.5	10.5	67.0	22.1	8.2	13.9	55,317
16. Import Rip-Rap (Barge) (80 days)	27.6	106.5	256.8	222.4	$98,565.26	10.0	1.0	67.0	4.5	1.2	13.9	9,726
17. Utilities #1 (3 days)	2.1	11.3	24.7	N/A		101.7	1.2	100.5	22.0	1.1	20.9	2,400
18. Utilities #2 (52 days)	1.1	5.1	11.7	N/A		101.2	0.7	100.5	21.5	0.6	20.9	1,264
Maximum (lbs/day)	**18.3**	**100.5**	**335.9**	**309.7**		**101.7**	**10.8**	**100.5**	**22.9**	**9.0**	**20.9**	**55,317**
SMAQMD thresholds (lbs/day)	**N/A**	**N/A**	**85**	**85**		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Total Estimated Mitigation Fee					**$171,810.43**							

Notes:
***** Values based on a 20% mitigation for off-road equipment
** Calculation of Mitigation Fee: (any mitigated value over the 85 lbs/day threshold) X (number of days the task is performed) X ($8.54/lb) X (5% Administrative Fee) (As of 12/18/2012)

Table 2a. Estimated Air Emissions for the American River Common Features Project (South) – Reach F (Year 2) (with Truck Rip-Rap Delivery)
Total Tons Per Construction Project

Project Tasks	ROG	CO	NO_x	Total PM_{10}	Exhaust PM_{10}	Fugitive Dust PM_{10}	Total $PM_{2.5}$	Exhaust $PM_{2.5}$	Fugitive Dust $PM_{2.5}$	CO_2
1. Clear Vegetation	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.0	62.8
2. Tree Removal	0.0	0.0	0.2	0.0	0.0	-	0.0	0.0	-	29.2
3. Strip to Stockpile	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	20.1
4. Strip to Spoils	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.1
5. Excavation to Stockpile	0.2	0.9	2.1	0.6	0.1	0.5	0.2	0.1	0.1	202.7
6. Excavation to Spoils	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	25.9
7. Import Sand	0.0	0.1	0.7	0.1	0.0	0.1	0.0	0.0	0.0	128.8
8. Import Fill	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	89.6
9. Cutoff Wall SCB	0.1	0.5	0.8	0.5	0.0	0.5	0.1	0.0	0.1	102.0
10. Cutoff Wall DSM	0.9	5.5	8.6	2.1	0.5	1.7	0.8	0.4	0.3	1,022.9
11a. Retaining Wall (Concrete)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	31.1
11b. Retaining Wall (Forms/Steel)	0.0	0.1	0.2	0.5	0.0	0.5	0.1	0.0	0.1	25.7
12. Fill from Stockpile	0.1	0.4	0.9	0.5	0.0	0.5	0.1	0.0	0.1	96.7
13. Import Random Fill	0.0	0.1	0.6	0.1	0.0	0.1	0.0	0.0	0.0	101.3
14. Import Topsoil Fill	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	84.6
15. Surfacing	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	30.4
16. Import Rip-Rap (Truck)	0.2	1.0	6.4	1.4	0.2	1.2	0.4	0.1	0.2	1,192.6
17. Utilities #1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	4.0
18. Utilities #2	0.0	0.1	0.3	1.2	0.0	1.2	0.3	0.0	0.2	33.4
Total (tons/construction project)	**1.5**	**9.0**	**23.0**	**7.5**	**0.8**	**6.8**	**2.0**	**0.6**	**1.1**	**3,305.9**
Federal standards (tons/year)	**25**	**100**	**25**	**100**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Table 2b. Estimated Air Emissions for the American River Common Features Project (South) – Reach F (Year 2) (with Barge Rip-Rap Delivery)
Total Tons Per Construction Project

Project Tasks	ROG	CO	NO_x	Total PM_{10}	Exhaust PM_{10}	Fugitive Dust PM_{10}	Total $PM_{2.5}$	Exhaust $PM_{2.5}$	Fugitive Dust $PM_{2.5}$	CO_2
1. Clear Vegetation	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.0	62.8
2. Tree Removal	0.0	0.0	0.2	0.0	0.0	-	0.0	0.0	-	29.2
3. Strip to Stockpile	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	20.1
4. Strip to Spoils	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.1
5. Excavation to Stockpile	0.2	0.9	2.1	0.6	0.1	0.5	0.2	0.1	0.1	202.7
6. Excavation to Spoils	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	25.9
7. Import Sand	0.0	0.1	0.7	0.1	0.0	0.1	0.0	0.0	0.0	128.8
8. Import Fill	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	89.6
9. Cutoff Wall SCB	0.1	0.5	0.8	0.5	0.0	0.5	0.1	0.0	0.1	102.0
10. Cutoff Wall DSM	0.9	5.5	8.6	2.1	0.5	1.7	0.8	0.4	0.3	1,022.9
11a. Retaining Wall (Concrete)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	31.1
11b. Retaining Wall (Forms/Steel)	0.0	0.1	0.2	0.5	0.0	0.5	0.1	0.0	0.1	25.7
12. Fill from Stockpile	0.1	0.4	0.9	0.5	0.0	0.5	0.1	0.0	0.1	96.7
13. Import Random Fill	0.0	0.1	0.6	0.1	0.0	0.1	0.0	0.0	0.0	101.3
14. Import Topsoil Fill	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	84.6
15. Surfacing	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	30.4
16. Import Rip-Rap (Barge)	1.1	4.5	10.6	0.4	0.0	0.4	0.0	0.0	0.1	401.6
17. Utilities #1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	4.0
18. Utilities #2	0.0	0.1	0.3	1.2	0.0	1.2	0.3	0.0	0.2	33.4
Total (tons/construction project)	**2.4**	**12.5**	**27.2**	**6.5**	**0.6**	**6.0**	**1.6**	**0.5**	**1.0**	**2,514.9**
Federal standards (tons/year)	**25**	**100**	**25**	**100**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Harbor Craft Model Emission Factors

Hp	Year	NO_x	PM	ROG	CO	SO_x	CO_2
40	2013	0.30	0.03	0.10	0.19	0.000	10.15
	2014	0.30	0.03	0.10	0.19	0.000	10.15
	2015	0.30	0.03	0.10	0.19	0.000	10.15
	2016	0.30	0.03	0.10	0.19	0.000	10.15
	2017	0.30	0.03	0.10	0.19	0.000	10.15
200	2013	2.09	0.08	0.21	0.74	0.001	56.38
	2014	1.99	0.08	0.20	0.73	0.001	56.38
	2015	1.94	0.07	0.20	0.73	0.001	56.38
	2016	1.91	0.07	0.20	0.73	0.001	56.38
	2017	1.88	0.07	0.20	0.74	0.001	56.38
250	2013	2.70	0.11	0.26	0.87	0.001	78.31
	2014	2.58	0.10	0.26	0.91	0.001	78.31
	2015	2.46	0.10	0.26	0.94	0.001	78.31
	2016	2.34	0.09	0.26	0.98	0.001	78.31
	2017	2.27	0.09	0.25	0.99	0.001	78.31
400	2013	4.31	0.18	0.42	1.40	0.001	125.29
	2014	4.13	0.17	0.42	1.45	0.001	125.29
	2015	3.94	0.16	0.41	1.51	0.001	125.29
	2016	3.75	0.15	0.41	1.57	0.001	125.29
	2017	3.63	0.14	0.41	1.58	0.001	125.29
450	2013	4.85	0.20	0.48	1.57	0.001	140.95
	2014	4.64	0.19	0.47	1.63	0.001	140.95
	2015	4.43	0.18	0.47	1.70	0.001	140.95
	2016	4.22	0.16	0.46	1.76	0.001	140.95
	2017	4.08	0.16	0.46	1.77	0.001	140.95
500	2013	5.39	0.22	0.53	1.75	0.002	156.61
	2014	5.16	0.21	0.52	1.82	0.002	156.61
	2015	4.93	0.20	0.52	1.89	0.002	156.61
	2016	4.69	0.18	0.51	1.96	0.002	156.61
	2017	4.54	0.18	0.51	1.97	0.002	156.61

15 ppm sulfur diesel
0.000015

64.066 Mol Wt. SO2
32.065 Mol Wt. S

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Clear Vegetation)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.5	22.7	194.3	71.2	4.2	67.0	16.6	2.7	13.9	38,067.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	4.5	22.7	194.3	71.2	4.2	67.0	16.6	2.7	13.9	38,067.8
Total (tons/construction project)	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.0	62.8

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 3910

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Clear Vegetation)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.0	10.3	88.3	32.4	1.9	30.5	7.6	1.2	6.3	17,303.6
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.0	10.3	88.3	32.4	1.9	30.5	7.6	1.2	6.3	17,303.6
Total (megagrams/construction project)	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.0	57.0

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 2989

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (C&G Clear Vegetation)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.2	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	3910.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.02
Grading/Excavation	0.15	0.09
Drainage/Utilities/Sub-Grade	0.00	0.06
Paving	0.00	0.03
Totals	0.15	0.20

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	50.00	30	
Round trips/day		196	
Vehicle miles traveled/day (calculated)			9775

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	3.4	177.7	15.1	3.6	2.1	36168.7
Tons per contruction period	0.01	0.29	0.02	0.01	0.00	59.68

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.98
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Skid Steer Loaders	0.15	1.77	1.86	0.10	0.10	275.98
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.1	7.4	13.8	0.6	0.5	1307.1
	Grading	tons per phase	0.0	0.0	0.0	0.0	0.0	2.2

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.0	0.0	0.0	2.2

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65	10.00	8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

20

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Strip to Spoils)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	13.7	66.8	272.4	75.4	8.4	67.0	20.7	6.8	13.9	40,202.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	13.7	66.8	272.4	75.4	8.4	67.0	20.7	6.8	13.9	40,202.0
Total (tons/construction project)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.1

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 3040

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Strip to Spoils)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	6.2	30.4	123.8	34.3	3.8	30.5	9.4	3.1	6.3	18,273.6
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	6.2	30.4	123.8	34.3	3.8	30.5	9.4	3.1	6.3	18,273.6
Total (megagrams/construction project)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	20.1

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 2324

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (C&G Strip to Spoils)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.1	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	3040.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.01
Grading/Excavation	0.05	0.05
Drainage/Utilities/Sub-Grade	0.00	0.03
Paving	0.00	0.02
Totals	0.05	0.10

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	50.00	30	
Round trips/day		152	
Vehicle miles traveled/day (calculated)			7600

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.6	138.1	11.7	2.8	1.7	28120.9
Tons per contruction period	0.00	0.08	0.01	0.00	0.00	15.47

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.33
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.0	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Crawler Tractors	1.85	11.17	23.79	0.92	0.84	2062.23
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.33	4.35	12.98	0.73	0.67	838.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
4.00	1	Scrapers	7.28	36.27	88.48	3.57	3.28	8040.11
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	11.0	54.8	131.4	5.5	5.1	11489.0
	Grading	tons per phase	0.0	0.0	0.1	0.0	0.0	6.3

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.1	0.0	0.0	6.3

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	10.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

40

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Strip to Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	10.5	51.7	129.2	72.4	5.4	67.0	18.8	4.9	13.9	12,179.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	10.5	51.7	129.2	72.4	5.4	67.0	18.8	4.9	13.9	12,179.0
Total (tons/construction project)	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	20.1

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 2520

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Strip to Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.8	23.5	58.7	32.9	2.4	30.5	8.6	2.2	6.3	5,535.9
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	4.8	23.5	58.7	32.9	2.4	30.5	8.6	2.2	6.3	5,535.9
Total (megagrams/construction project)	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	18.2

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported (meters^3/day)-> 1927

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a
yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (C&G Strip to Stockpile)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.2	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	2520.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.02
Grading/Excavation	0.15	0.09
Drainage/Utilities/Sub-Grade	0.00	0.06
Paving	0.00	0.03
Totals	0.15	0.20

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	2.00	30	
Round trips/day		126	
Vehicle miles traveled/day (calculated)			252

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.1	4.6	0.4	0.1	0.1	932.4
Tons per contruction period	0.00	0.01	0.00	0.00	0.00	1.54

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.98
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

Grubbing/Land Clearing	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Crawler Tractors	1.66	10.06	21.41	0.83	0.76	1856.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.20	3.92	11.68	0.66	0.60	754.90
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.52	2.71	5.51	0.29	0.27	493.10
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.39	1.70	3.48	0.26	0.24	314.47
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
4.00	1	Scrapers	6.55	32.65	79.63	3.21	2.95	7236.10
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	10.3	51.0	121.7	5.2	4.8	10654.6
	Grading	tons per phase	0.0	0.1	0.2	0.0	0.0	17.6

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default								
Paving	Number of Vehicles			ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts		0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors		0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs		0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers		0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws		0.00	0.00	0.00	0.00	0.00	0.00
		Cranes		0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Excavators		0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets		0.00	0.00	0.00	0.00	0.00	0.00
		Graders		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks		0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors		0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers		0.00	0.00	0.00	0.00	0.00	0.00
		Pumps		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers		0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards		0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers		0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes		0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers		0.00	0.00	0.00	0.00	0.00	0.00
		Welders		0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day		0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase		0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>				0.0	0.1	0.2	0.0	0.0	17.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	9.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	9.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	9.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	9.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	9.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8
45				

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Tree Removal) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.4	9.0	33.4	1.0	1.0	-	0.8	0.8	-	5,303.2
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	1.4	9.0	33.4	1.0	1.0	-	0.8	0.8	-	5,303.2
Total (tons/construction project)	0.0	0.0	0.2	0.0	0.0	-	0.0	0.0	-	29.2

Notes:

Project Start Year ->	2016
Project Length (months) ->	1
Total Project Area (acres) ->	28
Maximum Area Disturbed/Day (acres) ->	7
Total Soil Imported/Exported (yd^3/day)->	1505

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (C&G Tree Removal) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	0.7	4.1	15.2	0.4	0.4	-	0.3	0.3	-	2,410.6
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	0.7	4.1	15.2	0.4	0.4	-	0.3	0.3	-	2,410.6
Total (megagrams/construction project)	0.0	0.0	0.2	0.0	0.0	-	0.0	0.0	-	26.5

Notes:

Project Start Year ->	2016
Project Length (months) ->	1
Total Project Area (hectares) ->	11
Maximum Area Disturbed/Day (hectares) ->	3
Total Soil Imported/Exported ($meters^3$/day)->	1151

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (C&G Tree Removal)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.5	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	1505.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.05
Grading/Excavation	0.50	0.23
Drainage/Utilities/Sub-Grade	0.00	0.15
Paving	0.00	0.08
Totals	0.50	0.50

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	40.00	30	
Round trips/day	25.00	75	
Vehicle miles traveled/day (calculated)			1000

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.3	18.2	1.5	0.4	0.2	3700.1
Tons per contruction period	0.00	0.10	0.01	0.00	0.00	20.35

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust	1.00	2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.03	1.45	0.12	0.03	0.02	296.01
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	1.63
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation	0.00	6.7	0.0	0.0	0.0	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Skid Steer Loaders	0.15	1.77	1.86	0.10	0.10	275.98
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.1	7.4	13.8	0.6	0.5	1307.1
	Grading	tons per phase	0.0	0.0	0.1	0.0	0.0	7.2

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.1	0.0	0.0	7.2

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65	10.00	8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Cutoff Wall DSM)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	16.9	100.5	155.6	75.4	8.4	67.0	21.6	7.7	13.9	18,598.4
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	16.9	100.5	155.6	75.4	8.4	67.0	21.6	7.7	13.9	18,598.4
Total (tons/construction project)	0.9	5.5	8.6	2.1	0.5	1.7	0.8	0.4	0.3	1,022.9

Notes: Project Start Year -> 2016

Project Length (months) -> 5

Total Project Area (acres) -> 28

Maximum Area Disturbed/Day (acres) -> 7

Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Cutoff Wall DSM)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	7.7	45.7	70.7	34.3	3.8	30.5	9.8	3.5	6.3	8,453.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	7.7	45.7	70.7	34.3	3.8	30.5	9.8	3.5	6.3	8,453.8
Total (megagrams/construction project)	0.8	5.0	7.8	1.9	0.4	1.5	0.7	0.4	0.3	927.8

Notes: Project Start Year -> 2016

Project Length (months) -> 5

Total Project Area (hectares) -> 11

Maximum Area Disturbed/Day (hectares) -> 3

Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Cutoff Wall DSM)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	5.0	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.50
Grading/Excavation	5.00	2.25
Drainage/Utilities/Sub-Grade	0.00	1.50
Paving	0.00	0.75
Totals	5.00	5.00

Hauling emission default values can be overridden in cells C45 through C46.						
Soil Hauling Emissions	User Override of					
User Input	Soil Hauling Defaults	Default Values				
Miles/round trip		30				
Round trips/day		0				
Vehicle miles traveled/day (calculated)			0			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00
Worker commute default values can be overridden in cells C60 through C65.						
	User Override of Worker					
Worker Commute Emissions	Commute Default Values	Default Values				
Miles/ one-way trip		20				
One-way trips/day		2				
No. of employees: Grubbing/Land Clearing	0.00	10				
No. of employees: Grading/Excavation		15				
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11				
No. of employees: Paving	0.00	13				
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.16	0.01	0.00	0.00	32.56
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	1.7	13.9	0.3
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
2.00		Aerial Lifts	0.15	2.16	2.32	0.10	0.09	446.54
2.00		Air Compressors	1.71	8.55	10.96	0.92	0.84	1269.86
2.00		Bore/Drill Rigs	0.92	9.50	13.22	0.39	0.36	2364.04
4.00		Cement and Mortar Mixers	0.34	1.77	2.11	0.09	0.08	289.41
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Crawler Tractors	1.85	11.17	23.79	0.92	0.84	2062.23
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
2.00	3	Excavators	1.02	6.97	11.17	0.55	0.51	1432.16
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
4.00		Generator Sets	2.57	14.92	19.32	1.37	1.26	2435.33
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
2.00	1	Other Construction Equipment	1.72	8.99	18.27	0.96	0.88	1635.48
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
6.00		Pumps	3.28	18.49	23.94	1.75	1.61	2971.06
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Rough Terrain Forklifts	0.56	5.07	6.83	0.38	0.35	931.86
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Rubber Tired Loaders	1.31	7.79	16.28	0.56	0.51	1656.55
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Welders	1.42	4.93	4.51	0.36	0.33	511.86
	Grading/Excavation	pounds per day	16.8	100.3	152.7	8.3	7.7	18006.4
	Grading	tons per phase	0.9	5.5	8.4	0.5	0.4	990.3

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.9	5.5	8.4	0.5	0.4	990.3

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63	10.00	8
Air Compressors		106	10.00	8
Bore/Drill Rigs		206	10.00	8
Cement and Mortar Mixers		10	10.00	8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66	10.00	8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53	10.00	8
Rollers		81		8
Rough Terrain Forklifts		100	10.00	8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200	10.00	8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45	10.00	8

120

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Cutoff Wall SCB) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.8	30.0	50.1	69.6	2.6	67.0	16.3	2.4	13.9	6,181.5
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	4.8	30.0	50.1	69.6	2.6	67.0	16.3	2.4	13.9	6,181.5
Total (tons/construction project)	0.1	0.5	0.8	0.5	0.0	0.5	0.1	0.0	0.1	102.0

Notes: Project Start Year -> 2016

Project Length (months) -> 2

Total Project Area (acres) -> 28

Maximum Area Disturbed/Day (acres) -> 7

Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Cutoff Wall SCB) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.2	13.7	22.8	31.6	1.2	30.5	7.4	1.1	6.3	2,809.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.2	13.7	22.8	31.6	1.2	30.5	7.4	1.1	6.3	2,809.8
Total (megagrams/construction project)	0.1	0.4	0.8	0.5	0.0	0.5	0.1	0.0	0.1	92.5

Notes: Project Start Year -> 2016

Project Length (months) -> 2

Total Project Area (hectares) -> 11

Maximum Area Disturbed/Day (hectares) -> 3

Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a
yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Cutoff Wall SCB)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	1.5	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.15
Grading/Excavation	1.50	0.68
Drainage/Utilities/Sub-Grade	0.00	0.45
Paving	0.00	0.23
Totals	1.50	1.50

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip		30	
Round trips/day		0	
Vehicle miles traveled/day (calculated)			0

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust		2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade		1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.05	0.00	0.00	0.00	9.77
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.5	13.9	0.1
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	3	Excavators	1.54	10.46	16.75	0.82	0.76	2148.24
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Generator Sets	0.64	3.73	4.83	0.34	0.32	608.83
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Pumps	1.09	6.16	7.98	0.58	0.54	990.35
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rough Terrain Forklifts	0.28	2.53	3.42	0.19	0.17	465.93
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Rubber Tired Loaders	0.66	3.89	8.14	0.28	0.26	828.28
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	4.8	29.8	47.2	2.5	2.3	5589.5
	Grading	tons per phase	0.1	0.5	0.8	0.0	0.0	92.2

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.1	0.5	0.8	0.0	0.0	92.2

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66	10.00	8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53	10.00	8
Rollers		81		8
Rough Terrain Forklifts		100	10.00	8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200	10.00	8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

60

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Fill from Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.5	24.0	56.3	69.4	2.4	67.0	16.1	2.2	13.9	6,281.3
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	4.5	24.0	56.3	69.4	2.4	67.0	16.1	2.2	13.9	6,281.3
Total (tons/construction project)	0.1	0.4	0.9	0.5	0.0	0.5	0.1	0.0	0.1	96.7

Notes: Project Start Year -> 2016

Project Length (months) -> 1

Total Project Area (acres) -> 28

Maximum Area Disturbed/Day (acres) -> 7

Total Soil Imported/Exported (yd^3/day)-> 3030

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Fill from Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.0	10.9	25.6	31.6	1.1	30.5	7.3	1.0	6.3	2,855.1
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.0	10.9	25.6	31.6	1.1	30.5	7.3	1.0	6.3	2,855.1
Total (megagrams/construction project)	0.1	0.3	0.8	0.5	0.0	0.4	0.1	0.0	0.1	87.7

Notes: Project Start Year -> 2016

Project Length (months) -> 1

Total Project Area (hectares) -> 11

Maximum Area Disturbed/Day (hectares) -> 3

Total Soil Imported/Exported ($meters^3$/day)-> 2317

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Fill from Stockpile)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	1.4	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	3030.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.14
Grading/Excavation	1.40	0.63
Drainage/Utilities/Sub-Grade	0.00	0.42
Paving	0.00	0.21
Totals	1.40	1.40

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	2.00	30	
Round trips/day		152	
Vehicle miles traveled/day (calculated)			303

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.1	5.5	0.5	0.1	0.1	1121.1
Tons per contruction period	0.00	0.08	0.01	0.00	0.00	17.27

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.04	0.00	0.00	0.00	9.12
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.5	13.9	0.1
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

Grubbing/Land Clearing	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.33	4.35	12.98	0.73	0.67	838.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.44	1.89	3.86	0.28	0.26	349.42
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	1.02	8.43	13.06	0.45	0.42	1800.91
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	4.3	23.3	47.9	2.2	2.1	4568.1
	Grading	tons per phase	0.1	0.4	0.7	0.0	0.0	70.3

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default								
Paving	Number of Vehicles			ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts		0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors		0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs		0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers		0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws		0.00	0.00	0.00	0.00	0.00	0.00
		Cranes		0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Excavators		0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets		0.00	0.00	0.00	0.00	0.00	0.00
		Graders		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks		0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors		0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers		0.00	0.00	0.00	0.00	0.00	0.00
		Pumps		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers		0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards		0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers		0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes		0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers		0.00	0.00	0.00	0.00	0.00	0.00
		Welders		0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day		0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase		0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>				0.1	0.4	0.7	0.0	0.0	70.3

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes	425.00	98	10.00	8
Trenchers		81		8
Welders		45		8
475				
END OF DATA ENTRY SHEET				

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Cohesive Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	8.5	41.5	196.0	72.8	5.8	67.0	18.4	4.5	13.9	32,565.1
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	8.5	41.5	196.0	72.8	5.8	67.0	18.4	4.5	13.9	32,565.1
Total (tons/construction project)	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	89.6

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 2810

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Cohesive Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	3.9	18.9	89.1	33.1	2.7	30.5	8.4	2.0	6.3	14,802.3
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	3.9	18.9	89.1	33.1	2.7	30.5	8.4	2.0	6.3	14,802.3
Total (megagrams/construction project)	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	81.2

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 2148

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Cohesive Fill)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.3	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	2810.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.03
Grading/Excavation	0.25	0.11
Drainage/Utilities/Sub-Grade	0.00	0.08
Paving	0.00	0.04
Totals	0.25	0.25

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	50.00	30	
Round trips/day		141	
Vehicle miles traveled/day (calculated)			7025

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.4	127.7	10.8	2.6	1.5	25993.4
Tons per contruction period	0.01	0.35	0.03	0.01	0.00	71.48

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	1.63
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default Number of Vehicles							
Grubbing/Land Clearing			ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.41	2.79	4.47	0.22	0.20	572.86
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
	2	Graders	2.67	8.70	25.95	1.46	1.34	1677.56
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.44	1.89	3.86	0.28	0.26	349.42
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	1.02	8.43	13.06	0.45	0.42	1800.91
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	6.0	30.4	65.4	3.2	2.9	5979.8
	Grading	tons per phase	0.0	0.1	0.2	0.0	0.0	16.4

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.2	0.0	0.0	16.4

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes	425.00	98	10.00	8
Trenchers		81		8
Welders		45		8

475

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Random Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	6.7	34.2	176.2	71.8	4.8	67.0	17.5	3.6	13.9	30,691.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	6.7	34.2	176.2	71.8	4.8	67.0	17.5	3.6	13.9	30,691.0
Total (tons/construction project)	0.0	0.1	0.6	0.1	0.0	0.1	0.0	0.0	0.0	101.3

Notes: Project Start Year ->	2016
Project Length (months) ->	0
Total Project Area (acres) ->	28
Maximum Area Disturbed/Day (acres) ->	7
Total Soil Imported/Exported (yd^3/day)->	2760

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Random Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	3.1	15.5	80.1	32.7	2.2	30.5	8.0	1.6	6.3	13,950.4
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	3.1	15.5	80.1	32.7	2.2	30.5	8.0	1.6	6.3	13,950.4
Total (megagrams/construction project)	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	91.9

Notes: Project Start Year ->	2016
Project Length (months) ->	0
Total Project Area (hectares) ->	11
Maximum Area Disturbed/Day (hectares) ->	3
Total Soil Imported/Exported ($meters^3$/day)->	2110

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Random Fill)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.3	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	2760.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.03
Grading/Excavation	0.30	0.11
Drainage/Utilities/Sub-Grade	0.00	0.08
Paving	0.00	0.04
Totals	0.30	0.25

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of Soil Hauling Defaults	Default Values				
User Input						
Miles/round trip	50.00	30				
Round trips/day		138				
Vehicle miles traveled/day (calculated)			6900			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.4	125.4	10.7	2.5	1.5	25530.9
Tons per contruction period	0.01	0.41	0.04	0.01	0.00	84.25

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	1.95
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.33	4.35	12.98	0.73	0.67	838.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.44	1.89	3.86	0.28	0.26	349.42
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	1.02	8.43	13.06	0.45	0.42	1800.91
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	4.3	23.3	47.9	2.2	2.1	4568.1
	Grading	tons per phase	0.0	0.1	0.2	0.0	0.0	15.1

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.2	0.0	0.0	15.1

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes	425.00	98	10.00	8
Trenchers		81		8
Welders		45		8

475

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Barge+)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.2	9.3	17.5	67.6	0.6	67.0	14.5	0.5	13.9	2,377.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	1.2	9.3	17.5	67.6	0.6	67.0	14.5	0.5	13.9	2,377.0
Total (tons/construction project)	0.0	0.4	0.7	1.2	0.0	1.2	0.3	0.0	0.2	94.1

Notes: Project Start Year -> 2016
Project Length (months) -> 4
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Barge+)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	0.5	4.2	8.0	30.7	0.3	30.5	6.6	0.2	6.3	1,080.5
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	0.5	4.2	8.0	30.7	0.3	30.5	6.6	0.2	6.3	1,080.5
Total (megagrams/construction project)	0.0	0.3	0.6	1.1	0.0	1.1	0.2	0.0	0.2	85.4

Notes: Project Start Year -> 2016
Project Length (months) -> 4
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported (meters^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Barge+)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	3.6	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.36
Grading/Excavation	3.60	1.62
Drainage/Utilities/Sub-Grade	0.00	1.08
Paving	0.00	0.54
Totals	3.60	3.60

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip		30	
Round trips/day		0	
Vehicle miles traveled/day (calculated)			0

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.12	0.01	0.00	0.00	23.44
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	1.2	13.9	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	Cranes	0.97	8.27	13.69	0.48	0.45	1655.80
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Plate Compactors	0.15	0.79	0.94	0.04	0.03	129.18
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.1	9.1	14.6	0.5	0.5	1785.0
	Grading	tons per phase	0.0	0.4	0.6	0.0	0.0	70.7

Drainage/Utilities/Subgrade	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.4	0.6	0.0	0.0	70.7

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes	500.00	226	10.00	8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8	10.00	8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

530

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Truck) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.9	25.9	160.9	71.0	4.0	67.0	16.8	2.8	13.9	30,116.1
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	4.9	25.9	160.9	71.0	4.0	67.0	16.8	2.8	13.9	30,116.1
Total (tons/construction project)	0.2	1.0	6.4	1.4	0.2	1.2	0.4	0.1	0.2	1,192.6

Notes: Project Start Year -> 2016
Project Length (months) -> 4
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 3200

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Truck) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.2	11.8	73.1	32.3	1.8	30.5	7.6	1.3	6.3	13,689.1
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.2	11.8	73.1	32.3	1.8	30.5	7.6	1.3	6.3	13,689.1
Total (megagrams/construction project)	0.2	0.9	5.8	1.2	0.1	1.1	0.3	0.1	0.2	1,081.7

Notes: Project Start Year -> 2016
Project Length (months) -> 4
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 2446

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Rip Rap - Truck)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	3.6	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	3200.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	40.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.36
Grading/Excavation	3.60	1.62
Drainage/Utilities/Sub-Grade	0.00	1.08
Paving	0.00	0.54
Totals	3.60	3.60

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of						
User Input	Soil Hauling Defaults	Default Values					
Miles/round trip	90.00	30					
Round trips/day		80					
Vehicle miles traveled/day (calculated)			7200				
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**	
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86	
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	
Pounds per day	2.5	130.9	11.1	2.6	1.6	26640.9	
Tons per contruction period	0.10	5.18	0.44	0.10	0.06	1054.98	

Worker commute default values can be overridden in cells C60 through C65.

	User Override of Worker						
Worker Commute Emissions	Commute Default Values	Default Values					
Miles/ one-way trip		20					
One-way trips/day		2					
No. of employees: Grubbing/Land Clearing	0.00	10					
No. of employees: Grading/Excavation		15					
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11					
No. of employees: Paving	0.00	13					
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**	
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000	
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650	
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000	
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000	
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000	
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592	
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000	
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000	
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000	
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000	
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000	
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000	
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000	
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000	
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000	
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000	
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000	

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.12	0.01	0.00	0.00	23.44
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	1.2	13.9	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
2.00	3	Excavators	1.02	6.97	11.17	0.55	0.51	1432.16
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	2.4	14.5	27.2	1.3	1.2	2883.2
	Grading	tons per phase	0.1	0.6	1.1	0.1	0.0	114.2

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.1	0.6	1.1	0.1	0.0	114.2

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

30

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Sand)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	6.2	27.7	167.0	71.7	4.7	67.0	17.4	3.5	13.9	29,263.7
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	6.2	27.7	167.0	71.7	4.7	67.0	17.4	3.5	13.9	29,263.7
Total (tons/construction project)	0.0	0.1	0.7	0.1	0.0	0.1	0.0	0.0	0.0	128.8

Notes:	Project Start Year ->	2016
	Project Length (months) ->	0
	Total Project Area (acres) ->	28
	Maximum Area Disturbed/Day (acres) ->	7
	Total Soil Imported/Exported (yd^3/day)->	2755

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Sand)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	**ROG (kgs/day)**	**CO (kgs/day)**	**NOx (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM2.5 (kgs/day)**	**PM2.5 (kgs/day)**	**PM2.5 (kgs/day)**	**CO2 (kgs/day)**
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.8	12.6	75.9	32.6	2.1	30.5	7.9	1.6	6.3	13,301.7
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.8	12.6	75.9	32.6	2.1	30.5	7.9	1.6	6.3	13,301.7
Total (megagrams/construction project)	0.0	0.1	0.7	0.1	0.0	0.1	0.0	0.0	0.0	116.8

Notes:	Project Start Year ->	2016
	Project Length (months) ->	0
	Total Project Area (hectares) ->	11
	Maximum Area Disturbed/Day (hectares) ->	3
	Total Soil Imported/Exported ($meters^3$/day)->	2106

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Sand)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.4	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	2755.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.04
Grading/Excavation	0.40	0.16
Drainage/Utilities/Sub-Grade	0.00	0.11
Paving	0.00	0.05
Totals	0.40	0.36

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	50.00	30	
Round trips/day		138	
Vehicle miles traveled/day (calculated)			6887.5

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.4	125.2	10.6	2.5	1.5	25484.6
Tons per contruction period	0.01	0.55	0.05	0.01	0.01	112.13

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	2.60
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.33	4.35	12.98	0.73	0.67	838.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.44	1.89	3.86	0.28	0.26	349.42
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	3.7	16.8	38.9	2.1	1.9	3187.1
	Grading	tons per phase	0.0	0.1	0.2	0.0	0.0	14.0

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.2	0.0	0.0	14.0

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

50

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Topsoil Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	5.9	29.9	148.9	71.2	4.2	67.0	17.1	3.1	13.9	25,646.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	5.9	29.9	148.9	71.2	4.2	67.0	17.1	3.1	13.9	25,646.0
Total (tons/construction project)	0.0	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	84.6

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 2830

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Import Topsoil Fill)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.7	13.6	67.7	32.3	1.9	30.5	7.8	1.4	6.3	11,657.3
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	2.7	13.6	67.7	32.3	1.9	30.5	7.8	1.4	6.3	11,657.3
Total (megagrams/construction project)	0.0	0.1	0.4	0.1	0.0	0.1	0.0	0.0	0.0	76.8

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 2164

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Import Topsoil Fill)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.3	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	2830.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.03
Grading/Excavation	0.30	0.11
Drainage/Utilities/Sub-Grade	0.00	0.08
Paving	0.00	0.04
Totals	0.30	0.25

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of					
User Input	Soil Hauling Defaults	Default Values				
Miles/round trip	40.00	30				
Round trips/day		142				
Vehicle miles traveled/day (calculated)			5660			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.0	102.9	8.7	2.1	1.2	20942.7
Tons per contruction period	0.01	0.34	0.03	0.01	0.00	69.11

Worker commute default values can be overridden in cells C60 through C65.

	User Override of Worker					
Worker Commute Emissions	Commute Default Values	Default Values				
Miles/ one-way trip		20				
One-way trips/day		2				
No. of employees: Grubbing/Land Clearing	0.00	10				
No. of employees: Grading/Excavation		15				
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11				
No. of employees: Paving	0.00	13				
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	1.95
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.1	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

Grading/Excavation	Default Number of Vehicles							
			ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.83	5.03	10.71	0.41	0.38	928.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.20	3.92	11.68	0.66	0.60	754.90
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.52	2.71	5.51	0.29	0.27	493.10
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.39	1.70	3.48	0.26	0.24	314.47
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.92	7.59	11.76	0.41	0.37	1620.82
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	3.9	20.9	43.1	2.0	1.9	4111.3
	Grading	tons per phase	0.0	0.1	0.1	0.0	0.0	13.6

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.1	0.0	0.0	13.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	9.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	9.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	9.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	9.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes	425.00	98	9.00	8
Trenchers		81		8
Welders		45		8

470

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Retaining Wall - Concrete)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	4.0	19.6	146.3	70.6	3.6	67.0	16.3	2.4	13.9	28,259.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	4.0	19.6	146.3	70.6	3.6	67.0	16.3	2.4	13.9	28,259.0
Total (tons/construction project)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	31.1

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 1580

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Retaining Wall - Concrete)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.8	8.9	66.5	32.1	1.6	30.5	7.4	1.1	6.3	12,845.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	1.8	8.9	66.5	32.1	1.6	30.5	7.4	1.1	6.3	12,845.0
Total (megagrams/construction project)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	28.2

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 1208

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type

Project Name	ARCF ARS Reach F-Year 2 (Retaining Wall - Concrete)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.1	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	1580.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	9.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.01
Grading/Excavation	0.10	0.05
Drainage/Utilities/Sub-Grade	0.00	0.03
Paving	0.00	0.02
Totals	0.10	0.10

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	40.00	30	
Round trips/day		176	
Vehicle miles traveled/day (calculated)			7022.222222

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.4	127.6	10.8	2.6	1.5	25983.1
Tons per contruction period	0.00	0.14	0.01	0.00	0.00	28.58

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.65
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.0	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.51	3.49	5.58	0.27	0.25	716.08
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.5	8.5	15.8	0.9	0.8	1683.9
	Grading	tons per phase	0.0	0.0	0.0	0.0	0.0	1.9

Drainage/Utilities/Subgrade	Default								
	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.0	0.0	0.0	1.9

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Retaining Wall - Form & S Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.1	5.2	13.1	67.7	0.7	67.0	14.6	0.6	13.9	1,559.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	1.1	5.2	13.1	67.7	0.7	67.0	14.6	0.6	13.9	1,559.8
Total (tons/construction project)	0.0	0.1	0.2	0.5	0.0	0.5	0.1	0.0	0.1	25.7

Notes: Project Start Year -> 2016
Project Length (months) -> 2
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Retaining Wall - Form & S Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	0.5	2.4	6.0	30.8	0.3	30.5	6.6	0.3	6.3	709.0
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	0.5	2.4	6.0	30.8	0.3	30.5	6.6	0.3	6.3	709.0
Total (megagrams/construction project)	0.0	0.1	0.2	0.5	0.0	0.5	0.1	0.0	0.1	23.3

Notes: Project Start Year -> 2016
Project Length (months) -> 2
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	ARCF ARS Reach F-Year 2 (G&E Retaining Wall - Form & Steel)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	1.5	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.15
Grading/Excavation	1.50	0.68
Drainage/Utilities/Sub-Grade	0.00	0.45
Paving	0.00	0.23
Totals	1.50	1.50

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of Soil Hauling Defaults	Default Values				
User Input						
Miles/round trip	40.00	30				
Round trips/day		0				
Vehicle miles traveled/day (calculated)			0			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions	User Override of Worker Commute Default Values	Default Values				
Miles/ one-way trip		20				
One-way trips/day		2				
No. of employees: Grubbing/Land Clearing	0.00	10				
No. of employees: Grading/Excavation		15				
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11				
No. of employees: Paving	0.00	13				
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.05	0.00	0.00	0.00	9.77
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.5	13.9	0.1
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.0	5.0	10.2	0.6	0.6	967.8
	Grading	tons per phase	0.0	0.1	0.2	0.0	0.0	16.0

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.2	0.0	0.0	16.0

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

20

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E to Spoils) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	18.3	89.6	335.9	77.8	10.8	67.0	22.9	9.0	13.9	47,017.6
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	18.3	89.6	335.9	77.8	10.8	67.0	22.9	9.0	13.9	47,017.6
Total (tons/construction project)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	25.9

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 4090

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E to Spoils) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	8.3	40.7	152.7	35.4	4.9	30.5	10.4	4.1	6.3	21,371.7
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	8.3	40.7	152.7	35.4	4.9	30.5	10.4	4.1	6.3	21,371.7
Total (megagrams/construction project)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	23.5

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported (meters^3/day)-> 3127

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E to Spoils)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.1	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	4090.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.01
Grading/Excavation	0.05	0.02
Drainage/Utilities/Sub-Grade	0.00	0.02
Paving	0.00	0.01
Totals	0.05	0.05

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip	40.00	30	
Round trips/day	205.00	205	
Vehicle miles traveled/day (calculated)			8200

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	2.8	149.0	12.7	3.0	1.8	30341.0
Tons per contruction period	0.00	0.08	0.01	0.00	0.00	16.69

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.33
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.0	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Crawler Tractors	2.59	15.64	33.31	1.28	1.18	2887.12
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.87	6.09	18.17	1.02	0.94	1174.29
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.81	4.22	8.57	0.45	0.41	767.04
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
4.00	1	Scrapers	10.19	50.78	123.87	4.99	4.59	11256.15
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	15.4	76.7	183.9	7.7	7.1	16084.6
	Grading	tons per phase	0.0	0.0	0.1	0.0	0.0	8.8

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.1	0.0	0.0	8.8

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	14.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	14.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	14.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	14.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

56

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E to Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	11.2	55.5	139.6	72.7	5.7	67.0	19.1	5.2	13.9	13,161.5
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	11.2	55.5	139.6	72.7	5.7	67.0	19.1	5.2	13.9	13,161.5
Total (tons/construction project)	0.2	0.9	2.1	0.6	0.1	0.5	0.2	0.1	0.1	202.7

Notes: Project Start Year -> 2016

Project Length (months) -> 1

Total Project Area (acres) -> 28

Maximum Area Disturbed/Day (acres) -> 7

Total Soil Imported/Exported (yd^3/day)-> 2920

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E to Stockpile)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	5.1	25.2	63.4	33.0	2.6	30.5	8.7	2.4	6.3	5,982.5
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	5.1	25.2	63.4	33.0	2.6	30.5	8.7	2.4	6.3	5,982.5
Total (megagrams/construction project)	0.2	0.8	1.9	0.5	0.1	0.4	0.2	0.1	0.1	183.8

Notes: Project Start Year -> 2016

Project Length (months) -> 1

Total Project Area (hectares) -> 11

Maximum Area Disturbed/Day (hectares) -> 3

Total Soil Imported/Exported ($meters^3$/day)-> 2232

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E to Stockpile)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	1.4	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported	2920.0	yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.14
Grading/Excavation	1.40	0.63
Drainage/Utilities/Sub-Grade	0.00	0.42
Paving	0.00	0.21
Totals	1.40	1.40

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of					
User Input	Soil Hauling Defaults	Default Values				
Miles/round trip	2.00	30				
Round trips/day	146.00	146				
Vehicle miles traveled/day (calculated)			292			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.1	5.3	0.5	0.1	0.1	1080.4
Tons per contruction period	0.00	0.08	0.01	0.00	0.00	16.64

Worker commute default values can be overridden in cells C60 through C65.

	User Override of Worker					
Worker Commute Emissions	Commute Default Values	Default Values				
Miles/ one-way trip		20				
One-way trips/day		2				
No. of employees: Grubbing/Land Clearing	0.00	10				
No. of employees: Grading/Excavation		15				
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11				
No. of employees: Paving	0.00	13				
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust		2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.06	2.91	0.25	0.06	0.03	592.02
Tons per const. Period - Grading/Excavation	0.00	0.04	0.00	0.00	0.00	9.12
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.5	13.9	0.1
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Crawler Tractors	1.85	11.17	23.79	0.92	0.84	2062.23
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Graders	1.33	4.35	12.98	0.73	0.67	838.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
4.00	1	Scrapers	7.28	36.27	88.48	3.57	3.28	8040.11
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	11.0	54.8	131.4	5.5	5.1	11489.0
	Grading	tons per phase	0.2	0.8	2.0	0.1	0.1	176.9

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default								
Paving	Number of Vehicles			ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts		0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors		0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs		0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers		0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws		0.00	0.00	0.00	0.00	0.00	0.00
		Cranes		0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Excavators		0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets		0.00	0.00	0.00	0.00	0.00	0.00
		Graders		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors		0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks		0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors		0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers		0.00	0.00	0.00	0.00	0.00	0.00
		Pumps		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers		0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers		0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers		0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards		0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders		0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment		0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers		0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes		0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers		0.00	0.00	0.00	0.00	0.00	0.00
		Welders		0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day		0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase		0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>				0.2	0.8	2.0	0.1	0.1	176.9

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	10.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

40

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Surfacing) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	14.5	64.3	331.0	77.5	10.5	67.0	22.1	8.2	13.9	55,317.2
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	14.5	64.3	331.0	77.5	10.5	67.0	22.1	8.2	13.9	55,317.2
Total (tons/construction project)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	30.4

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 8228

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (G&E Surfacing) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	6.6	29.2	150.4	35.2	4.8	30.5	10.1	3.7	6.3	25,144.2
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	6.6	29.2	150.4	35.2	4.8	30.5	10.1	3.7	6.3	25,144.2
Total (megagrams/construction project)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	27.6

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 6291

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (G&E Surfacing)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.1	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	8228.0	yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.01
Grading/Excavation	0.05	0.05
Drainage/Utilities/Sub-Grade	0.00	0.03
Paving	0.00	0.02
Totals	0.05	0.10

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values	
Miles/round trip		30	
Round trips/day		411	
Vehicle miles traveled/day (calculated)			12342

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	4.3	224.3	19.1	4.5	2.7	45666.9
Tons per contruction period	0.00	0.12	0.01	0.00	0.00	25.12

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust	3.00	2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.08	4.36	0.37	0.09	0.05	888.03
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.49
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	67.0	0.0	13.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	1.02	6.15	13.08	0.50	0.46	1134.22
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	3	Excavators	1.23	8.37	13.40	0.66	0.61	1718.59
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
3.00	2	Graders	4.40	14.36	42.82	2.41	2.21	2767.98
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.64	3.31	6.73	0.35	0.33	602.67
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Rollers	1.44	6.23	12.75	0.94	0.86	1153.07
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Tractors/Loaders/Backhoes	1.48	6.49	13.49	1.04	0.96	1385.69
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	10.2	44.9	102.3	5.9	5.4	8762.2
	Grading	tons per phase	0.0	0.0	0.1	0.0	0.0	4.8

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.1	0.0	0.0	4.8

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	11.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175	11.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	11.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	11.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	11.00	8
Trenchers		81		8
Welders		45		8

55

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Utilities #1) Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	2.1	11.3	24.7	101.7	1.2	100.5	22.0	1.1	20.9	2,399.7
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	2.1	11.3	24.7	101.7	1.2	100.5	22.0	1.1	20.9	2,399.7
Total (tons/construction project)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	4.0

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Utilities #1) Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.0	5.1	11.2	46.2	0.6	45.7	10.0	0.5	9.5	1,090.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	1.0	5.1	11.2	46.2	0.6	45.7	10.0	0.5	9.5	1,090.8
Total (megagrams/construction project)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	3.6

Notes: Project Start Year -> 2016
Project Length (months) -> 0
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model — Version 7.1.2

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (Utilities #1)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	0.2	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.02
Grading/Excavation	0.15	0.09
Drainage/Utilities/Sub-Grade	0.00	0.06
Paving	0.00	0.03
Totals	0.15	0.20

Please note: You have entered a different number of months than the project length shown in cell C13.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions	User Override of					
User Input	Soil Hauling Defaults	Default Values				
Miles/round trip		30				
Round trips/day		0				
Vehicle miles traveled/day (calculated)			0			
Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions	User Override of Worker Commute Default Values	Default Values				
Miles/ one-way trip		20				
One-way trips/day		2				
No. of employees: Grubbing/Land Clearing	0.00	10				
No. of employees: Grading/Excavation		15				
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11				
No. of employees: Paving	0.00	13				
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust	1.00	2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.03	1.45	0.12	0.03	0.02	296.01
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.49
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	100.5	0.1	20.9	0.0
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Crawler Tractors	0.92	5.59	11.90	0.46	0.42	1031.11
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.13	0.57	1.16	0.09	0.08	104.82
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	2.1	11.1	23.3	1.2	1.1	2103.7
	Grading	tons per phase	0.0	0.0	0.0	0.0	0.0	3.5

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.0	0.0	0.0	0.0	3.5

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	3.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

33

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.2

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Utilities #2)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	1.1	5.1	11.7	101.2	0.7	100.5	21.5	0.6	20.9	1,263.8
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	1.1	5.1	11.7	101.2	0.7	100.5	21.5	0.6	20.9	1,263.8
Total (tons/construction project)	0.0	0.1	0.3	1.2	0.0	1.2	0.3	0.0	0.2	33.4

Notes: Project Start Year -> 2016
Project Length (months) -> 2
Total Project Area (acres) -> 28
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> ARCF ARS Reach F-Year 2 (Utilities #2)				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	-	-	-	-	-	-	-	-	-	-
Grading/Excavation	0.5	2.3	5.3	46.0	0.3	45.7	9.8	0.3	9.5	574.5
Drainage/Utilities/Sub-Grade	-	-	-	-	-	-	-	-	-	-
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	0.5	2.3	5.3	46.0	0.3	45.7	9.8	0.3	9.5	574.5
Total (megagrams/construction project)	0.0	0.1	0.3	1.1	0.0	1.1	0.2	0.0	0.2	30.3

Notes: Project Start Year -> 2016
Project Length (months) -> 2
Total Project Area (hectares) -> 11
Maximum Area Disturbed/Day (hectares) -> 3
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.2

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	ARCF ARS Reach F-Year 2 (Utilities #2)	
Construction Start Year	2016	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	2.4	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	1.5	miles
Total Project Area	28.0	acres
Maximum Area Disturbed/Day	6.7	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported		yd^3/day
Soil Exported		yd^3/day
Average Truck Capacity	20.0	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months
Grubbing/Land Clearing	0.00	0.24
Grading/Excavation	2.40	1.08
Drainage/Utilities/Sub-Grade	0.00	0.72
Paving	0.00	0.36
Totals	2.40	2.40

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values				
Miles/round trip		30				
Round trips/day		0				
Vehicle miles traveled/day (calculated)			0			

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	0.00	10
No. of employees: Grading/Excavation		15
No. of employees: Drainage/Utilities/Sub-Grade	0.00	11
No. of employees: Paving	0.00	13

	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/mile)	0.147	0.194	1.744	0.047	0.020	443.650
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grading/Excavation (grams/trip)	0.505	0.323	4.200	0.004	0.003	95.592
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Grading/Excavation	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Drainage/Utilities/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Drain/Util/Sub-Grade	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.000	0.000	0.000	0.000	0.000	0.000

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	0.00	2		80		
Grading/Excavation - Exhaust	1.00	2		80		
Drainage/Utilities/Subgrade	0.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Emission rate - Grading/Excavation (grams/mile)	0.16	8.25	0.70	0.17	0.10	1679.86
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.03	1.45	0.12	0.03	0.02	296.01
Tons per const. Period - Grading/Excavation	0.00	0.04	0.00	0.00	0.00	7.81
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		0	0.0	0.0	0.0	0.0
Fugitive Dust - Grading/Excavation		6.7	100.5	1.2	20.9	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		0	0.0	0.0	0.0	0.0

Off-Road Equipment Emissions

	Default							
Grubbing/Land Clearing	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default							
Grading/Excavation	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
	1	Other Construction Equipment	0.58	3.01	6.12	0.32	0.30	547.89
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.45	1.97	4.09	0.31	0.29	419.90
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	1.0	5.0	10.2	0.6	0.6	967.8
	Grading	tons per phase	0.0	0.1	0.3	0.0	0.0	25.5

	Default							
Drainage/Utilities/Subgrade	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
	2	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Drainage	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0

	Default								
Paving	Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	*Program-estimate*	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			0.0	0.1	0.3	0.0	0.0	25.5

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

		Default Values		Default Values
Equipment		Horsepower		Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		142		8
Excavators		163		8
Forklifts		89		8
Generator Sets		66		8
Graders		175		8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

20

END OF DATA ENTRY SHEET

Additional air quality analysis for the proposed Sacramento Weir and Bypass Widening is performed separately due to the spatial separation between the Sacramento Weir and the additional portion of the project in Alternatives 1 and 2. It should be noted that the Sacramento Weir and Bypass Widening portion of the project is only proposed under Alternative 2.

The air quality emissions analysis for the Sacramento Weir and Bypass Widening was developed based on the following assumptions:

- The Sacramento Weir and Bypass Widening would be constructed as three phases over three years: the Weir, the new levee, and the deconstruction of the old levee;
- The Sacramento Weir would be constructed on dry land on the portion of land between the railroad property and the Old River Road;
- The Old River Road and the railroad would be realigned onto the new weir crown under a separate construction agreement;
- The existing weir would remain in place, and a small transitional island would remain between the new weir and the existing weir;
- The new levee would be constructed using soil existing in the Sacramento Bypass, and no new soil would be imported from other borrow sites.

Sacramento Weir Widening

The construction and design for the proposed widening of the Sacramento Weir has not yet been determined. For the purpose of air quality analysis, it is assumed that the new portion of the weir would be constructed with cement formed on site, requiring haul trucks of both cement and treated wood for the forms. At the peak of construction, as many as 20 trucks could deliver cement or other materials in a day; however, for the purposes of air quality analysis it is anticipated that an average of 5 haul trucks per day would deliver materials to the site over a six month period. Waste materials would be exported on as as-needed basis. The construction of the weir would also include a new section of railroad tracks and a new segment of road in order to connect the existing Yolo Shortline Railroad and the existing Old River Road across the weir. It is currently assumed that the Yolo Shortline Railroad and the Old River Road would remain active during construction, and the only closures and detours would occur when the old section is connected with the new; however, it is possible that the Yolo Shortline Railroad would be closed during construction due to the proximity of the railroad to the footprint of the new weir section. If the railroad requires closure during construction, the goods normally transported by rail could be rerouted onto large cargo trucks; however, the potential emissions from rerouting rail goods onto trucks are outside the scope of this analysis. Construction design, additional traffic analysis, and additional air quality analysis would be conducted during the PED phase.

Construction of the Sacramento Weir and Bypass portion of Alternative 2 is assumed to take place over three years in three different phases: construction of the new levee, construction of the new weir, and demolition of the old levee. For the purposes of air quality analysis, several assumptions associated with each of these phases have been made.

It is assumed that the construction of the new levee segment would utilize soil available either from the existing bypass area or from the area that will be integrated into the new, larger bypass. This nearby borrow source would eliminate the use of haul trucks; therefore, the model analysis included in Appendix D reflects no haul trucks for this portion of construction. Large construction equipment such as scrapers would be needed in order to take the soil from the source to the site of the new levee. Upon completion of the new levee, a new road to take the place of County Road 126 would be constructed on the levee crown. Although construction is assumed to take place over a single construction season (approximately 6 months), the complete design may determine that additional time is needed to construct this portion of the project. Additional analysis may be needed at that time.

Table 3. Estimated Air Emissions for the Sacramento Bypass New Levee Construction.

	Annual Emissions in Tons					**Maximum Daily Emissions in Pounds**				
Construction Year	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in YSAQMD										
Construction of levee	0.7	7.3	6.5	2.5	0.8	18.5	184.7	157.9	47.9	15.6
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	No							No	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					

It is assumed that the construction of the new portion of the weir would be of similar design and materials of the existing weir and would therefore consist mostly of concrete formed on site. It is currently unknown how many cement trucks would be needed for the actual construction of the weir; however, for the purposes of air quality analysis it is assumed that approximately five loads of cement would be delivered to the site daily for the duration of the six month construction project. Additional analysis would be performed once the design of the new weir is completed. Upon completion of the new weir, a new segment of road and railroad would be constructed on the top of the weir and connected to the existing Old River Road and Yolo Shortline Railroad.

Table 4. Estimated Air Emissions for the Sacramento Bypass Weir Construction.

Construction Year	Annual Emissions in Tons					Maximum Daily Emissions in Pounds				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in YSAQMD										
Construction of weir	0.8	7.5	5.9	2.6	0.8	15.2	148.6	114.6	47.0	6.3
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	No							No	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					

Upon completion of the new levee and the new weir, the existing levee would be deconstructed and the soil from the degraded levee would be redistributed across the entire bypass area in order to encourage positive drainage toward the Yolo Bypass. Additionally, the segment of land that is currently between the existing Yolo Shortline Railroad and the Sacramento River would be lowered in order to connect the new section of the widened Sacramento Bypass to the Sacramento River. Soil removed from this segment of land would also be redistributed across the entire bypass area in order to meet elevation requirements as determined by future design. It is assumed that the majority of the existing river bank would remain in place; however, some vegetation and large trees could be removed. Full analysis of these potential impacts would be performed once the design is completed. Due to the large amount of soil that would be displaced and redistributed in this phase of work, as many as 20 scrapers could be in use at one time during the peak of construction; however, it is not anticipated that any soil would be brought in or removed from the site using haul trucks. The model analysis included in Appendix D reflects no haul trucks for this portion of construction.

Table 5. Estimated Air Emissions for the Sacramento Bypass Existing Levee Removal and Soil Redistribution.

Construction Year	Annual Emissions in Tons					Maximum Daily Emissions in Pounds				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in YSAQMD										
Levee Removal	1.5	14.2	13.1	3.0	1.1	30.3	297.2	281.8	52.4	19.7
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	Yes							No	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					

Maximum daily emissions are estimated for ROG, NO_X, PM_{10}, and $PM_{2.5}$ to evaluate emissions against YSAQMD thresholds. Those results are shown in Table 6. Construction-related emissions from the Sacramento Weir and Bypass Widening portion of the project would exceed the YSAQMD's emission threshold for NO_X. The actual emissions may be reduced by reducing the number and type of large construction vehicles utilized on site at one time and by following the mitigation measures as recommended by SMAQMD; however, the overall construction emissions under the alternative would likely exceed the thresholds and would therefore result in a significant effect. The Corps would be required to pay an off-site mitigation fee for NO_X emissions in the SVAB in order to reduce the effect to a less-than-significant level.

Table 6. Estimated Air Emissions for Alternative 2, Sacramento Bypass and Weir Widening Construction.

Construction Year	**Annual Emissions in Tons**					**Maximum Daily Emissions in Pounds**				
	ROG	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in YSAQMD										
Construction of New Levee	0.7	7.3	6.5	2.5	0.8	18.5	184.7	157.9	47.9	15.6
Construction of New Weir	0.8	7.5	5.9	2.8	0.8	1532	148.6	114.6	47.0	6.3
Demolition of Old Levee	1.5	14.2	13.1	3.0	1.1	30.3	297.2	281.8	52.4	19.7
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	Yes							No	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					

Although Alternative 2 would reduce the number of levee raises along the Sacramento River compared to Alternative 1, for the purposes of air quality analysis the emissions estimates are assumed to be the same as Alternative 1. Alternative 1 summarizes the maximum daily emissions estimated for ROG, NO_X, PM_{10}, and $PM_{2.5}$ under the construction emissions that would result in the most combined air emission. As shown in Table 6, the greatest potential emissions impacts would occur during the demolition of the old levee due to the large number of scrapers and other large construction equipment to displace and redistribute soil. These emissions are combined with the previously analyzed emissions from Alternative 1 in Tables 7 and 8, below.

Table 7. Estimated Air Emissions for the Truck Delivery Scenario With Bypass Widening.

	Annual Emissions in Tons					Maximum Daily Emissions in Pounds				
Construction Year	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in SMAQMD										
Year 2 Onsite Construction	1.5	22.3	8.9	7.4	2.0	11.6	159.7	66.8	29.9	5.4
Year 2 Off-Site Soil Borrow	0	0.7	0.1	0.1	0	6.7	176.2	34.2	71.8	17.5
Year 2 Total	1.5	23.0	9.0	7.5	2.0	18.3	335.9	101	101.7	22.9
CEQA Threshold							85			
Exceed Threshold?							Yes			
General Conformity *de minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					
Emissions generated in YSAQMD										
Year 2 Off-Site Soil Borrow	0	0.6	0.1	.01	0	6.03	158.8	30.78	65.67	15.75
Bypass Widening: Levee Demolition	1.5	14.2	13.1	3.0	1.1	30.3	297.2	281.8	52.4	19.7
Total	1.5	14.8	13.2	3.01	1.1	36.6	456.0	312.58	118.07	35.45
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	Yes							No	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					

Maximum daily emissions are estimated for ROG, NO_X, PM_{10}, and $PM_{2.5}$ to evaluate emissions against SMAQMD, YSAQMD, and BAAQMD thresholds under the barge delivery scenario. Those results are shown in Table 8. Construction-related emissions under Alternative 1 would exceed the SMAQMD's and BAAQMD's emission thresholds for NO_X. Therefore, construction of the alternative with barge delivery would result in a significant effect and the Corps would be required to pay an off-site mitigation fee for NO_X emissions in the SVAB. Payment of these mitigation fees would reduce the impacts to a less-than-significant level. Borrow activities and barge delivery emissions would not exceed YSAQMD thresholds; however, the addition of the Sacramento Weir and Bypass Widening portion of Alternative 2 would exceed the YSAQMD's emission threshold for NO_X. The actual emissions may be reduced by reducing the number and type of large construction vehicles utilized on site at one time and by following the mitigation measures as recommended by SMAQMD; however, the overall construction emissions under the alternative would likely exceed the thresholds and would therefore result in a significant effect. The Corps would be required to pay an off-site mitigation fee for NO_X emissions in the SVAB in order to reduce the effect to a less-than-significant level. Since less than 50 percent of borrow activities emissions could occur in FRAQMD, it was assumed FRAQMD thresholds would not be exceeded. Borrow activities emissions associated with potential borrow site located north of the project site were captured in the SMAQMD off-site soil estimations.

Table 8. Estimated Air Emissions for the Barge Delivery Scenario With Bypass Widening.

	Annual Emissions in Tons					Maximum Daily Emissions in Pounds				
Construction Year	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Emissions generated in SMAQMD										
Year 2 Onsite Construction	2.0	22.6	10.7	6.25	1.6	11.6	159.7	66.8	29.9	5.4
Year 2 Off-Site Soil Borrow	0	0.7	0.1	0.1	0	6.7	176.2	34.2	71.8	17.5
Year 2 Barge Delivery	0.41	3.92	1.67	0.15	0	10.2	95.0	39.4	3.7	1.7
Year 2 Total	2.4	27.2	12.5	6.5	1.6	28.5	430.9	140.4	105.4	24.6
CEQA Threshold	NA	NA	NA	NA	NA	NA	85	NA	NA	NA
Exceed Threshold?							Yes			
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	Yes	No	No	No					
Emissions generated in YSAQMD										
Year 2 Off-Site Soil Borrow	0	0.6	0.1	.01	0	6.03	158.8	30.78	65.67	15.75
Year 2 Barge Delivery	0.24	2.33	1	.01	0	6.07	56.5	23.43	2.2	1
Bypass Widening Levee Demolition	1.5	14.2	13.1	3.0	1.1	30.3	297.2	281.80	52.4	19.7
Year 2 Total	1.74	17.13	14.2	3.02	1.1	42.4	512.5	336.01	120.27	36.45
CEQA Threshold	10	10	NA	NA	NA				80	
Exceed Threshold?	No	Yes							Yes	
General Conformity *de Minimis* Threshold	25	25	100	100	100					
Exceed Threshold?	No	No	No	No	No					
Emissions generated in BAAQMD **										
Year 2 Barge Delivery	0.45	4.35	1.85	.16	0	11.32	105.3	91.2	4.1	1.84
CEQA Threshold						54	54		82	54
Exceed Threshold?						No	Yes		No	No
General Conformity *de Minimis* Threshold	50	100	100	NA	100					
Exceed Threshold?	No	No	No		No					

Notes: **Only on-water exhaust emissions generated from towboats are expected to occur within the BAAQMD.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Sac Bypass Widening: NEW LEVEE Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	6.1	49.3	62.2	42.9	2.9	40.0	11.0	2.7	8.3	10,244.4
Grading/Excavation	20.8	157.9	217.0	49.3	9.3	40.0	16.9	8.5	8.3	34,015.3
Drainage/Utilities/Sub-Grade	4.9	38.1	42.8	42.4	2.4	40.0	10.5	2.2	8.3	7,262.2
Paving	3.6	35.3	32.6	1.8	1.8	-	1.7	1.7	-	6,747.9
Maximum (pounds/day)	20.8	157.9	217.0	49.3	9.3	40.0	16.9	8.5	8.3	34,015.3
Total (tons/construction project)	0.8	6.5	8.5	2.6	0.4	2.2	0.8	0.3	0.5	1,370.1

Notes: Project Start Year ->	2021
Project Length (months) ->	6
Total Project Area (acres) ->	20
Maximum Area Disturbed/Day (acres) ->	4
Total Soil Imported/Exported (yd^3/day)->	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Sac Bypass Widening: NEW LEVEE Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	2.8	22.4	28.3	19.5	1.3	18.2	5.0	1.2	3.8	4,656.5
Grading/Excavation	9.4	71.8	98.6	22.4	4.2	18.2	7.7	3.9	3.8	15,461.5
Drainage/Utilities/Sub-Grade	2.2	17.3	19.4	19.3	1.1	18.2	4.8	1.0	3.8	3,301.0
Paving	1.6	16.0	14.8	0.8	0.8	-	0.8	0.8	-	3,067.2
Maximum (kilograms/day)	9.4	71.8	98.6	22.4	4.2	18.2	7.7	3.9	3.8	15,461.5
Total (megagrams/construction project)	0.8	5.9	7.7	2.3	0.3	2.0	0.7	0.3	0.4	1,242.7

Notes: Project Start Year ->	2021
Project Length (months) ->	6
Total Project Area (hectares) ->	8
Maximum Area Disturbed/Day (hectares) ->	2
Total Soil Imported/Exported (meters ^{3}/day)->	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model

Version 7.1.5.1

Data Entry Worksheet

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	Sac Bypass Widening: NEW LEVEE	
Construction Start Year	2021	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	6.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	2.00	miles
Total Project Area	20.00	acres
Maximum Area Disturbed/Day	4.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	0.50	0.60	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	3.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	1.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	1.50	0.90	0.00	0.00	0.00	0.00	0.00	0.00
Totals	6.00	6.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions **User Input**	User Override of Soil Hauling Defaults	Default Values
Miles/round trip		30
Round trips/day		0
Vehicle miles traveled/day (calculated)	0	

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**

Emission rate (grams/mile)	0.17	2.87	0.77	0.15	0.09	1551.98
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing		8
No. of employees: Grading/Excavation		20
No. of employees: Drainage/Utilities/Sub-Grade		18
No. of employees: Paving		14

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grading/Excavation (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Paving (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grubbing/Land Clearing (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Emission rate - Grading/Excavation (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Emission rate - Paving (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Pounds per day - Grubbing/Land Clearing	0.077	0.085	0.827	0.031	0.013	295.121
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.005	0.000	0.000	1.623
Pounds per day - Grading/Excavation	0.207	0.227	2.205	0.083	0.035	786.989
Tons per const. Period - Grading/Excavation	0.007	0.007	0.073	0.003	0.001	25.971
Pounds per day - Drainage/Utilities/Sub-Grade	0.181	0.199	1.929	0.072	0.030	688.616
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.021	0.001	0.000	7.575
Pounds per day - Paving	0.142	0.156	1.516	0.057	0.024	541.055
Tons per const. Period - Paving	0.002	0.003	0.025	0.001	0.000	8.927
tons per construction period	0.012	0.013	0.124	0.005	0.002	44.096

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions

	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day
Grubbing/Land Clearing - Exhaust	2.00	1		40
Grading/Excavation - Exhaust	2.00	1		40
Drainage/Utilities/Subgrade	1.00	1		40

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.17	2.87	0.77	0.15	0.09	1551.98
Emission rate - Grading/Excavation (grams/mile)	0.17	2.87	0.77	0.15	0.09	1551.98
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.17	2.87	0.77	0.15	0.09	1551.98
Pounds per day - Grubbing/Land Clearing	0.03	0.51	0.14	0.03	0.02	273.48
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	1.50
Pound per day - Grading/Excavation	0.03	0.51	0.14	0.03	0.02	273.48
Tons per const. Period - Grading/Excavation	0.00	0.02	0.00	0.00	0.00	9.02

Pound per day - Drainage/Utilities/Subgrade	0.01	0.25	0.07	0.01	0.01	136.74
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	1.50

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		4	40.0	0.2	8.3	0.0
Fugitive Dust - Grading/Excavation		4	40.0	1.2	8.3	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		4	40.0	0.8	8.3	0.2

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
	1	Crawler Tractors	0.71	5.58	8.52	0.32	0.30	1030.55
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Excavators	0.31	3.49	2.78	0.13	0.12	716.05
1.00		Forklifts	0.14	0.90	1.19	0.08	0.08	165.47
2.00		Generator Sets	0.72	7.21	6.36	0.35	0.32	1217.66
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Tractors	0.25	2.54	2.50	0.12	0.11	493.07
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.54	4.49	5.40	0.28	0.26	817.30
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Scrapers	2.41	18.15	26.47	1.03	0.95	4021.92
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Tractors/Loaders/Backhoes	0.49	3.92	4.76	0.28	0.26	837.10
1.00		Trenchers	0.42	2.10	3.65	0.27	0.24	376.64

		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	6.0	48.4	61.6	2.9	2.6	9675.8
	Grubbing/Land Clearing	tons per phase	0.0	0.3	0.3	0.0	0.0	53.2

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
	1	Crawler Tractors	0.71	5.58	8.52	0.32	0.30	1030.55
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	3	Excavators	0.93	10.46	8.35	0.40	0.37	2148.15
1.00		Forklifts	0.14	0.90	1.19	0.08	0.08	165.47
2.00		Generator Sets	0.72	7.21	6.36	0.35	0.32	1217.66
	1	Graders	0.83	4.33	7.61	0.42	0.39	833.84
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.54	4.49	5.40	0.28	0.26	817.30
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
3.00	2	Rollers	0.74	5.66	7.16	0.44	0.40	1048.10
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Rubber Tired Dozers	1.83	8.83	18.08	0.83	0.76	1888.37
3.00	1	Rubber Tired Loaders	1.06	9.34	11.45	0.38	0.35	1987.16
10.00	2	Scrapers	12.03	90.73	132.35	5.15	4.74	20109.62
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
4.00	2	Tractors/Loaders/Backhoes	0.98	7.84	9.52	0.56	0.52	1674.19
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	20.6	155.6	216.3	9.2	8.5	32954.9
	Grading	tons per phase	0.7	5.1	7.1	0.3	0.3	1087.5

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.41	3.28	2.83	0.18	0.16	507.95
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00

		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Concrete/Industrial Saws	0.30	2.90	2.40	0.14	0.13	467.14
1.00		Cranes	0.42	3.00	4.71	0.19	0.18	601.63
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Forklifts	0.14	0.90	1.19	0.08	0.08	165.47
2.00	1	Generator Sets	0.72	7.21	6.36	0.35	0.32	1217.66
	1	Graders	0.83	4.33	7.61	0.42	0.39	833.84
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.54	4.49	5.40	0.28	0.26	817.30
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rough Terrain Forklifts	0.13	2.03	1.63	0.06	0.06	372.90
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
2.00	2	Tractors/Loaders/Backhoes	0.49	3.92	4.76	0.28	0.26	837.10
1.00		Trenchers	0.42	2.10	3.65	0.27	0.24	376.64
1.00		Welders	0.31	1.70	1.51	0.08	0.07	204.74
	Drainage	pounds per day	4.7	36.1	42.3	2.3	2.2	6436.8
	Drainage	tons per phase	0.1	0.4	0.5	0.0	0.0	70.8

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cement and Mortar Mixers	0.07	0.35	0.42	0.02	0.02	57.88
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Generator Sets	0.72	7.21	6.36	0.35	0.32	1217.66
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00

		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.38	3.97	3.27	0.17	0.15	760.75
	1	Pavers	0.31	3.55	3.10	0.15	0.14	602.27
	1	Paving Equipment	0.24	3.37	2.37	0.12	0.11	532.69
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
	3	Rollers	0.74	5.66	7.16	0.44	0.40	1048.10
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Surfacing Equipment	0.25	4.18	2.95	0.11	0.10	880.33
1.00		Sweepers/Scrubbers	0.24	1.57	2.04	0.15	0.14	270.09
	2	Tractors/Loaders/Backhoes	0.49	3.92	4.76	0.28	0.26	837.10
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	3.4	33.8	32.4	1.8	1.6	6206.9
	Paving	tons per phase	0.1	0.6	0.5	0.0	0.0	102.4
Total Emissions all Phases (tons per construction period) =>			0.8	6.4	8.5	0.4	0.3	1313.9

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66	10.00	8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88	10.00	8
Other Material Handling Equipment		167	10.00	8
Pavers		126	10.00	8
Paving Equipment		131	10.00	8
Plate Compactors		8		8
Pressure Washers		26		8

Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	10.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254	10.00	8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

130

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Sac Bypass Widening: WEIR ONLY Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	7.0	55.3	66.7	43.2	3.2	40.0	11.2	2.9	8.3	11,096.6
Grading/Excavation	13.8	114.4	129.7	46.1	6.1	40.0	13.8	5.5	8.3	23,724.5
Drainage/Utilities/Sub-Grade	3.3	27.5	26.6	41.5	1.5	40.0	9.6	1.3	8.3	5,330.0
Paving	3.9	39.7	34.1	1.7	1.7	-	1.6	1.6	-	7,332.4
Maximum (pounds/day)	13.8	114.4	129.7	46.1	6.1	40.0	13.8	5.5	8.3	23,724.5
Total (tons/construction project)	0.7	5.9	6.6	2.5	0.3	2.2	0.7	0.3	0.5	1,214.9

Notes: Project Start Year ->	2022
Project Length (months) ->	6
Total Project Area (acres) ->	10
Maximum Area Disturbed/Day (acres) ->	4
Total Soil Imported/Exported (yd^3/day)->	120

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Sac Bypass Widening: WEIR ONLY Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	3.2	25.1	30.3	19.6	1.5	18.2	5.1	1.3	3.8	5,043.9
Grading/Excavation	6.3	52.0	59.0	20.9	2.8	18.2	6.3	2.5	3.8	10,783.9
Drainage/Utilities/Sub-Grade	1.5	12.5	12.1	18.8	0.7	18.2	4.4	0.6	3.8	2,422.7
Paving	1.8	18.1	15.5	0.8	0.8	-	0.7	0.7	-	3,332.9
Maximum (kilograms/day)	6.3	52.0	59.0	20.9	2.8	18.2	6.3	2.5	3.8	10,783.9
Total (megagrams/construction project)	0.6	5.4	6.0	2.3	0.3	2.0	0.7	0.3	0.4	1,101.9

Notes: Project Start Year ->	2022
Project Length (months) ->	6
Total Project Area (hectares) ->	4
Maximum Area Disturbed/Day (hectares) ->	2
Total Soil Imported/Exported (meters ^{3}/day)->	92

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model Version 7.1.5.1

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type		
Project Name	Sac Bypass Widening: WEIR ONLY	
Construction Start Year	2022	Enter a Year between 2009 and 2025 (inclusive)
Project Type	3	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	6.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	0.30	miles
Total Project Area	10.00	acres
Maximum Area Disturbed/Day	4.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	100.00	yd^3/day
Soil Exported	20.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%		2006	%	2007	%
Grubbing/Land Clearing	0.50	0.60	0.00		0.00	0.00	0.00	0.00	0.00
Grading/Excavation	4.00	2.70	0.00		0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	0.50	1.80	0.00		0.00	0.00	0.00	0.00	0.00
Paving	1.00	0.90	0.00		0.00	0.00	0.00	0.00	0.00
Totals	6.00	6.00							

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip	30.00	30
Round trips/day		6
Vehicle miles traveled/day (calculated)		180

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.18	1.77	0.83	0.15	0.08	1546.69
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.07	0.70	0.33	0.06	0.03	613.23
Tons per contruction period	0.00	0.03	0.01	0.00	0.00	26.98

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing		5
No. of employees: Grading/Excavation		28
No. of employees: Drainage/Utilities/Sub-Grade		18
No. of employees: Paving		8

	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.097	0.112	1.056	0.047	0.020	441.772
Emission rate - Grading/Excavation (grams/mile)	0.097	0.112	1.056	0.047	0.020	441.772
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.097	0.112	1.056	0.047	0.020	441.772
Emission rate - Paving (grams/mile)	0.097	0.112	1.056	0.047	0.020	441.772
Emission rate - Grubbing/Land Clearing (grams/trip)	0.310	0.168	2.386	0.004	0.004	96.127
Emission rate - Grading/Excavation (grams/trip)	0.310	0.168	2.386	0.004	0.004	96.127
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.310	0.168	2.386	0.004	0.004	96.127
Emission rate - Paving (grams/trip)	0.310	0.168	2.386	0.004	0.004	96.127
Pounds per day - Grubbing/Land Clearing	0.049	0.053	0.518	0.021	0.009	196.730
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.003	0.000	0.000	1.082
Pounds per day - Grading/Excavation	0.272	0.291	2.848	0.114	0.048	1082.017
Tons per const. Period - Grading/Excavation	0.012	0.013	0.125	0.005	0.002	47.609
Pounds per day - Drainage/Utilities/Sub-Grade	0.173	0.185	1.813	0.072	0.030	688.556
Tons per const. Period - Drain/Util/Sub-Grade	0.001	0.001	0.010	0.000	0.000	3.787
Pounds per day - Paving	0.074	0.079	0.777	0.031	0.013	295.096
Tons per const. Period - Paving	0.001	0.001	0.009	0.000	0.000	3.246
tons per construction period	0.014	0.015	0.147	0.006	0.002	55.724

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	1.00	1		40		
Grading/Excavation - Exhaust	1.00	1		40		
Drainage/Utilities/Subgrade	1.00	1		40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.18	1.77	0.83	0.15	0.08	1546.69
Emission rate - Grading/Excavation (grams/mile)	0.18	1.77	0.83	0.15	0.08	1546.69
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.18	1.77	0.83	0.15	0.08	1546.69
Pounds per day - Grubbing/Land Clearing	0.02	0.16	0.07	0.01	0.01	136.27
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.75
Pound per day - Grading/Excavation	0.02	0.16	0.07	0.01	0.01	136.27
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	6.00
Pound per day - Drainage/Utilities/Subgrade	0.02	0.16	0.07	0.01	0.01	136.27
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.75

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		4	40.0	0.2	8.3	0.0
Fugitive Dust - Grading/Excavation		4	40.0	1.2	8.3	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		4	40.0	0.8	8.3	0.2

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Concrete/Industrial Saws	0.28	2.89	2.21	0.12	0.11	467.14
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
	1	Crawler Tractors	0.63	5.57	7.35	0.28	0.26	1028.75
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Excavators	0.27	3.48	2.30	0.11	0.10	715.80
1.00		Forklifts	0.12	0.90	1.06	0.07	0.06	165.47
2.00		Generator Sets	0.67	7.20	5.90	0.31	0.28	1217.66
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.49	4.49	4.70	0.25	0.23	817.03
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.34	3.97	2.75	0.15	0.14	760.75
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Rubber Tired Dozers	2.21	11.05	21.39	0.98	0.90	2362.06
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Scrapers	1.06	9.09	11.06	0.43	0.40	2014.23
0.00	1	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Tractors/Loaders/Backhoes	0.43	3.92	4.21	0.23	0.21	838.04
1.00		Trenchers	0.40	2.10	3.51	0.25	0.23	376.67
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	6.9	54.7	66.4	3.2	2.9	10763.6
	Grubbing/Land Clearing	tons per phase	0.0	0.3	0.4	0.0	0.0	59.2

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
5.00		Cement and Mortar Mixers	0.42	2.21	2.64	0.10	0.09	361.76
1.00		Concrete/Industrial Saws	0.28	2.89	2.21	0.12	0.11	467.14
	1	Cranes	0.38	3.00	4.07	0.17	0.16	601.73
	2	Crawler Tractors	1.26	11.15	14.70	0.55	0.51	2057.50
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	4	Excavators	1.10	13.94	9.18	0.44	0.41	2863.19
1.00		Forklifts	0.12	0.90	1.06	0.07	0.06	165.47
2.00		Generator Sets	0.67	7.20	5.90	0.31	0.28	1217.66
	2	Graders	1.45	8.65	12.98	0.72	0.66	1667.81
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.49	4.49	4.70	0.25	0.23	817.03
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Pumps	0.23	2.38	1.95	0.10	0.10	396.14
2.00	3	Rollers	0.43	3.77	4.28	0.25	0.23	698.78
2.00		Rough Terrain Forklifts	0.24	4.06	2.99	0.10	0.10	745.77
2.00		Rubber Tired Dozers	2.21	11.05	21.39	0.98	0.90	2362.06
3.00	3	Rubber Tired Loaders	0.90	9.35	8.97	0.30	0.28	1988.60
2.00	4	Scrapers	2.12	18.18	22.12	0.86	0.79	4028.45
0.00	1	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.43	3.92	4.21	0.23	0.21	838.04
1.00		Trenchers	0.40	2.10	3.51	0.25	0.23	376.67
1.00		Welders	0.28	1.68	1.47	0.07	0.06	204.74
	Grading/Excavation	pounds per day	13.4	111.1	128.6	5.9	5.4	21893.0
	Grading	tons per phase	0.6	4.9	5.7	0.3	0.2	963.3

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.38	3.28	2.62	0.16	0.14	507.95
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
5.00		Cement and Mortar Mixers	0.42	2.21	2.64	0.10	0.09	361.76
1.00		Concrete/Industrial Saws	0.28	2.89	2.21	0.12	0.11	467.14
1.00		Cranes	0.38	3.00	4.07	0.17	0.16	601.73
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Forklifts	0.12	0.90	1.06	0.07	0.06	165.47
	1	Generator Sets	0.33	3.60	2.95	0.15	0.14	608.83
0.00	2	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rough Terrain Forklifts	0.12	2.03	1.49	0.05	0.05	372.88
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
2.00	2	Tractors/Loaders/Backhoes	0.43	3.92	4.21	0.23	0.21	838.04
1.00		Trenchers	0.40	2.10	3.51	0.25	0.23	376.67
1.00		Welders	0.28	1.68	1.47	0.07	0.06	204.74
	Drainage	pounds per day	3.1	25.6	26.2	1.4	1.3	4505.2
	Drainage	tons per phase	0.0	0.1	0.1	0.0	0.0	24.8

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
5.00		Cement and Mortar Mixers	0.42	2.21	2.64	0.10	0.09	361.76
1.00		Concrete/Industrial Saws	0.28	2.89	2.21	0.12	0.11	467.14
1.00		Cranes	0.38	3.00	4.07	0.17	0.16	601.73
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Generator Sets	0.67	7.20	5.90	0.31	0.28	1217.66
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.34	3.97	2.75	0.15	0.14	760.75
1.00	1	Pavers	0.26	3.55	2.51	0.12	0.11	602.53
	1	Paving Equipment	0.23	3.37	2.12	0.10	0.10	532.71
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rollers	0.22	1.89	2.14	0.12	0.11	349.39
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Signal Boards	0.18	1.20	1.07	0.04	0.04	157.43
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Surfacing Equipment	0.23	4.17	2.62	0.10	0.09	878.04
1.00		Sweepers/Scrubbers	0.20	1.57	1.79	0.12	0.11	270.09
	2	Tractors/Loaders/Backhoes	0.43	3.92	4.21	0.23	0.21	838.04
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	3.8	38.9	34.0	1.7	1.5	7037.3
	Paving	tons per phase	0.0	0.4	0.4	0.0	0.0	77.4
Total Emissions all Phases (tons per construction period) =>			0.7	5.8	6.5	0.3	0.3	1124.7

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10	10.00	8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66	10.00	8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88	10.00	8
Other Material Handling Equipment		167	10.00	8
Pavers		126	10.00	8
Paving Equipment		131	10.00	8
Plate Compactors		8		8
Pressure Washers		26		8
Pumps		53		8
Rollers		81	10.00	8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255	10.00	8
Rubber Tired Loaders		200		8
Scrapers		362	10.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254	10.00	8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

150

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Sac Bypass Widening: BYPASS				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	6.1	60.4	56.6	42.7	2.7	40.0	10.7	2.4	8.3	12,519.5
Grading/Excavation	30.3	271.8	297.2	52.4	12.4	40.0	19.7	11.3	8.3	58,683.4
Drainage/Utilities/Sub-Grade	5.0	44.7	43.3	42.2	2.2	40.0	10.3	2.0	8.3	9,199.0
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	30.3	271.8	297.2	52.4	12.4	40.0	19.7	11.3	8.3	58,683.4
Total (tons/construction project)	1.5	13.1	14.2	3.0	0.6	2.4	1.1	0.5	0.5	2,821.0

Notes: Project Start Year -> 2023
Project Length (months) -> 6
Total Project Area (acres) -> 320
Maximum Area Disturbed/Day (acres) -> 4
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Sac Bypass Widening: BYPASS				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	2.8	27.4	25.7	19.4	1.2	18.2	4.9	1.1	3.8	5,690.7
Grading/Excavation	13.8	123.6	135.1	23.8	5.6	18.2	8.9	5.2	3.8	26,674.3
Drainage/Utilities/Sub-Grade	2.3	20.3	19.7	19.2	1.0	18.2	4.7	0.9	3.8	4,181.4
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	13.8	123.6	135.1	23.8	5.6	18.2	8.9	5.2	3.8	26,674.3
Total (megagrams/construction project)	1.3	11.9	12.9	2.7	0.5	2.2	1.0	0.5	0.5	2,558.7

Notes: Project Start Year -> 2023
Project Length (months) -> 6
Total Project Area (hectares) -> 130
Maximum Area Disturbed/Day (hectares) -> 2
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model **Version 7.1.5.1**

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type		
Project Name	Sac Bypass Widening: BYPASS	
Construction Start Year	2023	Enter a Year between 2009 and 2025 (inclusive)
Project Type	2	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	6.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.00	miles
Total Project Area	320.00	acres
Maximum Area Disturbed/Day	4.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	1.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	4.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	1.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00
Totals	6.00	6.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip		30
Round trips/day		0
Vehicle miles traveled/day (calculated)		0

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.17	1.35	0.77	0.15	0.08	1541.90
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip		20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing		14
No. of employees: Grading/Excavation		29
No. of employees: Drainage/Utilities/Sub-Grade		23
No. of employees: Paving		19

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.093	0.105	0.999	0.047	0.020	441.716
Emission rate - Grading/Excavation (grams/mile)	0.093	0.105	0.999	0.047	0.020	441.716
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.093	0.105	0.999	0.047	0.020	441.716
Emission rate - Paving (grams/mile)	0.000	0.000	0.000	0.000	0.000	0.000
Emission rate - Grubbing/Land Clearing (grams/trip)	0.292	0.154	2.207	0.004	0.004	96.196
Emission rate - Grading/Excavation (grams/trip)	0.292	0.154	2.207	0.004	0.004	96.196
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.292	0.154	2.207	0.004	0.004	96.196
Emission rate - Paving (grams/trip)	0.000	0.000	0.000	0.000	0.000	0.000
Pounds per day - Grubbing/Land Clearing	0.130	0.137	1.344	0.057	0.024	540.946
Tons per const. Period - Grub/Land Clear	0.001	0.002	0.015	0.001	0.000	5.950
Pounds per day - Grading/Excavation	0.272	0.285	2.810	0.119	0.050	1131.069
Tons per const. Period - Grading/Excavation	0.012	0.013	0.124	0.005	0.002	49.767
Pounds per day - Drainage/Utilities/Sub-Grade	0.213	0.223	2.199	0.093	0.039	885.184
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.024	0.001	0.000	9.737
Pounds per day - Paving	0.000	0.000	0.000	0.000	0.000	0.000
Tons per const. Period - Paving	0.000	0.000	0.000	0.000	0.000	0.000
tons per construction period	0.016	0.017	0.163	0.007	0.003	65.454

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions

	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day
Grubbing/Land Clearing - Exhaust	2.00	1		40
Grading/Excavation - Exhaust	2.00	1		40
Drainage/Utilities/Subgrade	2.00	1		40

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.17	1.35	0.77	0.15	0.08	1541.90
Emission rate - Grading/Excavation (grams/mile)	0.17	1.35	0.77	0.15	0.08	1541.90
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.17	1.35	0.77	0.15	0.08	1541.90
Pounds per day - Grubbing/Land Clearing	0.03	0.24	0.14	0.03	0.01	271.70
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	2.99
Pound per day - Grading/Excavation	0.03	0.24	0.14	0.03	0.01	271.70
Tons per const. Period - Grading/Excavation	0.00	0.01	0.01	0.00	0.00	11.95

Pound per day - Drainage/Utilities/Subgrade	0.03	0.24	0.14	0.03	0.01	271.70
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	2.99

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		4	40.0	0.4	8.3	0.1
Fugitive Dust - Grading/Excavation		4	40.0	1.2	8.3	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		4	40.0	0.8	8.3	0.2

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
	1	Crawler Tractors	0.57	5.57	6.27	0.24	0.22	1027.72
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	2	Excavators	0.51	6.97	4.00	0.20	0.18	1431.85
1.00		Forklifts	0.11	0.90	0.97	0.06	0.06	165.47
2.00		Generator Sets	0.62	7.18	5.49	0.27	0.25	1217.66
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Off-Highway Tractors	0.40	5.07	3.36	0.16	0.15	986.29
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Other Construction Equipment	0.90	8.98	8.47	0.44	0.41	1633.88
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Scrapers	2.04	18.17	20.49	0.80	0.74	4028.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Tractors/Loaders/Backhoes	0.40	3.93	3.86	0.19	0.18	838.98
1.00		Trenchers	0.38	2.10	3.36	0.23	0.21	376.96

		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	5.9	58.9	56.3	2.6	2.4	11706.8
	Grubbing/Land Clearing	tons per phase	0.1	0.6	0.6	0.0	0.0	128.8

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
	0	Cranes	0.00	0.00	0.00	0.00	0.00	0.00
4.00	1	Crawler Tractors	2.27	22.27	25.08	0.97	0.89	4110.89
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	3	Excavators	0.77	10.46	6.00	0.29	0.27	2147.78
2.00		Forklifts	0.22	1.80	1.94	0.12	0.11	330.93
2.00		Generator Sets	0.62	7.18	5.49	0.27	0.25	1217.66
	2	Graders	1.28	8.65	11.16	0.61	0.57	1667.45
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Construction Equipment	0.45	4.49	4.24	0.22	0.20	816.94
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
4.00	2	Rollers	0.64	6.04	6.39	0.35	0.32	1118.06
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Rubber Tired Dozers	1.66	8.84	15.69	0.72	0.66	1890.27
3.00	1	Rubber Tired Loaders	0.84	9.35	7.87	0.26	0.24	1988.26
20.00	2	Scrapers	20.36	181.73	204.86	8.03	7.39	40279.99
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	4	Tractors/Loaders/Backhoes	0.80	7.86	7.71	0.38	0.35	1677.96
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	30.0	268.9	296.7	12.2	11.3	57280.6
	Grading	tons per phase	1.3	11.8	13.1	0.5	0.5	2520.3

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.36	3.27	2.43	0.14	0.13	507.95
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00

1.00		Cement and Mortar Mixers	0.07	0.35	0.42	0.02	0.02	57.88
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.36	3.00	3.71	0.15	0.14	601.71
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Forklifts	0.11	0.90	0.97	0.06	0.06	165.47
2.00	1	Generator Sets	0.62	7.18	5.49	0.27	0.25	1217.66
	1	Graders	0.64	4.33	5.58	0.31	0.28	833.72
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.04	0.21	0.25	0.01	0.01	34.45
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pumps	0.22	2.37	1.81	0.09	0.08	396.14
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rough Terrain Forklifts	0.11	2.03	1.41	0.05	0.04	372.94
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
	1	Scrapers	1.02	9.09	10.24	0.40	0.37	2014.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	3	Tractors/Loaders/Backhoes	0.60	5.89	5.78	0.29	0.26	1258.47
1.00		Trenchers	0.38	2.10	3.36	0.23	0.21	376.96
1.00		Welders	0.26	1.67	1.43	0.06	0.05	204.74
	Drainage	pounds per day	4.8	42.4	42.9	2.1	1.9	8042.1
	Drainage	tons per phase	0.1	0.5	0.5	0.0	0.0	88.5

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00

		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Pavers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2	Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	0.0	0.0	0.0	0.0	0.0	0.0
	Paving	tons per phase	0.0	0.0	0.0	0.0	0.0	0.0
Total Emissions all Phases (tons per construction period) =>			1.4	12.9	14.1	0.6	0.5	2737.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		106		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		10		8
Concrete/Industrial Saws		64		8
Cranes		226		8
Crawler Tractors		208	10.00	8
Crushing/Proc. Equipment		142		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		66	10.00	8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172	10.00	8
Other General Industrial Equipment		88	10.00	8
Other Material Handling Equipment		167	10.00	8
Pavers		126	10.00	8
Paving Equipment		131	10.00	8
Plate Compactors		8		8
Pressure Washers		26		8

Pumps		53		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200		8
Scrapers		362	10.00	8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254	10.00	8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		45		8

120

END OF DATA ENTRY SHEET

APPENDIX E
SECTION 404(b)(1) WATER QUALITY EVALUATION
AMERICAN RIVER COMMON FEATURES
GENERAL REEVALUATION REPORT
SACRAMENTO, CALIFORNIA

This document constitutes the Statement of Findings, and review and compliance determination according to the Section 404(b)(1) Guidelines for the proposed project described in the American River Common Features Environmental Impact Statement/Environmental Impact Report (EIS/EIR) issued by the Sacramento District. This analysis has been prepared in accordance with the Section 404(b)(1) Guidelines, 40 CFR Part 230 and the U.S. Army Corps of Engineers (Corps) Planning Guidance Notebook, Engineer Regulation (ER) 1105-2-100.

I. Project Description

a. Proposed Project

The American River Common Features General Reevaluation Report (ARCF GRR) is a cooperative effort by the Corps, the Central Valley Flood Protection Board, the non-federal sponsor, and the Sacramento Area Flood Control Agency, the local sponsor. The Corps completed the ARCF GRR final Environmental Impact Assessment/Environmental Impact Report (EIS/EIR) in September 2015. The final EIS/EIR will be referenced throughout the document to describe the existing conditions in the study area, as well as some potential impacts of the proposed project and the other alternatives.

The ARCF EIS/EIR identifies a number of problems associated with the flood risk management system protecting the city of Sacramento and surrounding areas. There is a high probability that flood flows in the American River and Sacramento River will stress the network of levees protecting Sacramento to the point that levees could fail. The consequences of such a levee failure would be catastrophic, since the area inundated by flood waters is highly urbanized and the flooding could be up to 20 feet deep.

No Action Alternative

The No Action Alternative, under NEPA, is the expected future without-project condition. Under CEQA, the No Action Alternative is the existing condition at the time the notice of preparation was published (February 28, 2008) as modified by what would reasonably be expected to occur in the foreseeable future if the project were not approved. The No Action Alternative assumes that no work would be completed by the Corps and the study area would continue to be at a very high risk of levee failure and subsequent flooding of the Sacramento Metropolitan area. This area includes the California State Capitol and many other State and Federal Agencies. For the purposes of this 404(b)(1) analysis, the No Action Alternative is also the no fill alternative. Under the no fill alternative, no measures would be proposed to place fill material in waters of the U.S. As a result, under the no fill alternative, the levee system's identified erosion problem would not be addressed, and the Sacramento area would remain at risk of a levee failure.

Alternative 1 – Improve Levees

Alternative 1 involves the construction of fix-in-place levee remediation measures to address seepage, slope stability, erosion, and overtopping concerns identified for the American River and Sacramento River, Natomas East Main Drainage Canal (NEMDC), Arcade Creek, and Magpie Creek levees. Table 1 summarizes the measures proposed under Alternative 1.

Table 1. Alternative 1 – Proposed Levee Improvement Measures by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench	---
Sacramento River	Cutoff Wall	Cutoff Wall, Geotextile, Slope Flattening	Bank Protection, Launchable Rock Trench	Levee Raise
NEMDC	Cutoff Wall	Cutoff Wall	---	Floodwall/Levee Raise
Arcade Creek	Cutoff Wall	Cutoff Wall, Geotextiles	---	Floodwall/Levee Raise
Dry/Robla Creeks	---	---	---	Floodwall
Magpie Creek[2]	---	---	---	Floodwall/New Levee/Detention Basin

Notes: [1]American River seepage, stability, and overtopping measures were addressed in the ARCF WRDA 1996 and 1999 construction projects. [2]In addition to the listed measures, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

Figure 1 shows the reaches where seepage, slope stability, erosion, and overtopping measures would be required.

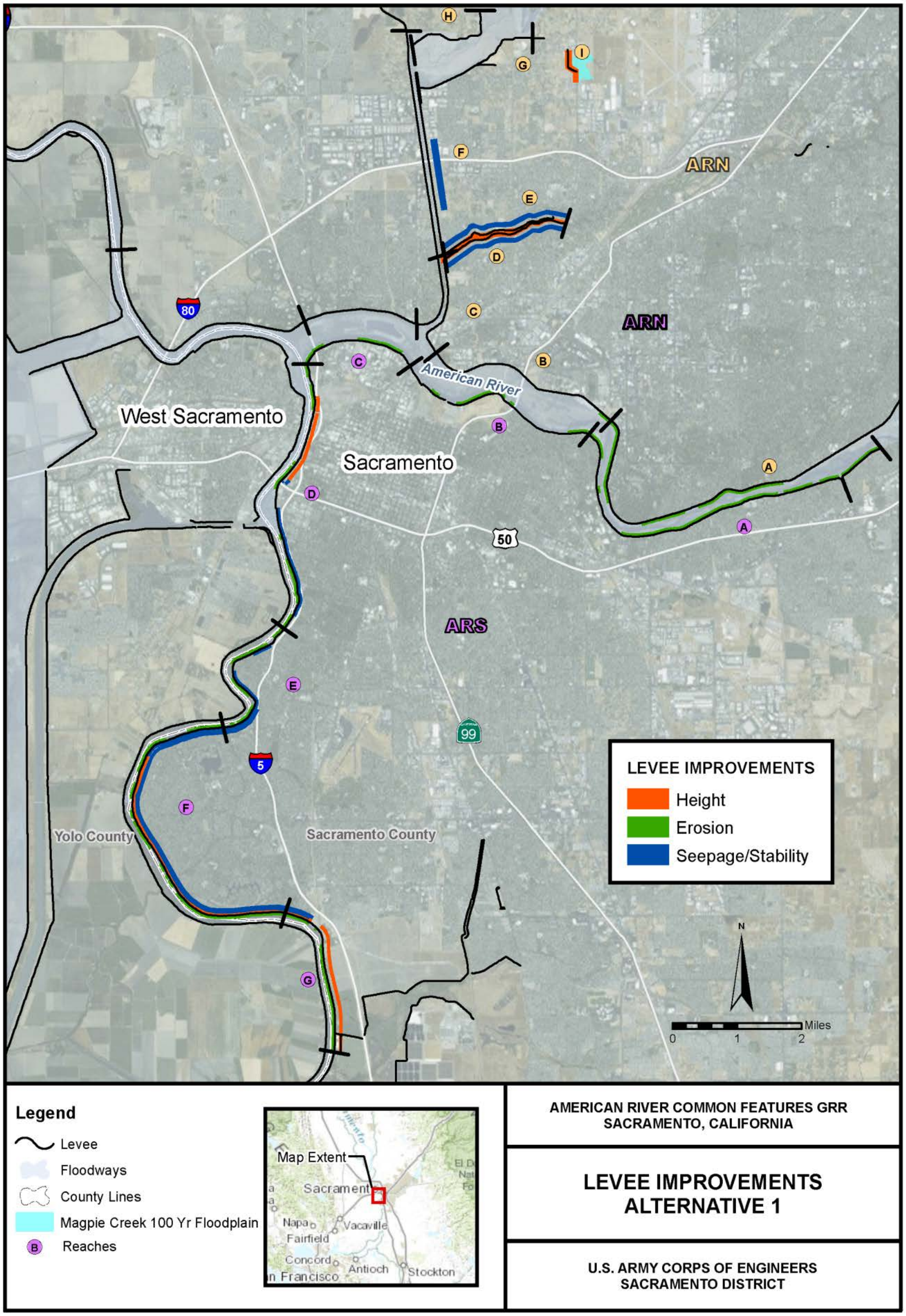

Figure 1. Alternative 1 Proposed Measures.

The proposed project would require discharge of fill material into waters of the U.S. The following subsections describe the measures proposed for Alternative 1 and identify any possible discharge of fill material associated with each measure.

Seepage and Slope Stability Measures

To address seepage concerns, a cutoff wall would be constructed through the levee crown. The cutoff wall would be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall construction selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of approximately 80 feet. For cutoff walls of greater depth, the DSM method would be utilized. Prior to construction of the cutoff wall, the construction site and any staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded up to half the levee height to create a large enough working platform (approximately 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids.

This measure is proposed along the Sacramento River, the east bank of the NEMDC, and Arcade Creek. Because seepage and slope stability measures would be installed directly into the levee as a cutoff wall, no fill material would be placed into waters of the U.S. by implementing this measure.

Erosion Protection

Erosion protection along the American River and Sacramento River would be addressed via either the launchable rock trench method or by standard bank protection. There are no erosion protection measures proposed for the East Side Tributaries. The erosion protection measures would involve the placement of fill into waters of the U.S. Construction methods for the bank protection and launchable rock trench measures are described in Section h below.

Overtopping Measures

Levee raises are proposed for the Sacramento River and the East Side Tributaries to address the potential for floodwaters overtopping the levees. For the Sacramento River, Arcade Creek, and NEMDC, there would be no placement of fill into waters of the U.S., because levee raises would be conducted primarily on the crown and landside of the levees and would be designed to avoid placement of fill in the waterways. At Magpie Creek, there is the potential for approximately 0.25-acre of vernal pool habitat on the landside of the levee to be permanently impacted by construction of a levee raise. Construction methods for the levee raise are described in Section h below.

Alternative 2 – Improve Levees and Widen the Sacramento Weir and Bypass

Alternative 2 includes all of the measures proposed under Alternative 1, with the exception of the approximately 7 miles of levee raises on the Sacramento River. Instead, under Alternative 2, the Sacramento Weir and Bypass would be widened to lower the water surface elevations on the Sacramento River to a level that would only require approximately 1 mile of levee raises and would divert more flows into the Yolo Bypass. Table 2 shows the measures that would be implemented under Alternative 2. Figure 2 shows the project area and extent of proposed measures under Alternative 2.

Table 2. Alternative 2 - Proposed Levee Improvement Measures by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench	---
Sacramento River	Cutoff Wall	Cutoff Wall, Geotextile, and Slope Flattening	Bank Protection, Launchable Rock Trench	Sacramento Bypass and Weir Widening
NEMDC	Cutoff Wall	Cutoff Wall	---	Floodwall/Levee Raise
Arcade Creek	Cutoff Wall	Cutoff Wall, Geotextile	---	Floodwall/Levee Raise
Magpie Creek[2]	---	---	---	Floodwall/New Levee/Detention Basin

Note: [1] American River seepage, stability, and overtopping measures were addressed in the American River Common Features, WRDA 1996 and 1999 construction projects.
[2]In addition to the listed measures, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

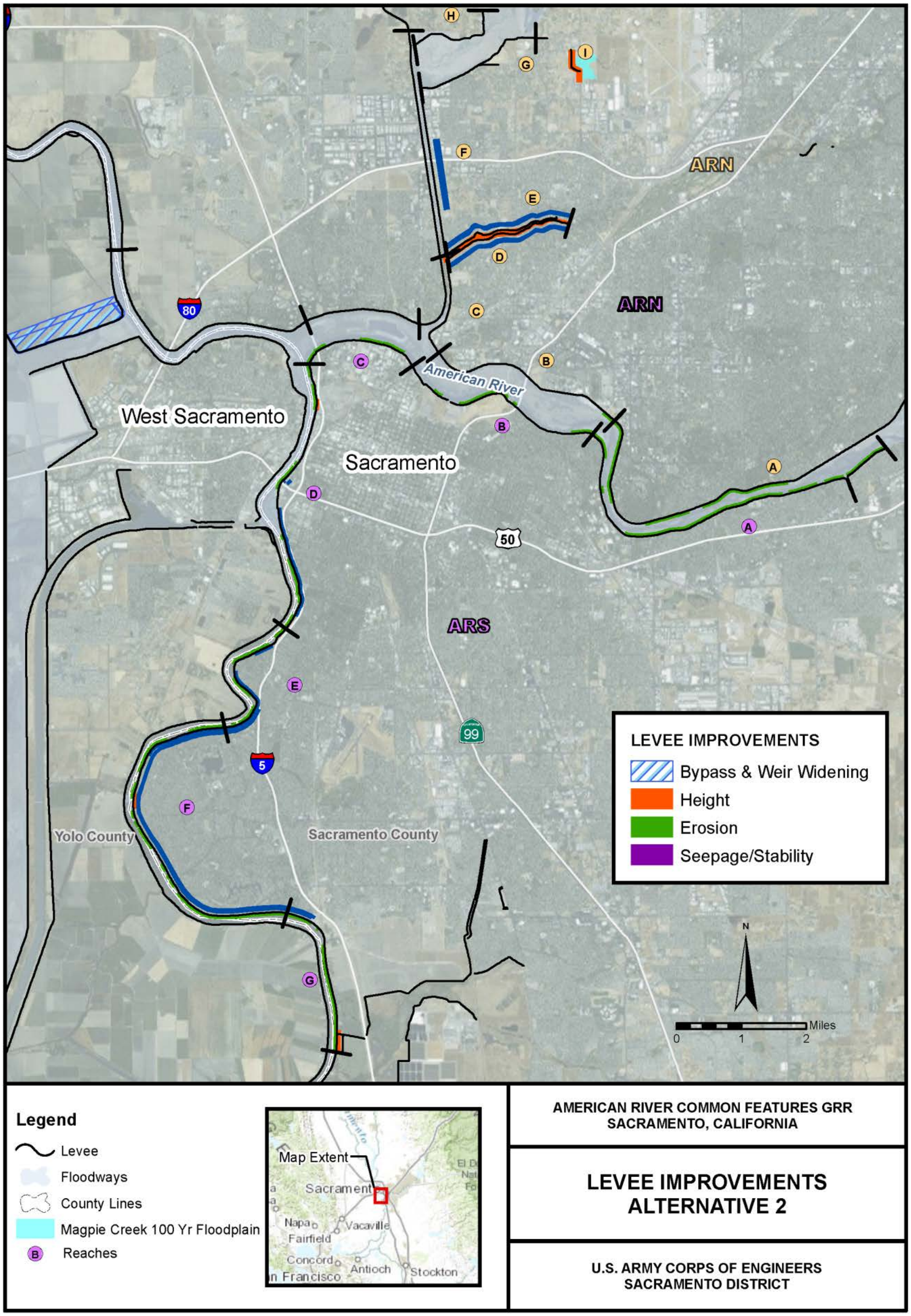

Figure 2. Alternative 2 Proposed Measures.

Sacramento Weir and Bypass Widening

The Sacramento Bypass and Weir currently allow excess flood waters to spill out of the system into the Yolo Bypass thereby reducing the loading on the levee system below. Alternative 2 leverages this existing structure by constructing a new weir structure, and relocating the levee 1,500 feet to the north. The existing weir would not be altered under this measure. The weir, combined with the increased bypass width and operations change, would allow more water to be released out of the system eliminating the need for most of the height improvements along the ARS sub-basin, Reaches D to G. However, this alternative does not reduce the need for seepage, stability and erosion improvements within those reaches. Relocation of the Sacramento Bypass levee would result in the placement of fill in waters of the U.S. Construction methods for this measure are described in Section h below.

<u>b. Location</u>

The proposed project is located in and around the city of Sacramento, California. The ARCF GRR study area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the NEMDC, Arcade Creek, and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento. Figure 1 shows the proposed study area for Alternative 1 and Figure 2 shows the Alternative 2 study area, which includes the additional measures to the Sacramento Weir and Bypass.

<u>c. Purpose and Need</u>

The purpose of this project is to reduce the flood risk and damage in the greater Sacramento area. The Sacramento Metropolitan area is one of the most at risk areas for flooding in the United States. There is a high probability that flows in either the American River or Sacramento River would stress the network of levees protecting the study area to the point that levees could fail. The consequences of such a levee failure would be catastrophic since the inundated area is highly urbanized and the flooding could be up to 20 feet deep. Providing flood damage reduction would reduce loss of life and damage to property in the project area.

The Sacramento metropolitan area has a high probability of flooding due to its location at the confluence and within the floodplain of two major rivers. Both of these rivers have large watersheds with very high potential runoff which has overwhelmed the existing flood management system in the past. The existing levee system was designed and built many years ago, before modern construction methods were employed. These levees were constructed close to the river, which increases velocities associated with flood flows. This results in increased erosion of levees, which are critical components of the flood management system needed to reduce the flood risk in the study area.

In addition to the high probability of flooding, the consequences of flooding in the study area would be catastrophic. The flooding would rapidly inundate a highly urbanized area with minimal warning or evacuation time. As the Capital of California, the Sacramento metropolitan area is the center of State government and many essential statewide services are located here. The study area is also at the crossroads of four major highway/interstate systems that would be impassable should a flood occur. The effects of flooding within the study area would be felt not only at the local level, but at the regional, State, and National level as well.

Because of the deposits of hydraulic mining debris that washed into the American River and Sacramento River valleys, early levee builders constructed the flood management features by dredging material from the river beds and placing it on the bank near the river. This served several purposes. First, the resulting levee provided a degree of protection from flooding. Second, it removed material from the river bed, allowing it to convey more water. And finally, by placing the levees close to the river's edge, the river flow was confined, speeding its flow, and causing it to erode away the material that had been deposited by hydraulic mining, further increasing the river's capacity.

The levees continue to confine the flow into a relatively narrow channel, still eroding and degrading the river channel. However, by now, most of the sediment deposited in the river channels has been removed. Both the Sacramento River and the American River are confined by levees and have very little sediment in the water. Additionally, on the American River, Folsom Dam blocks sedimentation from upstream sources. Therefore, the energy of the flow tends to erode riverbanks and levees. This channel erosion and degradation could have detrimental effects on the levees by undercutting the foundation materials beneath the levees, particularly if the riverbank consists of easily erodible materials. The erosion of the riverbank adjacent to levee embankments may increase the underseepage through the foundation soils. It can also reduce the stability of the levee slopes by undermining the levee embankment and eroding the levees themselves. Significant erosion can lead to the failure of the levee.

Empirical evidence and prototype experiments indicate that stream bank erosion in the area can be gradual or episodic. That is to say, some erosion occurs almost every year. This is primarily due to the fact that materials have been placed on the banks by landowners in an effort to halt erosion. These materials are generally random materials, placed without regard to engineering standards. The Sacramento District is currently evaluating erosion trends as part of the Sacramento River Bank Protection Project (SRBPP).

d. Authority

The authority for the Corps to study water resource related issues in the American and Sacramento Rivers is Section 209 of the Flood Control Act of 1962, Pu. L. No.87-875, § 209, 76 Stat. 1180, 1196-98 (1962). The EIS/EIR for the project was prepared as part of the interim general reevaluation study of the ARCF Project, which was authorized by Section 130 Section 130 of the Energy and Water Development and Related Agencies Appropriations Act of 2008, Pub. L. No. 110-161, § 130, 121 Stat. 1844, 1947 (2007). Additional authority was provided in Section 366 of WRDA of 1999. WRDA 1999, Pub. L. No. 106-53, § 366, 113 Stat. 269, 319-320 (1999). Significant changes to the project cost were recommended in the Second Addendum to the Supplemental Information Report of March 2002. This report was submitted to the Assistant Secretary of the Army for Civil Works, but before it could be forwarded to Congress, authorized total cost of the project was increased to $205,000,000 by Section 129 of the Energy and Water Development Appropriations Act of 2004, Pub. L. No. 108-137, § 129, 117 Stat. 269, 1839 (2003). The current estimated cost of the authorized project is $305,340,000. The allowable cost limit is $307,071,000.

e. Alternatives [40 CFR 230.10]

Unless otherwise noted, the information is from the September 2015 American River Common Features EIS/EIR.

(1) No action:

The No-Action Alternative is also the no fill alternative. The No Action Alternative assumes that no work would be completed by the Corps that would result in placement of fill in waters of the U.S. As a result, the identified erosion problem would not be addressed and the study area would continue to be at a very high risk of levee failure and subsequent flooding of the Sacramento Metropolitan area. Although the No Action Alternative would have no impacts on waters of the U.S., it does not meet the project purpose since it does not address the flood risk in the study area, and is, therefore, not considered to be one of the least environmentally damaging practicable alternatives (LEDPA).

(2) Other project alternatives:

Alternative 1 – Improve Levees

Alternative 1 involves the construction of fix-in-place levee remediation measures to address seepage, slope stability, erosion, and overtopping concerns identified for the American and Sacramento River, NEMDC, Arcade Creek, and Magpie Creek levees. A complete summary of the measures proposed under Alternative 1 can be found above in Table 1. The project area for Alternative 1 is shown above in Figure 1. This action is considered a practicable alternative and will be retained and evaluated in determining the LEDPA.

Alternative 2 – Improve Levees and Widen the Sacramento Weir and Bypass

Alternative 2 would include all of the levee improvements described for Alternative 1, except that instead of approximately 7 miles of levee raises along the Sacramento River there would be approximately 1 mile of levee raises. Instead of the full extent of levee raises, the Sacramento Weir and Bypass would be widened to divert more flows into the Yolo Bypass, as described above. A complete summary of the proposed measures can be found in Table 2 above. The project area for Alternative 2 is shown above in Figure 3. This action is considered a practicable alternative and will be retained and evaluated in determining the LEDPA.

f. General Description of Dredged or Fill Material

(1) General Characteristics of Material

Erosion Protection

Erosion protection measures would involve the discharge of fill material into waters of the U.S. Fill materials for erosion protection would consist of large stone riprap, ranging from 18 to 36 inches, to armor the waterside slope, or to construct a launchable rock trench, with a fine sand or silt fill over the top to allow for vegetation planting. The proposed sand or silt for the erosion protection measures would come from clean, imported fill material.

Overtopping Measures

The implementation of levee raises at Magpie Creek would involve the discharge of fill material into waters of the U.S. Fill materials for levee raises would be silty and clayey soils with a minimum content of 20% fine particles, a Liquid Limit less than 45, and a plasticity index between 7 and 15. No organic material or debris may be present in the soil. The proposed soil would be clean and would be imported from either a tested and approved borrow site, or from an commercial source.

Sacramento Bypass Widening

Relocation of the Sacramento Bypass north levee, as part of the Sacramento Bypass widening, would involve placement of fill into waters of the U.S. Fill materials associated with this action would consist of silty and clayey soils with a minimum content of 20% fine particles, a Liquid Limit less than 45, and a plasticity index between 7 and 15. No organic material or debris may be present in the soil. The proposed soil would be clean and would likely consist of the current Sacramento Bypass north levee soils, as the existing levee material is proposed for reuse to the maximum extent practicable. Any borrow material necessary would be clean and would be imported either from a tested and approved borrow site, or from a commercial source.

(2) Quantity of Material

Erosion Protection

Approximately 2.75 million tons of rock would be required to construct bank protection sites on the American River and Sacramento River. This would result in approximately 11 miles of bank protection fill on the American River and approximately 10 miles on the Sacramento River. Approximately 17 acres of fill would be placed in the American River. Approximately 15 acres of fill would be placed into the Sacramento River. Additionally, approximately 0.4 acre of wetland would be impacted by construction of a proposed launchable rock trench on the south bank of the American River.

Overtopping Measures

Approximately 0.25 acre of soil fill would be placed in waters of the U.S. to construct the levee raise at Magpie Creek.

Sacramento Weir and Bypass

There are approximately 14 acres of soil that would be placed in farm canals and drainage ditches in the widened Sacramento Weir and Bypass area. However, the widened Sacramento Bypass area of approximately 325 acres would become permanent waters of the U.S., therefore the effect from this measure could be offset by the new floodplain habitat created within the widened bypass, due to the potential for natural establishment of wetlands within this area.

(3) Source of Material

Erosion Protection

Riprap for bank protection, seepage berms, and adjacent levees would be imported from a licensed, permitted facility that meets all Federal and State standards and requirements. The material would be transported along either existing roadways and construction access roads, or for Sacramento River sites could be imported via river barge hauling.

Overtopping Measures

Potential locations for borrow material, soil maps and land use maps were obtained for a 25-mile radius surrounding the project area. Borrow sites would be lands that are the least environmentally damaging and would be obtained from willing sellers. Material would be excavated from upland areas and not waterways, wetlands, or water bodies. The criteria used to determine potential locations were based on current land use patterns, soil types from Natural Resources Conservation Service (NRCS), and Corps' criteria for material specifications. The data from land use maps and NRCS has not been field verified, therefore, to ensure that sufficient borrow material would be available for construction the Corps looked at all locations within the 25 miles radius for 20 times the needed material. This would allow for sites that do not meet specifications or are not available for extraction of material.

It is estimated that a maximum of 1 million cubic yards (CY) of borrow material (soil) could be needed to construct the project. Because this project is in the preliminary stages of design, detailed studies of borrow material needs for each alternative have not been completed. For the purposes of

NEPA/CEQA, the analysis evaluates the maximum foreseeable volume of borrow material that could be needed to construct the project. Actual volumes exported from any single borrow site would be adjusted to match demands for fill. The source of the material would come from inland areas (i.e. rock quarries).

The excavation limits on the borrow sites would provide a minimum buffer of 50 feet from the edge of the borrow site boundary. From this setback, the slope from existing grade down to the bottom of the excavation would be no steeper than 3H:1V. Excavation depths from the borrow sites would be determined based on available suitable material and local groundwater conditions. The borrow sites would be stripped of top material and excavated to appropriate depths. Once material is extracted, borrow sites would be returned to their existing use whenever possible, or these lands could be used to mitigate for project impacts, if appropriate. Waters of the U.S. would not be impacted by source material being used.

Sacramento Weir and Bypass

Soil necessary for the Sacramento Weir and Bypass levee relocation would be reused from the existing levee and the footprint of the new Sacramento Bypass. Any additional borrow soil needed would be acquired through the methods discussed above for Overtopping Measures.

g. Description of the Proposed Discharge Site

(1) Location

Erosion Protection

Erosion protection measures would be constructed along approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River. In addition, there would be construction along the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento. On the American River south levee, a short stretch of launchable rock trench is proposed for an area that includes wetlands adjacent to the levee.

Overtopping Measures

Overtopping measures are proposed along the west bank of the Magpie Creek Diversion Canal from just downstream from Raley Boulevard to about 100 feet south of Vinci Avenue Bridge.

Sacramento Weir and Bypass

The Sacramento Bypass is located in Yolo County approximately 4 miles west of Sacramento along the northern edge of the city of West Sacramento. The Sacramento Weir runs along the west bank of the Sacramento River and separates the river from the Bypass. The Sacramento Bypass is located in a rural area owned by the State of California and operated as the Sacramento Bypass Wildlife Area. The area proposed for the Sacramento Bypass widening is currently active farm fields which include row crops and newly planted nut orchards. A series of farm canals and drainage ditches separate the fields in this area.

(2) Size

Erosion Protection

Approximately 17 acres of fill would be placed in the American River. Approximately 15 acres of fill would be placed into the Sacramento River.

Overtopping Measures

Approximately 1 acre of fill would be placed in vernal pool habitat.

Sacramento Weir and Bypass

Approximately 14 acres of fill would be placed in canals and drainage ditches in the widened Sacramento Bypass.

(3) Type of Site

Erosion Protection

To construct the erosion protection measures, riprap would be placed in the American River and Sacramento River along the waterside slope of the levee. Additionally, on the south bank of the American River, a trench comprised of riprap would be buried adjacent to the levee.

Overtopping Measures

To construct the levee raise along the Magpie Creek levee, soil would be placed along the landside of the levee in vernal pool habitat.

Sacramento Weir and Bypass

To relocate the Sacramento Bypass levee and grade the bypass area, soil would be placed in canals and drainage ditches.

(4) Type of Habitat

Erosion Protection

Habitat types along the footprint of the bank protection measures include valley foothill riparian habitat and open water habitat. These habitat types are described below.

Valley Foothill Riparian Habitat. Valley foothill riparian habitat occurs along the Sacramento and American River levees. The overstory of the riparian habitat consists of mature, well-established trees: Fremont cottonwood (*Populus fremontii ssp. fremontii*), valley oak (*Quercus lobata*), black willow (*Salix gooddingii*), and box elder (*Acer negundo var. californicum*). During the reconnaissance-level field visits, Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), and white alder (*Alnus rhombifolia*) were also observed. The shrub layer consists of smaller trees and shrubs; representative species observed were poison oak (*Toxicodendron diversilobum*), sandbar willow (*Salix exigua*), and Himalayan blackberry (*Rubus discolor*). Elderberry shrubs (*Sambucus mexicana*), the host plant of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), which is Federally listed as threatened, were observed in the riparian habitat along the Sacramento River north and south levees. Riparian habitat is listed as a sensitive natural community by the CNDDB (2009).

Open Water. The American River and Sacramento River are located within the study area and would both be impacted by placement of fill into waters of the U.S. Both of these rivers are navigable waterways that are jurisdictional under Section 404 of the Clean Water Act.

Wetlands. Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas (40 CFR 230.3[t]). Representative species observed in seasonal wetlands include Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), Italian ryegrass (*Lolium multiflorum*), water pepper (*Persicaria hydropiperpoides*), and alkali mallow (*Malvella leprosa*). Wetlands in the study area are assumed to be jurisdictional waters of the United States subject to regulation under CWA Section 404. Within the study area, wetlands also include features such as drainage ditches and farm canals, vernal pools, and open water habitat such as rivers and creeks. Vernal pools are discussed further in Section 3.8. Wetlands and vernal pools are considered sensitive habitats under CEQA.

Overtopping Measures

Habitat types in the footprint of the levee raises at Magpie Creek include potential vernal pool habitat. Vernal pool habitat is described below.

Vernal Pools. Vernal pools are depressions in areas where a hard underground layer prevents rainwater from draining downward into the subsoils. When rain fills the pools in the winter and spring, the water collects and remains in the depressions. In the springtime the water gradually evaporates away, until the pools become completely dry in the summer and fall. Vernal pools support plants and animals that are specifically adapted to living with very wet winter and spring conditions followed by very dry summer and fall conditions. The pools are most beautiful in the spring, when many specially-adapted flowering plants are in full bloom following initial evaporation of surface water. Almost all plants that occur in vernal pools are annuals, meaning they germinate, flower, set seed, and die all within one year. Many vernal pool plant species have seeds that can remain dormant for many years, an adaptation that allows them to survive through periods of drought. Many specially-adapted crustaceans, amphibians, and insects also occur only in vernal pools.

Sacramento Weir and Bypass

Habitat types in the expanded Sacramento Weir and Bypass area include primarily agricultural habitats, such as irrigated grain, row, and field crops. The habitat impacted by placement of fill is primarily open water habitat, as described above for the bank protection sites, in the form of small canals and drainage ditches.

(5) Timing and Duration of Discharge

Erosion Protection

The construction schedule for the ARCF project was estimated based on a 3 month construction window per year due to logistical constraints. Construction would likely occur during the summer months due to special status species work windows and the flood season. Construction of erosion protection measures on the American River would take approximately 9 years. Construction of the overall work proposed for the Sacramento River, including the seepage, slope stability, and height improvements, would take approximately 8 years, with bank protection construction occurring intermittently throughout that time frame.

Overtopping Measures

Construction of the levee raises at Magpie Creek would occur in one construction year. Similar to the erosion protection schedule discussed above, this schedule assumes a 3 month construction window. Construction would likely occur during the summer months due to special status species work windows and the flood season.

Sacramento Weir and Bypass

Relocation of the Sacramento Bypass levee would occur in one construction year. Similar to the erosion protection schedule discussed above, this assumes a 3 month construction window. Construction would likely occur during the summer months due to special status species work windows and the flood season.

h. Description of Disposal Method

Erosion Protection

Erosion protection along the American River and Sacramento River would be addressed via either the launchable rock trench method or by standard bank protection. There are no erosion protection measures proposed for the East Side Tributaries. Construction methods for the bank protection and launchable rock trench measures are described below.

Bank Protection

This measure consists of placing riprap on the river's bank, and in some locations on the levee slope, to prevent erosion (Figure 3). Bank protection is proposed along the American River and Sacramento River and would result in the placement of fill in waters of the U.S. Construction methods are described below.

When necessary, the eroded portion of the bank would be filled and compacted prior to the rock placement. The sites would be prepared by clearing and stripping the site prior to construction. Small vegetation and loose materials would be removed. In most cases, large vegetation would be permitted to remain at these sites. Temporary access ramps would be constructed, if needed, using imported borrow material that would be trucked on site.

Riprap would be imported from an offsite location via haul trucks and temporarily stored at a staging area located in the immediate vicinity of the construction site. A loader would be used to move riprap from the staging area to an excavator that would be placing the material. The excavator would place a large rock berm in the water up to an elevation slightly above the mean summer water surface. A planting trench would be established on this rock surface for revegetation purposes. The excavator would either be working from the top of the bank placing riprap on the bank beneath it and in the water, or from on top of the rock berm that it established.

The placement of rock onto the levee slope would occur from atop the levee. Rock placement from atop the levee would require one excavator and one loader for each potential placement site. The loader would then bring the rock from a staging area to the excavator and the excavator then places it on the waterside of the levee slope

The riprap would be placed on the existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After riprap placement has been completed, a small planting berm would be constructed in the rock where feasible to allow for some revegetation of the site, outside of the vegetation free zone required by ETL 1110-2-583. This vegetation would be designed on a site specific basis to minimize the O&M responsibility of the LMA and in such a way to not impact the hydraulic conveyance of the channel.

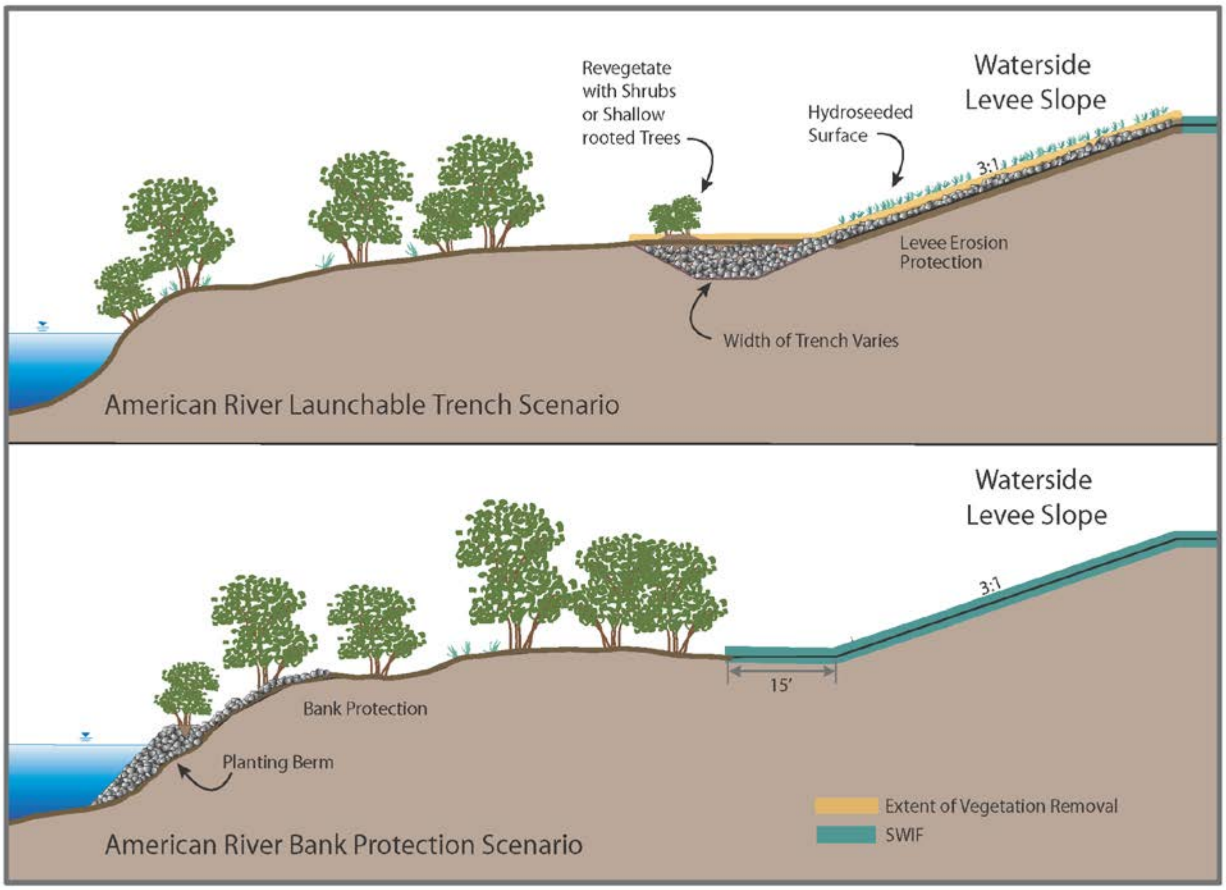

Figure 3. Erosion Protection Measures Typical Design.

Launchable Rock Trench

This measure includes construction of a launchable rock filled trench, designed to deploy once erosion has removed the bank material beneath it (Figure 3). All launchable rock trenches would be constructed outside of the natural river channel. As a result, launchable rock trenches would be above the ordinary high water mark and fill materials would not be placed into waters of the U.S. However, this measure is described in detail below because it is a practicable alternative to the bank protection measure.

The vegetation would be removed from the footprint of the trench and the levee slope prior to excavation of the trench. The trench configuration would include a 2:1 landside slope and 1:1 waterside slope and would be excavated at the toe of the existing levee. All soil removed during trench excavation would be stockpiled for reuse or disposal. The bottom of the trench would be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and amount of rock required.

After excavation, the trench would be filled with riprap that would be imported from an offsite location. After rock placement the trench would be covered with a minimum of 3 feet of the stockpiled soil to allow for planting over the trench. Rock placed on the levee slope would be covered with the stockpiled soil. All disturbed areas would be reseeded with native grasses and small shrubs where appropriate. Some vegetation could be permitted over the trench if planted outside the specified vegetation free zone required by ETL 1110-2-583. This vegetation would likely be limited to native grasses, shrubs, and trees with shallow root systems to ensure that they do not limit the functionality of the trench during a flood event.

Overtopping Measures

To begin levee raising, the area would be cleared, grubbed, stripped, and, where necessary, portions of the existing embankment would be excavated to allow for bench cuts and keyways to tie in additional embankment fill. Excavated and borrow material (from nearby borrow sites) would be stockpiled at staging areas. Haul trucks or scrapers would bring borrow materials to the site, which would then be spread evenly and compacted according to levee design plans. The existing levee centerline would be shifted landward, where necessary, in order to meet the Corps' standard levee footprint requirements. The levee crown patrol road would be re-established and a new toe access corridor would be added 10 feet landward of the levee toe in areas where levee raises are required.

Sacramento Weir Bypass

For this alternative, the existing north levee of the Sacramento Bypass would be degraded and a new levee constructed approximately 1,500 feet to the north. A new weir would be extended north of the existing Sacramento Weir without impacting the existing structure. The new weir would be extended approximately 1,500 feet and include a seepage cutoff wall below. The increase in Bypass flows through the new weir would occur during high water events only, when the flow released from Folsom Dam on the American River exceeds 115,000 cfs. The existing Sacramento Weir and Bypass would be operated consistent with current conditions based on the stage at the I Street gage.

The new north levee of the Sacramento Bypass would be constructed per new levee construction standards, including 3H:1V waterside and landside slopes and a minimum crest width of 20 feet. As both the existing north and south levees have experienced underseepage and slope stability related distress, the new north levee would include a 300-foot wide drained landside seepage berm (5 feet thick at the landside levee toe tapering to 3 feet thick at the berm toe and constructed of random fill with a 1.5-foot thick drainage and filter layer at the base) with a system of relief wells located at least 15 feet landward of the berm toe and spaced at 200-foot intervals. Existing infrastructure, including roads, railways, canals, and pump stations would be relocated to maintain current operation. Placement of fill into waters of the U.S. would occur as a result of the relocation of canals and drainage ditches associated with the Bypass widening.

II. Factual Determinations

a. Physical Substrate Determinations (Sections 230.11 (a) and 230.20)

(1) Comparison of Existing Substrate and Fill

The project area generally consists of deep soils derived from alluvial sources, which range from low to high permeability rates and low to high shrink-swell potential. Soils immediately adjacent to the Sacramento River are dominated by deep, nearly level, well-drained loamy and sandy soils. The natural drainage is good, and the soils have slow to moderate subsoil permeability. The river terraces consist of very deep, well drained alluvial soils. The porous nature of the soils underneath the existing levee system is an important consideration for the design of levee improvements within the ARCF GRR study area. The major source of sediments deposited in the ARCF GRR study area is from the erosion of the Sierra Nevada mountain range and foothills to the east of the Sacramento Valley. Naturally occurring asbestos (NOA) is known to occur in the foothill metamorphic belt. Therefore, NOA may be present; however, the likelihood of project area soils containing significant concentrations of NOA is low due to the long distance from the source rock.

As discussed in Section I.f(1) above, fill material for bank protection construction would consist of large stone riprap ranging from 18 to 36 inches, to armor the waterside slope, with a fine sand or silt fill over the top to allow for vegetation planting on the berms. Approximate size of the berms would be 5 feet thick at the berm toe and construction of random fill with a 1.5-foot thick drainage and filter layer at the base). The proposed sand or silt for the bank protection would come from clean, imported fill material. The fill material for the overtopping measures and the Sacramento Bypass levee relocation would consist of silty and clayey soils with a minimum content of 20% fine particles, a liquid limit less than 45, and a plasticity index between 7 and 15. No organic material or debris may be present in the soil. The proposed soil would be clean and would be imported from either a tested and approved borrow site, or from an commercial source.

(2) Changes to Disposal Area Elevation

Erosion Protection

Due to the placement of rock bank protection along the river banks, there would be an increase in elevation of approximately 1.5 feet in the locations where fill is placed in the waters of the U.S. Launchable rock trenches would be buried beneath the surface and would not result in a change in elevation.

Overtopping Measures

Raising the Magpie Creek levee would increase the ground elevation in the footprint of the fill placement by anyway from a few inches to a few feet, depending on the slope of the levee.

Sacramento Weir and Bypass

There would be a significant increase in elevation in the footprint of the new Sacramento Bypass levee, as the levee would be constructed above the existing ground surface elevation.

(3) Migration of Fill

Erosion Protection

The erosion repairs within the project area is likely to somewhat reduce the sediment supply for riverine reaches directly downstream because the riprap would hold the bank or levee in place. However, from a system sediment perspective, the bank material that would be protected in the project reaches is not a major source of sediment compared to the upstream reaches of the Sacramento, Feather, and, especially, the Yuba River systems.

A typical bank protection site has an approximate life span of 50 years. Over that time period, there would be a natural erosion and migration of fill occurring at the site; however it would occur at a slightly slower rate than natural conditions if no bank protection were to occur. Riprap established along the waterside levee toe is designed to stay in place and prevent further erosion. However, there is a possibility that there may be slight degradation or migration of riprap material over the years as well. The sites would be designed to avoid significant migration of newly placed fill through the use of geotextiles and the establishment of on-site vegetation.

Sediment associated with the launchable rock trench measure is not expected to migrate over time. The soil placed on the trench would be compacted and vegetation would be established to avoid long-term erosion impacts.

Overtopping Measures

Sediment associated with the levee raise at Magpie Creek is not expected to migrate over time. The soil placed would be compacted and would be seeded with natural grasses to avoid long-term erosion impacts.

Sacramento Weir and Bypass

Sediment placed to construct the relocated Sacramento Bypass levee is not expected to migrate over time. The Bypass is dry the majority of the time. During a flood event there would be some natural erosion associated with flood flows in the bypass, however, the levee would be constructed in a manner to ensure that it would not significantly degrade during a typical flood event.

(4) Duration and Extent of Substrate Change

Erosion Protection

There would be a permanent change of substrate on the riverbanks from alluvial soils to stone riprap. However the rock berms would be covered with a silty or sandy layer of soil in order to allow for the planting of vegetation along the river banks. This silty or sandy layer of soil would be of a similar substrate type to the existing condition. The launchable rock trench measure would result in a change in substrate of approximately 0.4-acre from undrained hydric soils to buried stone riprap with a silty or sandy layer of soil on the surface to allow for revegetation of the site.

Overtopping Measures

There would be a permanent change of substrate from vernal pool hardpan soils to the silty clayey soils described above for levee construction.

Sacramento Weir and Bypass

There would be a permanent change of substrate in the drainage canals to the silty clayey soils described above for levee construction. However, relocation of the Sacramento Bypass levee would not substantially alter the majority of the soil in the footprint of the new levee construction. Since the existing levee would be used to construct the new levee, and the borrow material used in the levees likely originated in the Bypass footprint, these soils would be consistent with the soil content of the overall area.

(5) Changes to Environmental Quality and Value

Alternative 1 would result in potential impacts to water quality, including increased turbidity during bank protection construction, runoff of exposed soils, and cement, slurry, or fuel spills during construction. Emissions from construction equipment, haul trucks, and barges also pose a potential impact to environmental quality and value during the duration of construction activities. BMPs would be implemented during construction to reduce these impacts to less than significant. There would be a permanent change in substrate in the footprint of the erosion protection areas; however these sites would be designed to be as consistent as feasible with natural riverbanks through the placement of silt over the rock layer and the planting of on-site shrubby vegetation and native grasses. To the extent feasible, large trees on the lower waterside slope would be left in place to maintain shaded riverine aquatic habitat for special-status fish species and new vegetation would be established to provide mitigation for vegetation that must be removed in order to construct the project.

Alternative 2 would reduce water surface elevation in the Sacramento River downstream of the confluence of the American River without significantly increasing water surface elevation in the Yolo Bypass downstream of the confluence of the Sacramento Bypass. Impacts associated with the placement of fill in waters of the U.S. to water quality, air quality, vegetation, and listed fish species are the same as discussed above for Alternative 1, with the addition of the 14 acres of canals and drainage ditches that would be permanently impacted as part of the Sacramento Bypass widening. However, Alternative 2 would also create approximately 300 acres of new floodplain habitat within the widened Sacramento Bypass. Impacts to existing soil and substrate conditions are the same as Alternative 1.

(6) Actions to Minimize Impacts

The following mitigation measures would be used during construction of Alternative 1 to reduce impacts to environmental quality:

- Prior to construction, the Corps or its contractor would be required to acquire all applicable permits for construction.
- Prior to construction, a Stormwater Pollution Protection Plan (SWPPP), Spill Prevention Control and Countermeasures Plan, and a bentonite slurry spill contingency plan would be prepared, and best management practices (BMPs) would be proposed to reduce potential erosion and runoff during rain events.
- Minimize ground and vegetation disturbance during project construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of any grading operations.

- After construction of the flood risk management features is completed, the direct effects to habitat for special status species would be compensated in accordance with the Biological Opinions. Mitigation plantings would be monitored during the plant establishment period for success. Successful habitat mitigation would compensate for significant effects to vegetation, wildlife, special status species, and aesthetic resources.
- BMPs, including the Sacramento Metropolitan Air Quality Management District's Basic Construction Emission Control Practices, would be implemented to reduce emissions of criteria pollutants and greenhouse gases and to reduce potential effects to air quality and associated with climate change.
- During construction, noise-reducing measures would be employed in order to ensure that construction noise complies with local ordinances. Prior to the start of construction, a noise control plan would be prepared that would identify feasible measures to reduce construction noise, when necessary.
- Coordination with recreation user groups would occur prior to and during construction for input into mitigation measures that would reduce affects to the maximum extent practicable. Advance notice would be given to recreation users informing them of anticipated activities and detours to reduce the affects. To ensure public safety, flaggers, warning signs, and signs restricting access would be posted before and during construction, as necessary. In the event that bike trails would be disrupted, detours would be provided. Detour routes would be clearly marked, and fences would be erected in order to prevent access to the project area. In areas where recreational traffic intersects with construction vehicles, traffic control will be utilized in order to maintain public safety.

Additional mitigation associated with Alternative 2 includes:

- Planting riparian tree species within the widened Sacramento Bypass to compensate for 8 acres of permanent, direct impacts associated with construction of the new Sacramento Weir.
- Grading the new portion of the Sacramento Bypass to ensure positive drainage with the design of the existing Sacramento Bypass.
- Inclusion of fish passage features and ramp down of operation following flood events to reduce potentially adverse effects to listed fish species due to stranding within the Sacramento Bypass.

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b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Alternation of Current Patterns and Water Circulation

Since Alternative 1 consists of fix-in-place levee improvements, implementation of these measures would have no effect on current patterns and water circulation.

Alternative 2 would result in a diversion of flows from the Sacramento River to the Yolo Bypass that would slightly raise water surface elevations by approximately 0.10-foot in the Yolo Bypass during large flood events events (200 year) compared to both the existing and future without project conditions. To avoid potential effects to the Yolo Bypass, the widened portion of the Sacramento Weir would only be operated when the release from Folsom Dam is increased to above 115,000 cfs. With the Folsom Dam improvements in place, releases from Folsom Dam would be above 115,000 cfs for flood events greater than 1/100 ACE event. Operation of the existing segment of the Sacramento Weir would not change from current practices.

Therefore, for events up to and including the 1/100 ACE event, only the existing weir would be operated per the criteria previously established. For events greater than the 1/100 ACE event when the release from Folsom Dam would go above 115,000 cfs, the new weir would be opened. As a result of the increased flood storage space and anticipatory releases at Folsom Dam, this translates into a reduction of flows into the Yolo Bypass with Alternative 2 in place compared to the existing conditions. Table 3 compares the flows at various locations for the Existing, Future Without Project, and with Alternative 2 in place. For the 1/100 ACE event and greater, the benefits of the Folsom Dam improvements would be realized in the form of reduced flows compared to the Existing condition.

Table 3. Comparison of 10-, 100-, and 200-year Frequency Flows under Various Conditions.

10 year event	**Existing Condition**	**Future Without Project Condition (also Alternative 1)**	**Alternative 2**
American River	43,000 cfs	72,000 cfs	72,000 cfs
Sacramento Bypass	50,000 cfs	66,000 cfs	66,000 cfs
Yolo Bypass below Sac Bypass	270,000 cfs	296,000 cfs	296,000 cfs
100 year event	**Existing**	**Future Without Project and Alt. 1**	**Alt. 2 (TSP)**
American River	145,000 cfs	115,000 cfs	115,000 cfs
Sacramento Bypass	131,000 cfs	115,000 cfs	115,000 cfs
Yolo Bypass below Sac Bypass	555,000 cfs	535,000 cfs	535,000 cfs
200 year event	**Existing**	**Future Without Project and Alt. 1**	**Alt. 2 (TSP)**
American River	320,000 cfs	160,000 cfs	160,000 cfs
Sacramento Bypass	183,000 cfs	149,000 cfs	164,000 cfs
Yolo Bypass below Sac Bypass	656,000 cfs	631,000 cfs	643,000 cfs

Although Alternative 2 would result in the creation of a new drainage area within the Sacramento Bypass, the area would be contained within the levee system and would not result in substantial additional erosion, siltation, or runoff. The expanded bypass would not create or contribute flows in excess of the existing capacity of the system, as shown in Table 12 above.

(2) Interference with Water Level Fluctuation

Because the Sacramento River and American River systems are regulated by upstream dams which allow a specific amount of water to be released into systems, the Alternative 1 and the no action/no project alternative would not change water level fluctuation patterns. Alternative 2 would change the water level fluctuation patterns by reducing and stabilizing the maximum water surface elevations on the Sacramento River during flood events, as described in Table 3 above.

Potential implications of the simulated long-term changes in bed profiles can be increased stress along the toe of the project levees or overbank berms in the degradational reaches, which may result in increased scour along unrevetted channel sections. In the aggradational reaches, an increase in bed elevations may result in higher flood stages and reduced flood conveyance.

(3) Salinity Gradients Alteration

Salinity gradients would not be affected, as salinity normally only increases in the river system during low flow events when there is a higher than average tidal influx from the Delta. With-project conditions in the system would remain consistent with existing conditions during normal and low flow periods. Flows would be increased during high water events, however the flood flows during these events would be pushing any salinity intrusion back down into the Bay-Delta system and would not result in any salinity increases in the riverine system.

(4) Effects on Water Quality

The Basin Plan states that where ambient turbidity is between 5 and 50 nephelometric turbidity units (NTUs), projects would not increase turbidity on the Sacramento River by more than 20 percent above the ambient conditions. Furthermore, if the ambient diurnal variation in turbidity fluctuates in and out of the 5 and 50 NTUs threshold, the Basin Plan states that averaging periods can be applied to data to determine compliance. For example, during the summer months, the Sacramento River turbidity could be less than 50 NTUs, and during the winter months, the turbidity could be more than 50 NTUs because of the higher flow rate causing more river scouring. Thus, the monthly average was calculated using hourly CDEC data and is presented in Table 3-3 below. Specific construction activities that are part of the potential alternatives would need to comply with the above-stated thresholds for turbidity.

Water quality impacts that could result from project construction activities and project operations were evaluated based on the construction practices and materials that would be used, the location and duration of the activities, and the potential for degradation of water quality or beneficial uses of project area waterways.

Table 3-3. Monthly Average Total Suspended Sediment and Turbidity for the Sacramento River at Freeport from 1997 to 2007.

Month	Discharge (cfs)	TSS (mg/L)	TSS Load (tons)	Turbidity (NTU)
January	41,414	104	11,670	64
February	44,084	83	9,839	68
March	39,586	70	7,476	15
April	28,552	51	3,946	11
May	25,152	48	3,279	12
June	21,461	30	1,741	17
July	20,432	37	2,019	21
August	18,235	27	1,332	9
September	16,121	29	1,266	10
October	11,950	29	940	6
November	13,612	24	868	8
December	25,105	81	5,463	12

Note: Flow and TSS data are from the USGS and are presented as monthly average from 1997 to 2007. Turbidity data are from CDEC from March 2007 to January 2009 and also are presented as a monthly average. Turbidity data are from the Sacramento River at Hood, a few river miles downstream from the USGS station.
Source: USGS 2013; DWR 2012b.

Where bank protection construction is proposed, riprap would be placed along the river bank to prevent erosion. The placement of riprap along the river banks would temporarily generate increased turbidity in the immediate vicinity of the construction area. Additionally, placement of riprap in the water could result in a sediment plume, generated from the channel bottom and levee side, becoming suspended in the water and could generate turbidity levels above those identified as acceptable by the Basin Plan. Turbidity effects from landside construction (e.g., vehicle, staging, placement of construction equipment) would be limited to stormwater runoff carrying loose soil from staging areas and construction vehicle access areas. Best management practices would be implemented to reduce the effect of runoff into the stormwater system to less than significant. Best management practices include such things as coir mats or hay bales to prevent runoff, rock groins to retain sediment, sand bags to prevent erosion, and drain screens to prevent sediment from traveling outside the construction area footprint and into the storm drains system.

As rock riprap is placed in the open water, significant indirect effects would result as the sediment and turbidity plume would drift further downstream and later affect the water qualify in those areas further downstream of the project area. By implementing the BMPs contained within the SWPPP, impacts would be reduced to less than significant.

Effects to water quality for Alternative 2 would be the same as Alternative 1 with the additional effects associated with the widening of the Sacramento Weir and Bypass. Construction of the new north levee would occur when water is not flowing through the bypass, and therefore there would be not impacts to water quality during construction of the new north levee of the bypass. However, effects could occur during the construction of the expanded weir along the Sacramento River. There is a potential for water quality impacts to occur if the weir is constructed in a way that debris or other construction materials could enter the Sacramento River. However, it is likely that the weir could be constructed behind the existing levee, which would result in no impacts to water quality.

(a) Water Chemistry

The potential of hydrogen (pH) is a unit for measuring the concentration of hydrogen ion activity in water and is reported on a scale from 0 to 14. If a solution measures less than 7, it is considered acidic. If a solution measures more than 7, it is considered basic, or alkaline. If a solution measures 7, it is considered neutral. Many biological functions occur only within a narrow range of pH values. The Basin Plan objective for pH is between 6.5 and 8.5. Furthermore, discharges cannot result in changes of pH that exceed 0.5. The monthly average pH of the Sacramento River from 2003 to 2009 remained stable throughout the year (Table 3-4). Construction materials such as concrete or other chemicals could affect the pH of the Sacramento River if a discharge were to occur. The proposed materials and construction activities have the potential to affect water chemistry during the duration of construction. Construction contractors would be required to prepare and implement a SWPPP and comply with the conditions of the NPDES general stormwater permit for construction activity. The contractor would be required to obtain a permit from the CVRWQCB detailing a plan to control any spills that could occur during construction. The plan would describe the construction activities to be conducted, BMPs that would be implemented to prevent discharges of contaminated stormwater into waterways, and inspection and monitoring activities that would be conducted.

(b) Salinity

The proposed materials and construction activities are not expected to affect salinity.

(c) Clarity

Placement of fill materials would temporarily reduce clarity due to an increase in total suspended solids within the project area. Clarity is not expected to be substantially affected outside the immediate project area. However, the reduction of clarity caused by construction activities would be short in duration and would return to pre-construction levels upon project completion.

(d) Color

The proposed project is expected to affect color only during fill activities. Placement of fill materials would temporarily induce a color change due to an increase in turbidity. These effects would be consistent with those discussed above for clarity. The change in color caused by construction activities would be short in duration and would return to pre-construction levels upon project completion.

(e) Odor

The proposed project would not result in any major sources of odor, and the project would not involve operation of any of the common types of facilities that are known to produce odors (e.g., landfill, wastewater treatment facility). Odors associated with diesel exhaust emissions from the use of onsite construction equipment may be noticeable from time to time by adjacent receptors. However, the odors would be intermittent and temporary and would dissipate rapidly from the source with an increase in distance. Furthermore, as required by CARB regulation 13 CCR 2449(d)(3), no in-use off-road diesel vehicles may idle for more than 5 consecutive minutes. Therefore, this direct effect would be less than significant. In addition, implementation of mitigation measures, which are required under other air quality effects, would further reduce exhaust emissions and provide advanced notification of construction activity.

(f) Taste

The proposed materials and construction activities are not expected to affect taste.

(g) Dissolved Gas Levels

The proposed materials and construction activities are not expected to affect dissolved gases.

(h) Temperature

Construction activities have the potential to create substantial turbidity affecting water temperature. Implementing the BMPs established in the SWPPP, conducting work during low flow periods, and installing sediment barriers to reduce sediment from entering waterways would be required to control turbidity and the mobilization of pollutants that may be present in sediments. There is the potential for some increases in water temperature, due to the removal of waterside vegetation during construction. However, the vegetation that would be removed would primarily consist of shrubby vegetation and grasses, which do not significantly contribute to shade. The larger trees in the bank protection footprint, which are the primary contributors to shade, would be protected in place, which would help to maintain consistent long-term water temperatures after construction. Additionally, shrubs would be planted on the bank protection planting berms during construction to allow the vegetative cover near the banks to redevelop long-term.

(i) Nutrients

The proposed materials and construction activities have the potential to affect nutrient levels in the water. Release of suspended sediments during construction could potentially cause turbidity thresholds for metals and nutrients to be exceeded. Turbidity would be controlled outside the working area using a combination of BMPs as appropriate. Development and implementation of an approved SWPPP would also prevent release of excess nutrients. Long-term nutrient levels would not be significantly altered by project construction because existing vegetation on the waterside slopes of the levee would be protected in place, and the shaded riverine aquatic corridor would still remain a source of nutrients for the rivers. In addition, nutrients from the upstream watershed would remain in the system.

(j) Eutrophication

The project is not expected to contribute excess nutrients into the stream or promote excessive plant growth due to BMPs and the high content of rock in disposal material.

c. Suspended Particulate/Turbidity Determinations

(1) Alteration of Suspended Particulate Type and Concentration

Where bank protection construction is proposed, riprap would be placed along the river bank to prevent erosion. The placement of riprap along the river banks would temporarily generate increased turbidity in the immediate vicinity of the construction area. Additionally, placement of riprap in the water could result in a sediment plume, generated from the channel bottom and levee side, becoming suspended in the water and could generate turbidity levels above those identified as acceptable by the Basin Plan. Turbidity effects from landside construction (e.g., vehicle, staging, placement of construction equipment) would be limited to stormwater runoff carrying loose soil from staging areas and construction vehicle access areas. Best management practices would be implemented to reduce the effect of runoff into the stormwater system to less than significant. Best management practices include such things as coir mats or hay bales to prevent runoff, rock groins to retain sediment, sand bags to prevent erosion, and drain screens to prevent sediment from traveling outside the construction area footprint and into the storm drains system.

As rock riprap is placed in the open water, significant indirect effects would result as the sediment and turbidity plume would drift further downstream and later affect the water qualify in those areas found further downstream of the project area. By implementing avoidance and minimization measures, discussed in Section 3.5.6 of the ARCF GRR EIS/EIR, impacts could be reduced to less than significant.

(2) Particulate Plumes Associated with Discharge

Placement of riprap in the water could result in a sediment plume, generated from the channel bottom and levee side, becoming suspended in the water and could generate turbidity levels above those identified as acceptable by the Basin Plan. As rock riprap is placed in the open water, significant indirect effects would result as the sediment and turbidity plume would drift further downstream and later affect the water qualify in those areas found further downstream of the project area. By implementing avoidance and minimization measures, discussed in Section 3.5.6 of the ARCF GRR EIS/EIR, impacts could be reduced to less than significant.

(3) Changes to Environmental Quality and Value

There could be significant affects to water quality due to increased turbidity during construction, as discussed above. Additionally, on the Sacramento River, the use of barges to install the riprap could cause additional turbidity as the barge moves into the site and anchors. With the implementation of the BMPs that will be established in the SWPPP, these effects would be reduced to less than significant during construction. Once construction is complete there could be reduced turbidity in the direct vicinity of the site because there would be no exposed soil to erode and deposit into the river. Further, the bank protection sites would include the installation of riparian vegetation which could slow the flows down and reduce turbidity during high flows.

Construction contractors would be required to prepare and implement a SWPPP and comply with the conditions of the NPDES general stormwater permit for construction activity. The contractor would be required to obtain a permit from the Central Valley RWQCB detailing a plan to control any spills that could occur during construction. The plan would describe the construction activities to be conducted, BMPs that would be implemented to prevent discharges of contaminated stormwater into waterways, and inspection and monitoring activities that would be conducted.

(4) Actions to Minimize Impacts

Environmental commitments included in the project to reduce the potential for impacts to water quality include: preparation and implementation of the SWPPP, Spill Prevention Control and Countermeasures Plan (SPCCP), and a bentonite slurry spill contingency plan (BSSCP).

d. Contaminant Determinations

The proposed project is not expected to add contaminants to any body of water; however, if there were a release of contaminants into adjacent water bodies, that could result in significant effects. Therefore, BMPs are proposed during construction to ensure that no contaminants enter the waterways.

Under Alternative 1, construction activities would involve the use of potentially hazardous material, such as fuels, oils and lubricants, and cleaners, which are commonly used in construction projects. Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations during project construction and operation. Testing of borrow sites would occur prior to the use of material and sites which have contaminated soils would not be used for this project. Any hazardous substance encountered during construction would be removed and properly disposed of by a licensed contractor in accordance with Federal, State, and local regulations. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities. The risk of significant hazards associated with the transport, use, and disposal of these materials is low.

Project areas would be tested for HTRW contaminants prior to construction, and any materials found would be disposed of by the non-federal sponsor in accordance with all Federal, State, and local laws and regulations at an approved disposal site. Implementation of these mitigation measures would reduce the impacts from hazardous materials at project sites to less than significant. If significant time has elapsed between approval of this document and construction, additional investigations should be done to reduce the risk of encountering a site during construction. If construction activities would occur in close proximity to sites listed in the existing conditions section, a Phase II ESA should also be conducted. This would further reduce the risk of exposure to workers and the public during construction and assist in the remediation planning.

Alternative 2 would have the same impacts as Alternative 1, with the additional affects associated with the expansion of the Sacramento Weir and Bypass. A known HTRW site, the Old Bryte Landfill, is currently present within the area proposed for the expanded Sacramento Bypass. No construction activities would occur in proximity to this site until the site has been completely remediated and meets all Federal, State, and local regulatory requirements. Therefore, this alternative would have no impacts.

Compliance with applicable laws and regulations would reduce the potential for accidental release of hazardous materials during construction of both Alternatives 1 and 2. The contractor would also be required to prepare a SWPPP, which details the contractors plan to prevent discharge from the construction site into drainage systems, lakes, or rivers. This plan would include BMPs, as detailed in Section 3.5.6 of the ARCF GRR EIS/EIR, which would be implemented at each construction site.

In addition, a SPCCP would be prepared prior to project construction. An SPCCP is intended to prevent any discharge of oil into navigable water or adjoining shorelines. The contractor would develop and implement an SPCCP to minimize the potential for adverse effects from spills of hazardous, toxic, or petroleum substances during construction and operation activities. The SPCCP would be completed before any construction activities begin. Implementation of this measure would comply with state and Federal water quality regulations. The SPCCP would describe spill sources and spill pathways in addition to the actions that would be taken in the event of a spill (e.g., an oil spill from engine refueling would be immediately cleaned up with oil absorbents). The SPCCP would outline descriptions of containments facilities and practices such as doubled-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures and spill response kits. It would also describe how and when employees are trained in proper handling procedure and spill prevention and response procedures.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton

Plankton are drifting organisms that inhabit the pelagic zone of oceans, seas, or bodies of fresh water. Project construction activities would be temporary and short-term. The only short-term effect would be a less abundant supply of plankton for the Delta smelt, and other fish and aquatic organisms. With implementation of mitigation measures and BMPS, this project would not introduce materials that would disrupt the nutrient supply for plankton, and as a result effects to plankton would be temporary and not significant.

(2) Effects on Benthos

Benthic organisms may be disturbed during construction, but following construction, the rock berm would be covered with a silty soil layer, and native benthic organisms would be expected to recolonize the area.

(3) Effects on Nekton

Nekton are actively swimming aquatic organisms that range in size and complexity from plankton to marine mammals. Native fish present in the project area can be separated into anadromous species and resident species. Native anadromous species include four runs of Chinook salmon, steelhead trout, Delta smelt, and green sturgeon. All of these anadromous species are expected to use habitat in parts of the study area.

Within the ARCF GRR study area, the Sacramento River and Sacramento Bypass are designated critical habitat for winter-run Chinook salmon. Critical habitat for spring-run Chinook salmon includes all river channels and sloughs within the ARCF study area on the Sacramento River and on the American River from the confluence to the Watt Avenue bridge (NMFS 2006b). Critical habitat for Central Valley steelhead includes the stream channels and the lateral extent as defined by the ordinary high-waterline or bank-full elevation in the designated stream reaches of the Sacramento and American River, NEMDC and Dry/Robla Creek portions of the ARCF project area. Critical habitat for delta smelt consists of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the contiguous waters in the Delta (USFWS 1994). Critical habitat for delta smelt is designated in the following California counties: Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo (USFWS 2003). Designated critical habitat for the southern DPS of green sturgeon includes the Sacramento River downstream of Keswick

Dam, the Feather River downstream of Oroville Dam, and the Yuba River downstream of Daguerre Dam; portions of Sutter and Yolo Bypasses; the legal Delta, excluding Five Mile Slough, Seven Mile Slough, Snodgrass Slough, Tom Paine Slough and Trapper Slough; and San Francisco, San Pablo, and Suisun bays.

Under Alternative 1 and 2, rock placement on the Sacramento River and American River would most likely disturb the native resident fish by increasing vibration, water turbulence, and turbidity, causing them to move away from the area of placement. In some pelagic native juvenile species utilizing the near shore habitat for cover, moving away from that cover could put them at a slight risk of predation. Direct effects to resident native fish species are less than significant, with the implementation of mitigation. Proposed mitigation for salmonid species includes the creation of planting berms to provide shade and instream woody material elements of SRA habitat. The natural bank element of SRA would be lost with the placement of rock along the levee slope. Over time sediment would settle into the rock voids and provide similar substrate characteristics as a natural bank. The direct effects would also not result in a substantial reduction in population abundance, movement, and distribution for salmonid species.

Alternative 1 and 2 would result in permanent impacts to 14 acres of Delta smelt shallow water habitat, and a change in substrate to 32 acres of Delta smelt spawning habitat. Construction-related effects include disruption of spawning activities, disturbance or mortality of eggs and newly hatched larvae, and alteration of spawning and incubation habitat. With the implementation of compensation for the impacts to Delta smelt shallow water habitat and spawning habitat, these effects would be reduced to less than significant.

Alternative 1 and 2 would result in significant, direct effects to green sturgeon through the loss of benthic feeding habitat due to the change in substrate at the bank protection sites. If larvae or juveniles are present during construction, in-water activities could result in localized displacement and possible injury or mortality to individuals that do not readily move away from the channel or nearshore areas. Project actions associated with bank protection measures may increase sediment, silt, and pollutants, which could adversely affect rearing habitat or reduce food production, such as aquatic invertebrates, for larval and juvenile green sturgeon. Compensation would be implemented for the impacts to benthic substrate, and construction-related monitoring would occur to help to better identify additional measures to reduce significant effects to green sturgeon.

Effects associated with Alternative 2 would be the same as described for Alternative 1 above. Proposed construction in the Sacramento Bypass would take place during the dry season when no water would be flowing through the project area from the Sacramento River. There would be no significant direct effects to native fish populations because they would not be present in the construction footprint during the proposed construction. By widening the Sacramento Weir and Bypass, the project would create additional floodplain habitat, which could benefit native fish consistent with the results of the Knaggs Ranch Study. The increase of floodplain habitat could increase opportunities for successful rearing and feeding during seasonal flooding.

Widening of the weir and bypass will increase the entrainment and stranding exposure and rates of juvenile fish species. When the weir is overtopping and water is flowing down the bypass, adult fish are attracted to the flow and follow it upstream in an attempt to reach their holding and spawning habitat. Widening the weir and bypass would increase the amount of water going over the weir and increase the attraction rate of sturgeon, salmon and steelhead. Without fish passage in place, the stranding rates of these fish would increase. Given that green sturgeon are long-lived species that have the strongest upstream migration and cohort replacement rates during wet water years and especially after high river flow conditions, the effect of the stranding occurring only two to three times over a 50 year period could be significant to sturgeon. Implementation of fish passage features, operational considerations, and grading of the expanded bypass to reduce stranding pits and ensure positive drainage would reduce these impacts to less than significant.

(4) Effects on Aquatic Food Web

Effects on the aquatic food web, or the plankton, benthic, and nekton communities, would be temporary and less than significant. Indirect effects were not considered significant to resident native fish species because it was determined that existing conditions would not be worsened by project construction, and would not result in a substantial reduction in population abundance, movement, and distribution.

(5) Effects on Special Aquatic Sites

(a) Sanctuaries and Refuges

No sanctuaries and refuges are within the project area.

(b) Wetlands

Approximately 0.4-acre of wetland could be filled and permanently lost during construction of both Alternatives 1 and 2. The Corps has proposed to purchase one acre of credit from a mitigation bank in order to compensate for this loss of habitat.

Wetlands in the existing Sacramento Bypass would not be impacted by construction of Alternative 2. There is a potential for additional wetlands to develop in the additional 300 acres since this land would no longer be farmed. The conversion of this land back to its natural state would have benefits to other wildlife and could become an expansion of the Sacramento Bypass Wildlife Refuge in Alternative 2.

Reasonable effort would be taken in the detailed design of the project to avoid disturbance to existing wetlands and implementation of environmentally sustainable designs. Any destruction, loss, or degradation of wetlands would be compensated through creation of new wetland habitat.

(c) Mud Flats

No mud flats are within the project area.

(d) Vegetated Shallows

No vegetated shallows are within the project area.

(e) Coral Reefs

No coral reefs are within the project area.

(f) Riffle and Pool Complexes

No riffle pool and complexes are within the project area.

(6) Threatened and Endangered Species

Implementation of Alternative 1 or 2 would result in direct effects to giant garter snake, valley elderberry longhorn beetle, salmonids, green sturgeon, Delta smelt, Western yellow-billed cuckoo, vernal pool crustaceans, and Swainson's Hawks. Impacts to special status fish species were addressed above in Section e(3), nekton.

Construction activities under Alternative 2 have the potential to affect giant garter snake and their habitat, due to the removal and relocation of farm canals and drainage ditches during construction of the Sacramento Weir and Bypass Widening. Giant garter snake habitat would be restored on site to the maximum extent practicable. Permanent impacts to giant garter snake habitat would be compensated through the purchase of credits at a mitigation bank.

Direct effects would occur to valley elderberry longhorn beetle due to the removal and transplanting of shrubs from the construction footprint on the American River and Sacramento River. Additionally, elderberry shrubs could be incidentally damaged by construction personnel or equipment. Potential impacts due to damage or transplantation include direct mortality of beetles and/or disruption of their lifecycle. The Corps will compensate for lost habitat onsite to the maximum extent practicable, create new offsite mitigation areas in coordination with the Sacramento County Department of Parks and Recreation, or purchase credits at a mitigation bank.

Adverse effects could occur to Western yellow-billed cuckoo and Swainson's hawk due to the removal of riparian vegetation during construction of Alternative 1 and 2 on the Sacramento River and American River. Swainson's hawk is known to nest within the study area. Prior to construction, the Corps would survey the construction area per the CDFW survey protocols and determine if nesting hawks are present. If they are present, buffers would be set up and the nests would be monitored. Additional avoidance and minimization measures would be coordinated with CDFW, as needed. Western yellow-billed cuckoo is not currently known to nest in the project area, however the riparian habitat along the American River is suitable nesting habitat for the cuckoo. Additionally, both rivers lie within the cuckoo's migratory corridor and they are likely to be present during their migration period. As a result, the Corps proposes to compensate for the removal of riparian vegetation onsite to the maximum extent possible. If onsite mitigation is not possible, offsite mitigation would occur in coordination with the Sacramento County Department of Parks and Recreation, or credits would be purchased at a mitigation bank.

Vernal pool tadpole shrimp and vernal pool fairy shrimp could be adversely affected by the removal of 0.25 acre of vernal pool habitat due under both Alternatives 1 and 2. During the design phase of the project, a wetland delineation and survey would be conducted near Magpie Creek to verify this impact. The Corps will compensate for this impact by purchasing 1 acre of credit from a mitigation bank.

Because avoidance, minimization, and compensation measures would be implemented in accordance with the requirements of the Endangered Species Act (ESA), California Endangered Species Act (CESA) and other relevant regulatory requirements, and the protect would protect habitat in place and create habitat, potential adverse effects on special-status species and on sensitive habitats would be reduced to a less than significant level.

(7) Other Wildlife

Wildlife effects associated with the construction are expected to be temporary and no additional measures to minimize effects are needed for fill occurring in the area. Under Alternative 1, construction of levee improvements and vegetation removal would result in significant loss of vegetation and wildlife habitat on the landside of the Sacramento River Parkway, and along Arcade Creek. Alternative 2 would have the same impacts on the project area in addition to the construction of the Sacramento Weir extension. That would require the widening of the Sacramento Weir and Bypass which would result in a reduced affect to landside vegetation and wildlife.

Because this area is very urbanized under Alternative 1, the primary effects to wildlife would be to avian species. Surveys would be conducted to determine if any nesting birds are present prior to construction. If nesting birds are located adjacent to the project area, coordination with the resource agencies would occur. Trees where nesting birds are located would not be removed while they are actively nesting. However, once the young have fledged the trees may be removed to construct the project. The same impacts apply to Alternative 2 with the addition of construction activities causing any wildlife within the bypass and adjacent areas to relocate to nearby rural lands and away from human activities. Once construction is complete the wildlife is expected to return to the area. Therefore, the impacts to wildlife in the Sacramento Bypass would be less than significant. Both native and non-native fish species, along with some endangered species, use this area of the river and are discussed in Fisheries (Section 3.7) and Special Status Species (Section 3.8).

Mitigation measures would include, when possible, in-kind compensation would be planted on planting berms, on top of launchable rock trenches, or on other lands within the Parkway. A hydraulic evaluation would be conducted to determine whether mitigation could occur in the Sacramento Bypass. Additional mitigation sites are identified in Section 3.6.6 of the ARCF EIS/EIR.

To compensate for the removal of 134 acres of riparian habitat supporting Swainson's hawks and other migratory birds approximately 268 acres of replacement habitat would be created as a mitigation area. Some areas that may be considered for mitigation are Cal Expo and Woodlake. For those mitigation lands within the American River Parkway species selected to compensate for the riparian corridor removal would be consistent with the approved list of trees, shrubs, and herbaceous plants native to the Parkway. Mitigation within the Parkway would provide contiguous habitat connectivity with wildlife migratory corridors that supports the needs of important native wildlife species, without compromising the integrity of the flood control facilities, the flood conveyance capacity of the Parkway, and Parkway management goals in the Parkway Plan. To comply with the Parkway Plan, lands within the Parkway will be evaluated for compensation opportunities for any riparian habitat removed from Parkway. The exact location of the compensation lands in the Parkway would be coordinated in the design phase of the project with Sacramento County Parks Department and comply with the Parkway Plan objectives and goals. It is assumed that sufficient lands will be available within the Parkway, however, if there is not sufficient land, other locations within Sacramento County will be identified and pubic coordination will occur. Additional mitigation may be planted in the expanded Sacramento Bypass or on other lands within the Sacramento area that provide similar value to those removed.

(8) Actions to Minimize Impacts

The proposed project is not likely to result in take to these species for either Alternative as long as the applicable conservation and mitigation measures, as detailed in Section 3.8.6 of the ARCF GRR EIS/EIR are adhered to. Among other measures listed in the EIS/EIR, the conclusion of non-jeopardy is based on the Corps' commitments to: (1) avoid direct impacts by maintaining buffers around sensitive habitat (e.g. 100-foot buffer for elderberry shrubs) and/or conducting construction activities outside of sensitive timeframes (e.g. during the giant garter snake active window or fledging period of special-status birds); (2) minimize wetland losses through the purchase of credits from an approved mitigation bank; (3) implement a SWPPP and associated BMPs; including the designation of staging areas for stockpiling of construction materials, portable equipment, vehicles, and supplies and (4) appoint onsight biologists to provide worker environmental awareness training to contractors and to monitor, report, and remove and transport special-status species if necessary or suspend construction activities until special-status species leave the project on their own. Concurrent implementation of these conservation measures would adequately avoid, minimize, and mitigate adverse effects on the special-status fish, wildlife and plant species discussed in this document.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Size Determination

Not applicable.

(2) Determination of Compliance with Applicable Water Quality Standards

Water quality could be affected within the actual construction area and upstream and downstream of the work area. Construction activities such as rock placement, clearing and grubbing, and slope flattening, have the potential to temporarily degrade water quality through the direct release of soil and construction materials into water bodies or the indirect release of contaminants into water bodies through runoff.

The ARCF study is located within the jurisdiction of the Central Valley RWQCB, within the greater Sacramento Valley watershed. The preparation and adoption of water quality control plans, or Basin Plans, and statewide plans, is the responsibility of the SWRCB. State law requires that Basin Plans conform to the policies set forth in the California Water Code beginning with Section 13000 and any State policy for water quality control. These plans are required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards which "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected and water quality objectives to protect those uses. Adherence to Basin Plan water quality objectives protects continued beneficial uses of water bodies. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 CFR 131.20). The potential effects of the proposed project on water quality have been evaluated and are discussed in Section 3.5 of the ARCF EIS/EIR. Compliance with the California Water Code will be accomplished by obtaining certifications from the Central Valley RWQCB prior to construction. In addition a CWA Section 404 review has been conducted internally by the Corps.

(3) Potential Effects on Human Use Characteristics

a) Municipal and Private Water Supplies

The Sacramento River waterways historically were used as places to dispose of contaminants. In recent decades, treatment for municipal wastewater, industrial wastewater, and management of urban stormwater runoff have increased and improved greatly. Industries and municipalities now provide at least secondary treatment of wastewater. The American River originates in the high Sierra Nevada just west of Lake Tahoe, in the Tahoe and El Dorado National Forests. Its three main forks – the South, Middle, and North – flow through the Sierra foothills and converge east of Sacramento. The waters of the American River provide recreation, municipal power, and irrigation for the northern California area. The fill material would not violate Environmental Protection Agency or State water quality standards or violate the primary drinking water standards of the Safe Drinking Water Act (42 USC 300f-300j). Project design, compliance with State water quality thresholds and standard construction and erosion practices would preclude the introduction of substances into surrounding waters. The groundwater table is separated from the slurry wall by a non-permeable layer of soil, therefore there would be minimal risk to groundwater supply. Materials removed for disposal off-site would be disposed of in an appropriate landfill or other upland area.

b) Recreation and Commercial Fisheries

Under Alternative 1, there would be temporary closure of recreation facilities in the American River Parkway during construction, including the bike trails, walking trails, and boat launches. Alternative 2 would affect the same facilities as Alternative 1, but the possible closure of the Sacramento Bypass during hunting season. Notification and coordination with recreation users and bike groups would be arranged. Flaggers, signage, detours, and fencing would be present to notify and control recreation access and traffic around construction sites.

Alternative 1 would cause indirect effects to fish habitat from the removal of vegetation from the levee slopes. Direct effects from the placement of rock at a bank protection sites would cause an increase in turbidity. The same effects for Alternative 1 apply for Alternative 2, with the addition of widening the Sacramento Bypass, which would create a floodplain that could provide a benefit to fish species. For Alternatives 1 and 2, a vegetation variance would allow waterside vegetation, which would include native grasses, shrubs, and trees, to remain on the lower one-third of the waterside slope along the Sacramento River. Bank protection sites and launchable rock trenches would be revegetated with native grasses, shrubs and trees following construction. BMPs would be implemented to address turbidity.

c) Water-related recreation

Recreational boating is one of the primary uses of the American River. Boat access is located at Discovery Park on both the Sacramento and American River side of the park. Boat launches within the Parkway are located at Howe Avenue, Watt Avenue, and Gristmill Park. The river can become very shallow between Sunrise and Howe Avenue when releases from Folsom Dam are reduced, making motorized boating impracticable. Rafting on this stretch of the river is very common during summer months with the highest use on the weekends and holidays.

Under Alternative 1, recreational resources that could potentially be affected by construction of the erosion protection measures include Paradise Beach, the Campus Commons Golf Course, the Guy West Bridge, and the boat launches at Howe Avenue, Watt Avenue, and Gristmill Park. Construction will also occur during the summer months when the Parkway recreation activities are at the peak. There would be short-term term significant effects along the Sacramento River reach of the project, however, there would be no long-term effects because the area would be returned to the pre-construction conditions once completed. The timing of construction cannot be mitigated as it is unsafe to perform construction activities in the floodway during the flood season.

Effects to recreation from the construction of levee improvements under Alternative 2 would be consistent with those analyzed for Alternative 1 with the addition of effects resulting from construction of levee improvements associated with the Sacramento Weir and Bypass widening. Impacts to water-related recreation are the same for both Alternatives.

If any access point needs to be closed during construction, notices will be posted providing alternative access routes. Any recreation facilities affected by the project would be replaced in-kind within the existing area and no long-term impacts are anticipated.

d) Aesthetics

Alternatives 1 and 2 would result in vegetation loss and construction activities would disrupt the existing visual conditions in the Parkway and along the Sacramento River. Native trees would be planted after construction is completed on planting berms and on top of launchable rock trenches; however, there would still be a temporal loss of vegetation. Disturbed areas would be reseeded with native grasses.

e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

Many parks are located within the American River Parkway portion of the study. Following is a description of the parks and their activities.

<u>Discovery Park</u>. Located just north of downtown Sacramento at the confluence of the American River and the Sacramento River, this 302-acre park is a popular site for rafters and waders. Discovery Park is the trailhead for the 32-mile long Jedediah Smith Memorial Trail. The park also features a boat launch. Discovery Park was designed to flood and take pressure off American River levees during high water events. For safety reasons, the park closes when water flows into the public areas and remains closed until the water subsides.

<u>Sutter's Landing Regional Park</u>. Nestled along the banks of the American River about a mile northeast of downtown Sacramento, this 172-acre park currently offers a wide variety of recreational opportunities including a covered skateboard park, a dog park, picnic areas, basketball and bocce ball courts, as well as access to trails along the American River and a boat launch for kayaks, canoes, and other non-motorized boats. Visitors can also see a diversity of wildlife at this site including river otters, beavers, jackrabbits, cottontails, coyotes, raccoons, gopher snakes, fence lizards, skunks, ground

squirrels, voles, and an occasional sea lion, as well as a wide variety of bird species ranging from shorebirds and waterfowl to raptors making it an ideal location for nature watching as well as birding. Other popular activities at this location include walking, jogging, and biking.

Paradise Beach. Just off of U.S. 50 at Howe Avenue, Paradise Beach offers a sandy beach area and is a popular spot for swimming.

Campus Commons Golf Course. Built in 1972, the 1,699 yard Campus Commons Golf Course is a public nine hole executive course located just north of California State University Sacramento, along the American River.

Guy West Bridge. The Guy West Bridge is a pedestrian-only suspension bridge crossing the historic Lower American River. It is modeled after the famed Golden Gate Bridge in San Francisco, but spans only 600 feet compared to the Golden Gate's 6,450 feet. The bridge was constructed to tie the California State University campus to a business and residential community on the north side of the American River.

Howe Avenue. Located down river from California State University, Sacramento, this car-top launch site allows small boats and rafts to be launched into the American River. Because of the swift rapids, this site is not conducive to swimming and wading.

Waterton and Save the American River Association. Just off of U.S. 50 at Watt Avenue, Waterton Access is a small site providing access along the river. The area is inhabited by deer and jackrabbits, so it is ideal for nature watching. The nearby Save the American River Association Access offers similar opportunity.

Watt Avenue. Just off Watt Avenue is an American River access point popular as a take-out spot for rafters, canoeists, and kayakers. Fishing is also popular here because of the range of shallow and deep water.

Gristmill Park. Located off Mira Del Rio Drive and Folsom Boulevard in Rancho Cordova, Gristmill Park is a popular place for fishing, bird watching, and nature watching/photography. The area also has some nice walking paths popular with the locals that wind through oak woodlands along the southern bank of the river in either direction from the parking area. In addition to the usual assortment of birds in these woodlands such as woodpeckers, Northern flickers, and red-shouldered hawks, it is not unusual to spot deer and coyote here as well. Due to the calmness of the river at this location, it is a popular launch spot for kayaking and canoeing.

William Pond Recreation Area. Located off Arden Way, the William Pond Recreation Area is one of the most well-established and popular parks along the river. Named in honor of the first director of County Parks, the park is handicap-friendly and offers a man-made fishing pond with a specialized fishing pier and ramp and paved walking trails that gently slope around the park.

River Bend Park (formerly Goethe Park). River Bend Park, formerly C.M. Goethe Park, is one of Sacramento's oldest county parks. It is located at U.S. 50 and Bradshaw Road and offers many recreation facilities. Horse and hiking trails wind through the park for plenty of wildlife viewing. This facility also has large group picnic sites often used for community events. River Bend Park is the endpoint for many recreational rafters on the American River.

Soil Born Farms. Located on the American River in Rancho Cordova (40 acres) and in Sacramento on Hurley Way (1.5 acres), Soil Born Farms organically grows a wide variety of fruits and vegetables linked to the seasons and temperament of the Sacramento region. All produce is harvested within a day of distribution to local restaurants, famers markets, and at their own farm stand at the American River ranch location from May to November. This nonprofit farm is actively involved in fostering organic farming through their farm apprentice program and youth education. All water used in irrigation comes from the American River and no synthetic pesticides or fertilizers are used.

Miller Park. Adjacent to the Sacramento Marina, off Harborview Drive from Front Street, this 57 acre city park is right on the Sacramento River. The park includes picnic areas, boat trailer parking, and a boat ramp and dock. There is also a store called Rat's Snack Shop.

Garcia Bend Park. Located between Pocket Road and the Sacramento River, this 19-acre community park is a popular place for recreation providing soccer fields, lighted tennis courts, play areas, picnic areas, restrooms, and a public boat ramp providing access to the Sacramento River.

The Riverfront Promenade. A new addition to Sacramento's riverfront, a couple blocks were opened in 2001. It is located just downstream of Old Sacramento and is still in the early stages of development. When complete, the promenade will be a mile long walking and cycling path that connects Old Sacramento to Miller Park.

For Alternative 1, construction of erosion protection measures is expected to take up to 10 years, with construction occurring in multiple locations within the Parkway at the same time. While this would not be a permanent long-term affect, 10 years of linear construction would be considered a significant effect to recreation activities because it would reduce the quality of existing recreation activities. Portions of the road on top of the levee would be closed to pedestrian access during the construction period. Additionally, construction of the launchable rock trench would temporarily disturb several miles of bike trails as well as access to public parks and boat launches within or adjacent to the Parkway. Such closures and disturbances would result in non-compliance with the American River Parkway Plan which states that flood control berms, levees and other facilities should be, to the extent consistent with proper operation and maintenance of these facilities, open to the public for approved uses, such as hiking, biking and other recreational activities. Once construction is complete the recreation facilities would be returned to the pre-construction conditions and long term effects would be less than significant.

These closures and disturbances would also result in direct and adverse effects to recreation, an outstandingly remarkable value under the Wild and Scenic Rivers Act. Recreational resources that could potentially be affected by construction of the erosion protection measures include Paradise Beach, the Campus Commons Golf Course, the Guy West Bridge, and the boat launches at Howe Avenue, Watt Avenue, and Gristmill Park.

Effects to recreation from the construction of levee improvements under Alternative 2 would be consistent with those analyzed for Alternative 1 with the addition of effects resulting from construction of levee improvements associated with the Sacramento Weir and Bypass widening. Construction of levee improvements associated with the Sacramento Weir and Bypass widening would have possible short-term effects on recreational use. During construction, certain areas would be closed to the public while other areas might be used as haul routes or borrow/disposal sites. Activities such as bird watching, walking, running, and jogging along the Sacramento Bypass levee crown and nearby roads would be restricted. Construction activities could potentially overlap with hunting season in the Sacramento Bypass Wildlife Area, which occurs from September 1 through January 31, restricting hunting activities for a limited period of time. In addition, there may be temporary effects to the Yolo Shortline Railroad. Construction activities would have a significant effect on the Yolo Shortline Railroad as portions of the railway may have to be shut down or relocated during construction activities.

To ensure public safety, flaggers, warning signs, and signs restricting access would be posted before and during construction, as necessary. In the event that bike trails would be disrupted, detours would be provided. Detour routes would be clearly marked, and fences would be erected in order to prevent access to the project area. In areas where recreational traffic intersects with construction vehicles, traffic control will be utilized in order to maintain public safety. The public will have continued access to the Parkway and recreation facilities during construction, but bike and running trail users would likely be required to detour onto public roads or alternative trails. If any access point needs to be closed during construction, notices will be posted providing alternative access routes.

These mitigation measures will reduce the effects on recreation; however, impacts would still be significant because of the duration of construction and the inability to provide similar quality recreation during construction. Any recreation facilities affected by the project would be replaced in-kind within the existing area and no long-term impacts are anticipated.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

Effects of the proposed action include reductions in nearshore aquatic and riparian habitats that are used by aquatic and terrestrial species. Corps actions which could create a cumulative effect on waters of the U.S. in the Sacramento area include the West Sacramento Project, the Southport Early Implementation Project, the American River Common Features Project, the North Sacramento Streams Project, the Sacramento River East Levee Project, and the Sacramento River Bank Protection Project (SRBPP). The North Sacramento Streams Project and the Sacramento River East Levee Project are proposed by SAFCA to construct certain features that are also part of the ARCF GRR Alternative 2. The

North Sacramento Streams Project includes proposed measures on Arcade Creek and NEMDC, and the Sacramento River East Levee Project includes the seepage and stability measures on the Sacramento River that are also proposed by the Corps under the ARCF GRR project, but with limited erosion protection.

The purpose of the West Sacramento Project is to investigate and determine the extent of Federal interest in plans that reduce flood risk to the City of West Sacramento. The proposed alternative for this project consists of levee improvements to 50 miles of existing levees surrounding the city and extending down along the Sacramento Deep Water Ship Channel to address identified seepage, stability, and erosion concerns through the construction of slurry walls and bank protection. In addition, the project proposes to set back the Sacramento River levee in the Southport area of West Sacramento. The recommended West Sacramento Project includes the geographic area and project features that are also being considered in the Southport Early Implementation Project. The Southport Early Implementation Project is being proposed by the West Sacramento Area Flood Control Agency and the State of California to provide 200-year protection consistent with the State's goal for urbanized areas, as well as to provide opportunities for ecosystem restoration and public recreation. The Southport Early Implementation Project's proposed alternative includes the Sacramento River setback levee in the Southport area of West Sacramento. The Southport project is planned to begin construction in 2016. The West Sacramento and Southport projects propose to implement a combined 16,000 linear feet of rock protection on the west bank of the Sacramento River in the study area.

The SRBPP was authorized to protect the existing levees and flood control facilities of the SRFCP. The SRBPP is a long-range program of bank protection authorized by the Flood Control Act of 1960. The SRBPP directs the Corps to provide bank protection along the Sacramento River and its tributaries, including that portion of the lower American River bordered by Federal flood control project levees. Beginning in 1996, erosion control projects at five sites covering almost two miles of the south and north banks of the lower American River have been implemented. Additional sites at RM 149 and 56.7 on the Sacramento River totaling one-half mile have been constructed since 2001. During 2005 through 2007, 29 critical sites totaling approximately 16,000 linear feet were constructed under the Declaration of Flood Emergency by Governor Schwarzenegger. This is an ongoing project, and additional sites requiring maintenance will continue to be identified indefinitely until the remaining authority of approximately 24,000 linear feet is exhausted over the next 3 years. WRDA 2007 authorized an additional 80,000 linear feet of bank protection, however sites for implementation have not been selected at this time.

The construction periods and related effects from these projects could all occur simultaneously. For the ARCF and West Sacramento projects, to include the Sacramento River East Levee Project and the Southport Project, this means that similar construction-related effects such as rock placement or tree removal could be occurring at the same time for the stretch of the projects from the I Street Bridge to the Stone Locks. To avoid potentially significant construction-related cumulative effects, the two projects would coordinate to ensure that construction sites are offset from each other (i.e., sites directly across the Sacramento River from each other where there is bank protection being installed, specifically from the I-Street Bridge downstream to the Stone Locks, would not be constructed in the same construction season). These are also different types of bank protection. The West Sacramento side has some berm between the levee and the channel, and therefore it is really a "bank" fix, while the ARCF side has levee toe underwater and includes rock berm. Both of these projects propose to implement planting berms and new SRA habitat, and to protect lower waterside trees in place to preserve the existing habitat to the maximum extent possible.

Additionally, levee maintenance activities by state agencies and local reclamation districts are likely to continue, although any effects on waters of the U.S. will be addressed through the Section 404 permitting process with the Corps Regulatory Division. Potential cumulative effects on the aquatic ecosystem could include: wave action in the water channel caused by boats that may degrade riparian and wetland habitat and erode banks; dumping of domestic and industrial garbage; land uses that result in increased discharges of pesticides, herbicides, oil, and other contaminants; and conversion of riparian areas for urban development.

h. Determination of Secondary Effects on the Aquatic Ecosystem

The placement of rock would not only reduce the risk of erosion, but would also anchor remaining trees in place and reduce the potential for trees falling over during a high flow event. The understory, which provides habitat for small rodents, ground nesting birds and waterfowl, and various reptiles, would be removed in order to provide a clean surface to place the rock. Because the riprap is a hard surface it would not support the growth of large amounts of vegetation. In areas with a soil trench or soil placed over rock on the lower portion of the slope vegetation would be planted or allowed to establish naturally. The riprap would also provide basking areas for some small reptiles such as snakes and lizards. Because the riparian corridor and shaded river aquatic habitat left in place would still provide value to fish and wildlife species, and compensatory mitigation would be implemented for trees that were removed, impacts are consider less than significant.

Risk exists for the unintentional placement of dredge and/or fill material to be placedoutside of the proposed project area. Unintentional placement could result in additional adverse impacts to water quality, erosion and accretion patterns, aquatic and other wildlife habitat, recreation, aesthetics and air quality. In order to reduce the risk of such impacts, contract specifications would require the contractor to mark the project boundaries, and that the contractor install erosion control (i.e. silt fencing, silt curtains) where possible within any standing waters.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation

No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site

The only practicable alternative to the proposed bank protection sites along the American River is the launchable rock trench measure, which was described in Section I(h) above. This measure would involve digging a trench in the berm at the waterside toe of the levee and filling it with rock. The rock would be covered with soil, and as the berm slowly erodes away during a high water event, the rock would "launch" and cover the bank to form a barrier to prevent further erosion. While this measure would minimize impacts associated with the placement of fill in waters of the U.S., it would still result in the removal of 0.40-acre of wetlands on the south bank of the American River. Additionally, this measure would result in significant impacts to vegetation, wildlife, and recreation during construction due to the removal of 65 acres of riparian habitat during construction, and disruption or closure of trails within the American River Parkway during construction. It is anticipated that this measure will be used in some locations on the American and Sacramento Rivers, however, the least environmentally damaging alternative would be a combination of both this measure and bank protection, with onsite environmental and recreational conditions taken into account when selecting the appropriate measure. Implementation of the launchable rock trench would reduce the quantity of fill in the American River from what was analyzed in this 404(b)(1) analysis by reducing the quantity of in-river bank protection required, while implementation of the bank protection would reduce significant effects on riparian habitat, recreational resources, and could avoid impacts to 0.40-acre of wetlands..

Additionally, in some locations where the river flow velocity is low, it may be practicable to use a biotechnical measure rather than bank protection or launchable trenches to provide erosion protection. This measure would involve using biomaterials such as fallen trees to protect the banks from erosion. This would be the least environmentally damaging measure, however it is not practicable for the majority of the river because currents are too strong. As a result there are only minimal locations where this measure could be feasibly implemented.

Because of the significant effects associated with the launchable rock trench measure, the feasibility of the biotechnical measures, and the placement of fill associated with the bank protection measure, a combination of these measures would be the least environmentally damaging practicable alternative.

c. Compliance with Applicable State Water Quality Standards

The proposed project would implement BMPs to ensure that it does not violate State water quality standards identified in the Central Valley Basin Plan (CVRWQCB 1998).

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act

The discharges of fill materials will not cause or contribute to, after consideration of disposal site dilution and dispersion, violation of any applicable State water quality standards for waters. The discharge operations will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act of 1973

The placement of fill materials in the project area(s) will not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972

Not applicable.

g. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

Appropriate and practicable steps to minimize potential adverse effects of discharge and fill on the aquatic ecosystem include: placing fill material only where it is needed for the proposed project and confining it to the smallest practicable area. The areas disturbed by construction would be returned as close as possible to pre-project conditions when practicable.

On the basis of the guidelines, the proposed project is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effect on the aquatic ecosystem. Alternative 2 has been identified as the Least Environmentally Damaging Practicable Alternative, as it minimizes the footprint of the levee improvements through the removal of the majority of the levee raises along the Sacramento River, results in less impacts to aquatic resources, and also proposes to create approximately 300 acres of new floodplain habitat through the widening of the Sacramento Bypass.

INTRODUCTION

This appendix provides responses to public and agency comments on the American River Common Features (ARCF) Draft Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) and General Reevaluation Report (GRR), as received during the public comment period.

PUBLIC COMMENT SUMMARY

The draft GRR and EIS/EIR were circulated for public review beginning on March 13, 2015. The notice of availability (NOA) was published in the Federal Register on March 13, 2015. The draft GRR and EIS/EIR were made available both on the Sacramento District, Corps of Engineers website as well as the website for the Central Valley Flood Protection Board. Hard copies of the draft GRR and EIS/EIR were provided to area libraries. Letters and/or DVD copies of the GRR and EIS/EIR were sent to interested parties, local residents, and to the agencies and elected officials listed in Section 6.4 of the EIS/EIR. Public workshops were held during the review period to provide additional opportunities for comments on the draft documents. All comments received during the public review period were considered and incorporated into the final GRR and EIS/EIR as appropriate. The meeting locations, dates and times were as follows:

- April 8, Hagginwood Community Center—3270 Marysville Blvd, Sacramento (5-7 p.m.).
- April 9, Elk's Lodge— 6446 Riverside Boulevard, Sacramento (5-7 p.m.).
- April 15, Library Galleria—828 I Street, Sacramento (3-5 p.m.).
- April 17, Arden-Dimick Library— 891 Watt Ave., Sacramento (5-7 p.m.).

A total of 137 people attended the four meetings. Comments were solicited through the use of court reporters at the meetings. Additionally, comments could be submitted through mail or electronic mail. Oral and written comments were made throughout the series of meetings by local, State, and Federal agencies, community organizations, and individuals.

During the Draft EIS public review period, a total of 471 comments were received from the public in the following manner:

- 39 different parties commented, including 2 Federal agencies, 7 State of California agency, 9 local agencies and organizations, 1 Native American Tribe, and 20 private citizens.
- 9 people presented verbal comments to the court reporter at the public meetings.
- 4 people left hand-written comment cards at the public meetings.

A summary of the major issues from the public comments are included below. Original letters, e-mails, and the transcripts of the public hearings follow. Responses to the public comments are included in the table that follows.

RESPONSES TO PRIMARY COMMENTS

Public comments on the draft documents focused in part on: 1) access to recreational features during and after construction; 2) design, placement and justification for rock erosion protection along the American and Sacramento Rivers; 3) effects to vegetation as a result of the recommendations; 4) clear presentation of the anticipated level of the performance of the project; and 5) coordination with stakeholders in future phases of the project.

MATRIX OF COMMENTS AND RESPONSES

The following pages include the posters from the public scoping meeting. Following the posters are all public comments received and a matrix of the Corps' responses to those comments. The responses are annotated to refer back to the corresponding letters and comments that precede them. Each letter and comment has been annotated with a designation such as "C-5". The letter, "C" refers to the comment letter, and the number, "5" refers to the comment number within the letter.

Welcome

Welcome to our

Sacramento Area Levee Improvements

public meeting

US Army Corps of Engineers®

CENTRAL VALLEY FLOOD PROTECTION BOARD — PUBLIC SAFETY WITH FLOOD PROTECTION — STATE OF CALIFORNIA

SAFCA

Please Sign In

Introduction

Sacramento Area Levee Improvements

- Together, the State of California, Sacramento Area Flood Control Agency and the U.S. Army Corps of Engineers have made tremendous progress in reducing flood risk for Sacramento – perhaps America's most at-risk city for severe flooding.

- Modernizing Sacramento's aging flood infrastructure still requires a lot of work. These proposed plans recommend $1.46 billion in further improvements to modernize Sacramento's flood infrastructure so it reliably and sustainably reduces Sacramento's flood risk for decades to come.

- SAFCA's plan and the Corps' are well coordinated and work together to achieve the same goals.

- We need your feedback. These proposals are drafts, and this is your chance to have a say in the development of the project.

US Army Corps of Engineers

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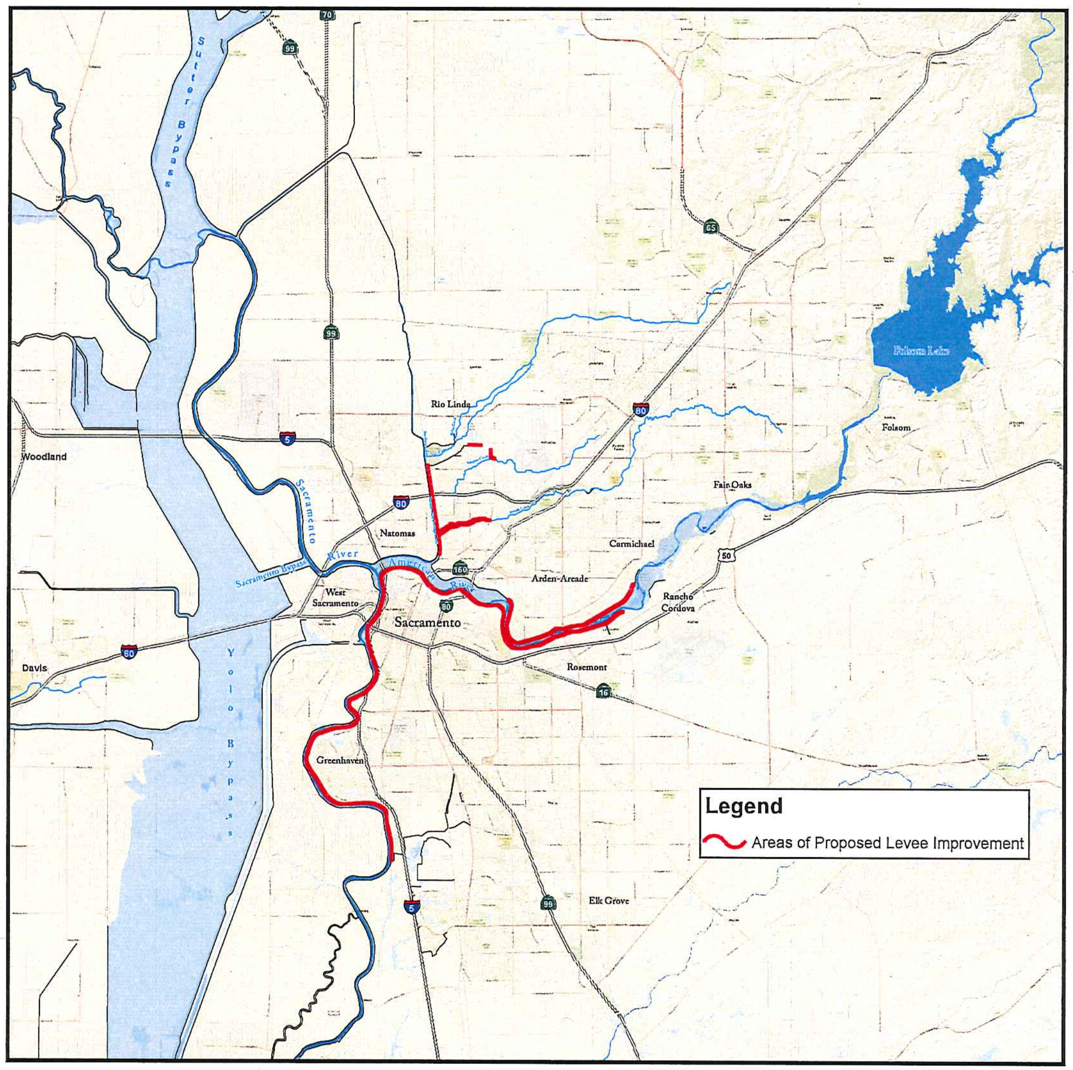
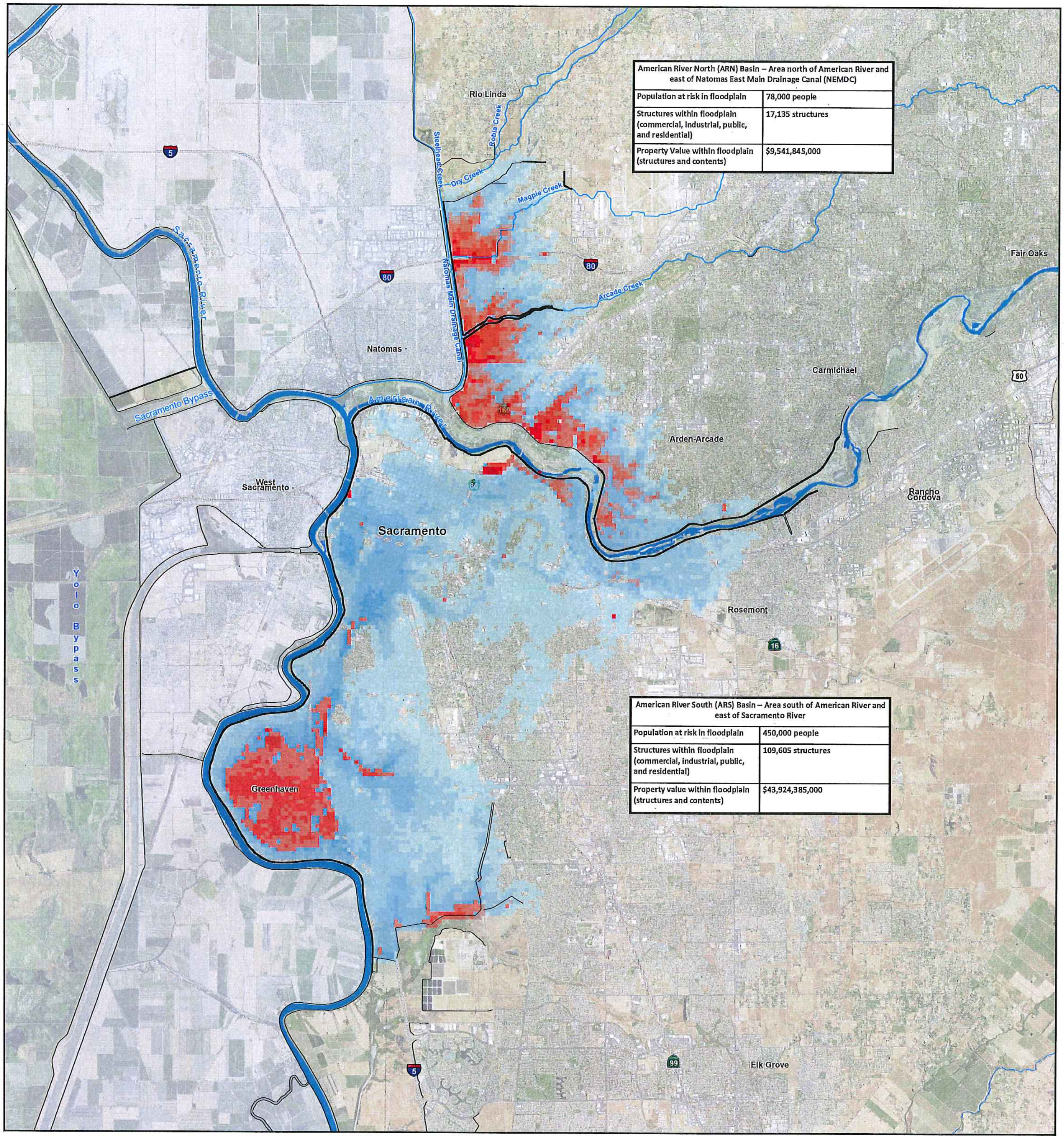




American River North (ARN) Basin – Area north of American River and east of Natomas East Main Drainage Canal (NEMDC)	
Population at risk in floodplain	78,000 people
Structures within floodplain (commercial, industrial, public, and residential)	17,135 structures
Property Value within floodplain (structures and contents)	$9,541,845,000

American River South (ARS) Basin – Area south of American River and east of Sacramento River	
Population at risk in floodplain	450,000 people
Structures within floodplain (commercial, industrial, public, and residential)	109,605 structures
Property value within floodplain (structures and contents)	$43,924,385,000

Existing 200-Year Floodplain

(Study Areas Only)

Legend

- Proposed Projects
- Existing Levees
- River/Creek
- Major Roads
- Interstate/Highway

Floodplain Depth (Feet)

- 0 - 4
- 5 - 8
- 9 - 12
- 13 - 16
- 17 - 20
- 21 - 24
- 25 - 28

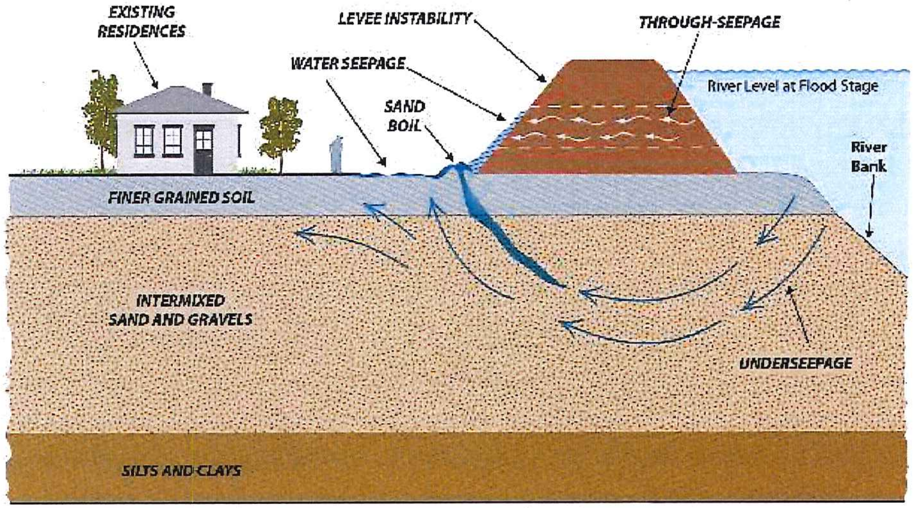
* West Sacramento & Natomas floodplain not shown.

N

0 0.5 1 2 3 4
Miles

Sacramento Area Flood Control Agency

Seepage & Stability Issues



Seepage and stability problems

Levee Instability:

Saturated soil and sand layers may cause levee slopes to slump, or levee foundation to settle risking levee failure at flood stage.

Levee Through-Seepage:

When the river is approaching flood stage, high water pressure at some locations causes seepage through the levee.

Levee Underseepage:

High river levels lead to seepage through sandy and gravelly soils. High water pressure beneath the surface can emerge at the landside levee toe, causing sand boils, and can also appear at the surface up to several hundred feet landside of the levee. Sand boils could cause loss of levee foundation, and eventual collapse of levee.

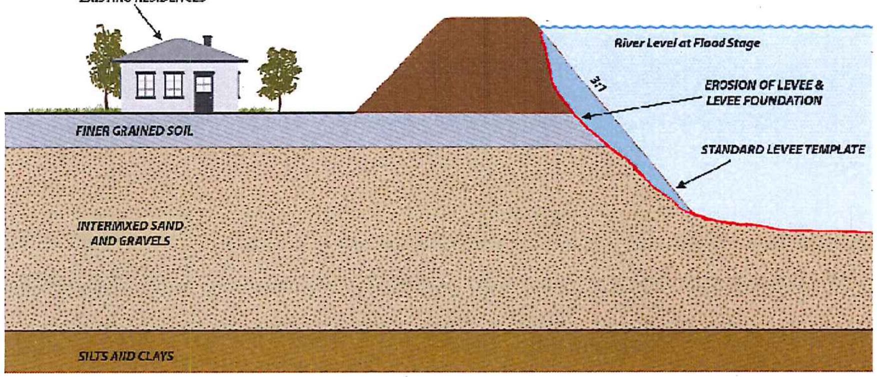
Seepage problem

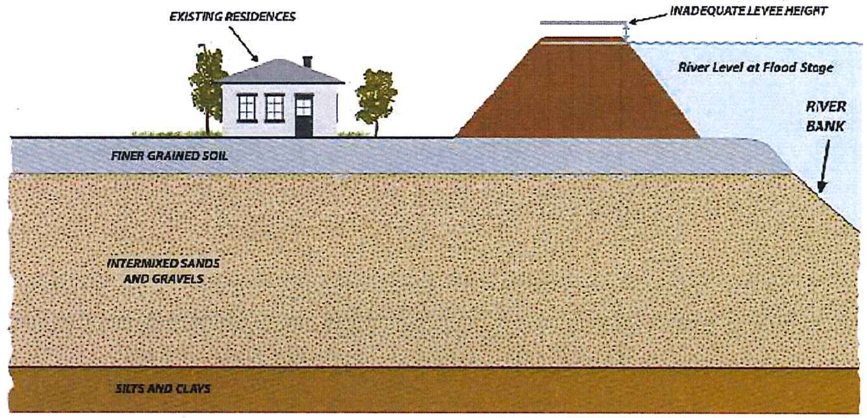
Levee instabiity problem

US Army Corps of Engineers

SAFCA

Erosion & Height Issues





Levee Erosion Problems:

River currents remove soil material from channel bank. Eventually, or sometimes suddenly, a portion of the levee and/or levee foundation erodes away which greatly reduces the stability of the levee.

Levee Height Problems:

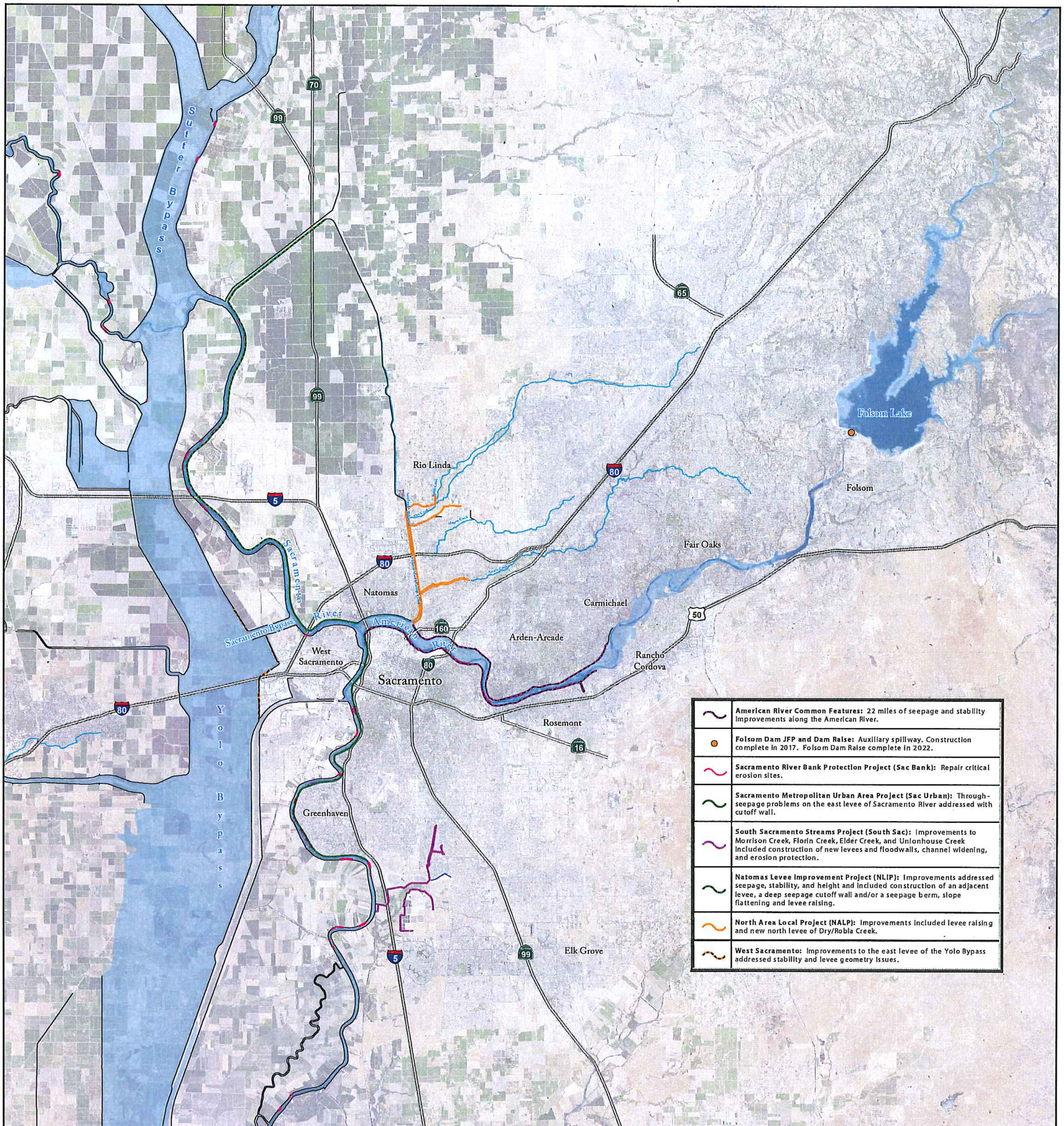
Levee height may be too low to contain high river flows, account for uncertainty in the design water level, and/or contain wind-wave run-up.

Erosion problems

Erosion problems

Levee overtopping problem

US Army Corps of Engineers. SAFCA



What We've Accomplished

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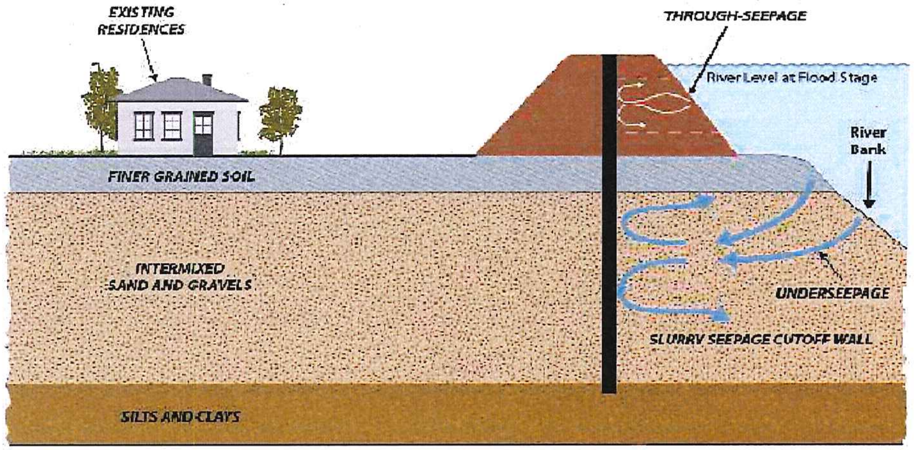
SAFCA
Sacramento Area Flood Control Agency

Seepage & Stability Addressed



Levee Seepage:

Primarily addressed by constructing a seepage cutoff wall. Water pressure is greatly reduced as it passes through the wall so that seepage and boils on the landside toe are either eliminated or greatly reduced.

Levee Instability:

Stability problems are typically addressed by construction of a seepage cutoff wall, with either soil reinforcement or levee slope flattening improvements constructed. In areas needing soil reinforcement, geotextiles will be placed within the levee in layers. In areas needing slope flattening, new soil material will be added to the levee slope and compacted.

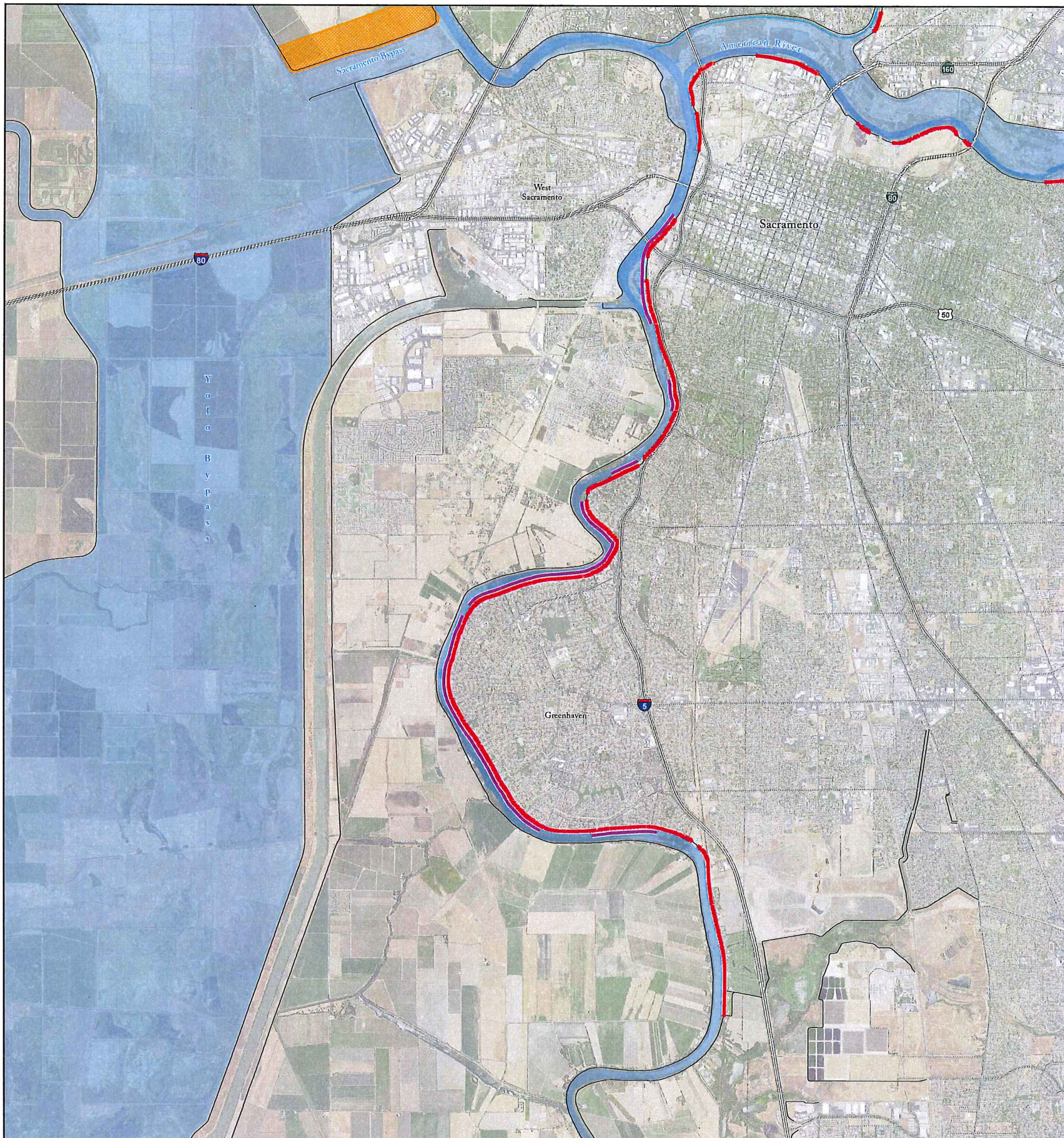
RIGHT: Deep soil mixing seepage cutoff wall

BELOW: Levee instability repair

ABOVE: Levee instability repair

LEFT: Conventional seepage cutoff wall construction

US Army Corps of Engineers. SAFCA



USACE & SAFCA Projects

Legend

- USACE Plan
- SAFCA Plan
- Existing Levees (not part of this project)
- River/Creek
- Major Roads
- Interstate/Highway

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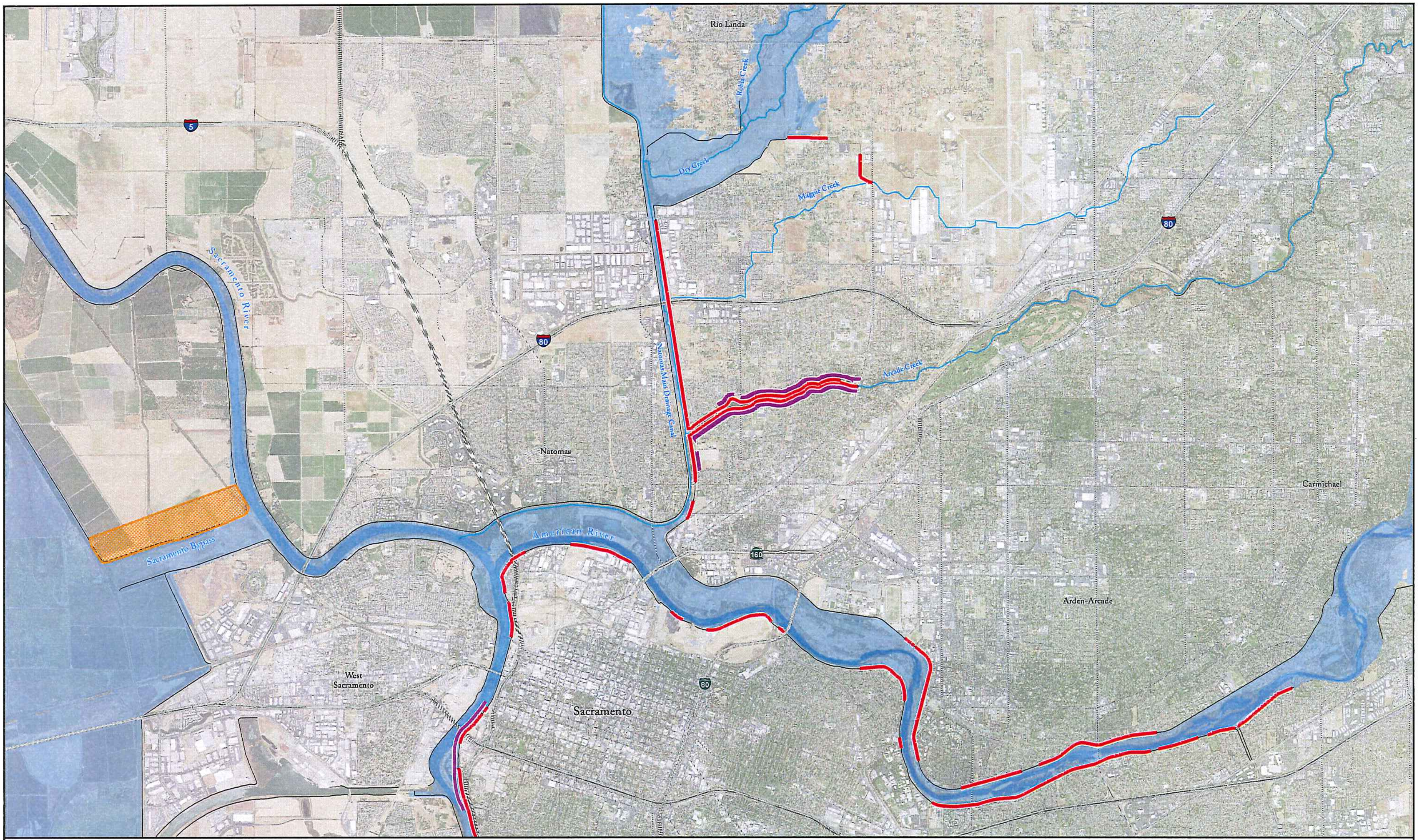
Miles

Sacramento Area Flood Control Agency



USACE & SAFCA Projects

Legend

- USACE Plan
- SAFCA Plan
- Existing Levees (not part of this project)
- River/Creek
- Major Roads
- Interstate/Highway
- Sac Bypass Expansion

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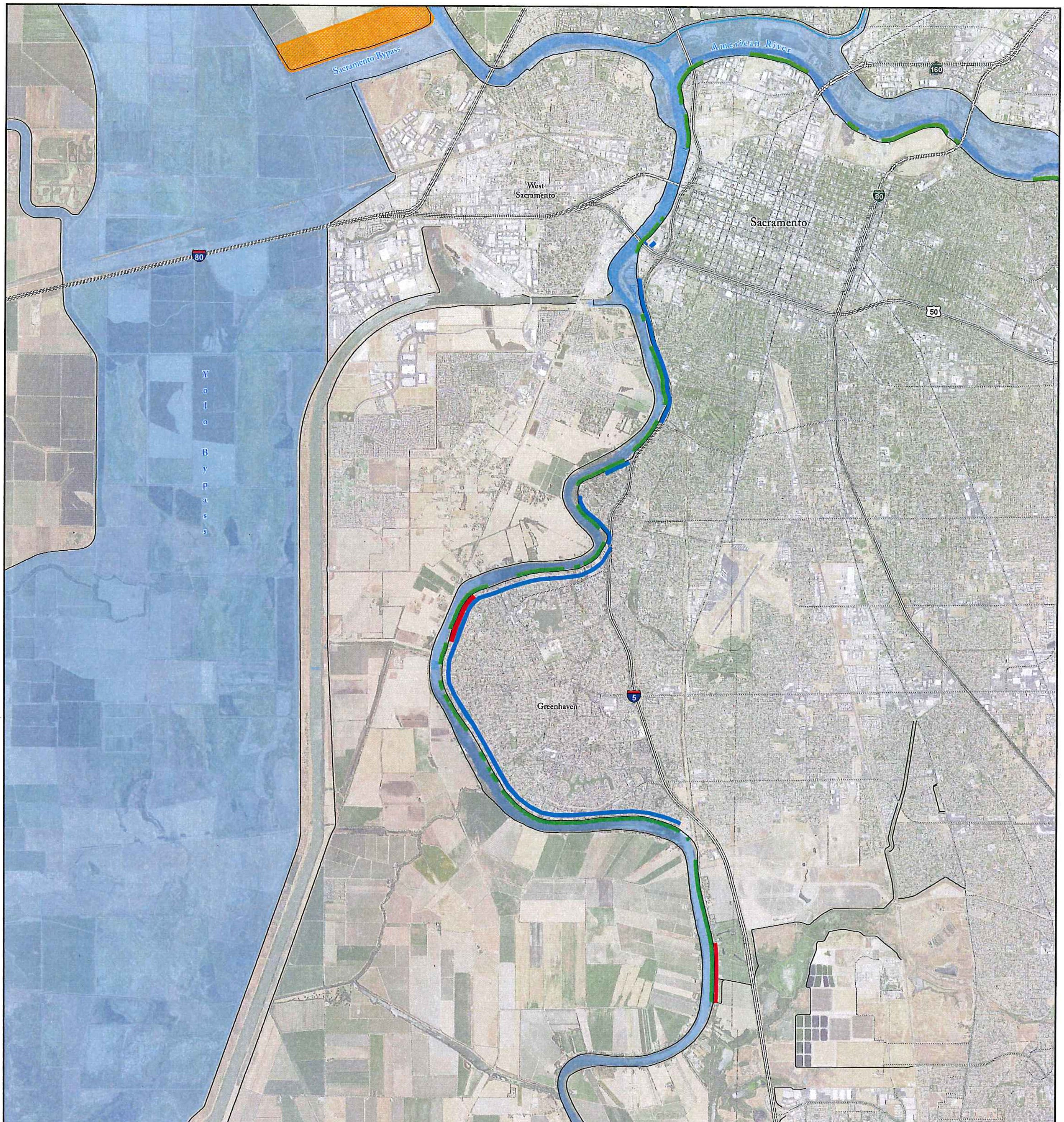
SAFCA
Sacramento Area Flood Control Agency



USACE Plan

Legend
Height Improvements
Seepage/Stability Improvements
Erosion Improvements
Existing Levees (not part of this project)
River/Creek
Major Roads
Interstate/Highway

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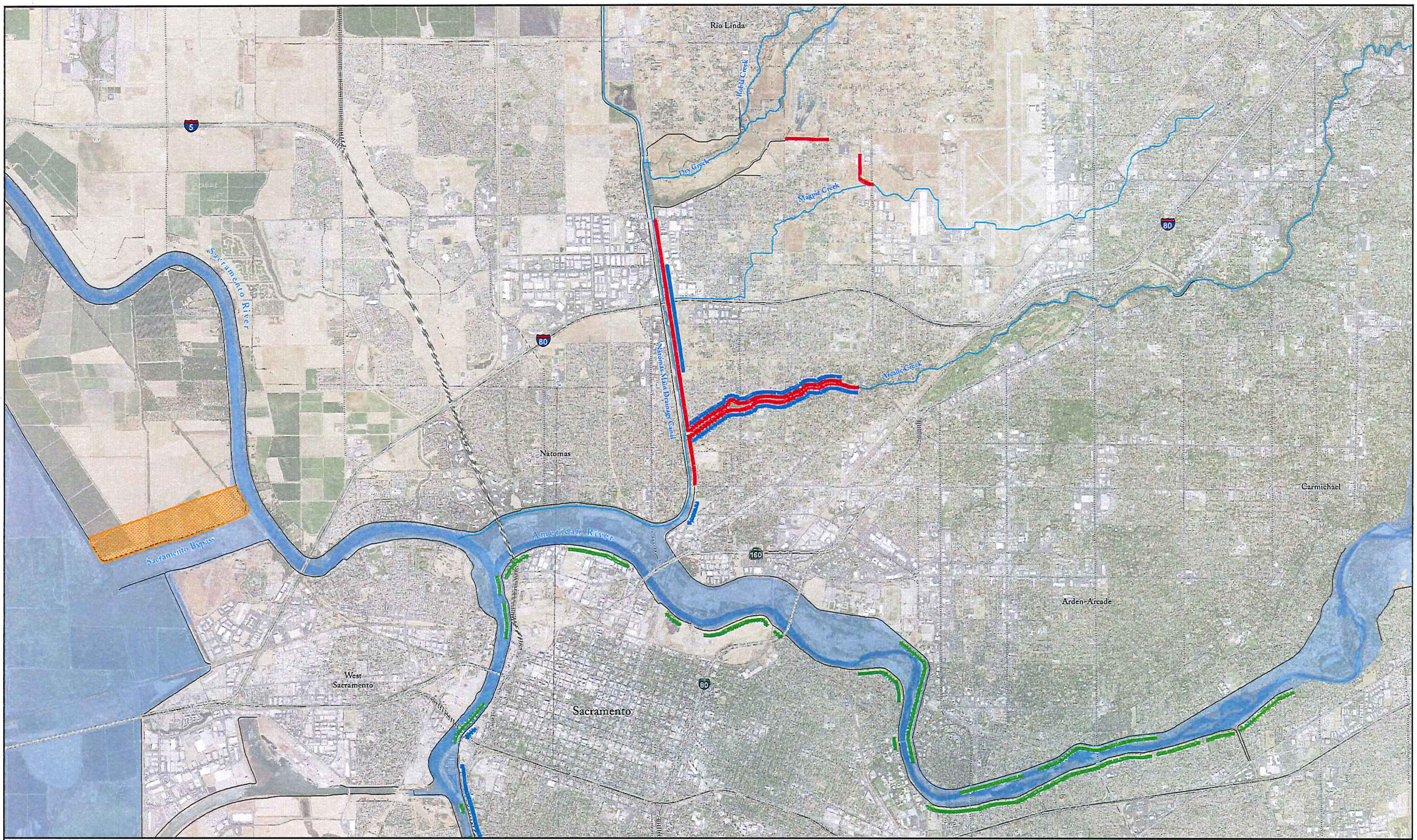
Sacramento Area Flood Control Agency



USACE Plan

Legend

- Height Improvements
- Seepage/Stability Improvements
- Erosion Improvements
- Existing Levees (not part of this project)
- River/Creek
- Major Roads
- Interstate/Highway
- Sac Bypass Expansion

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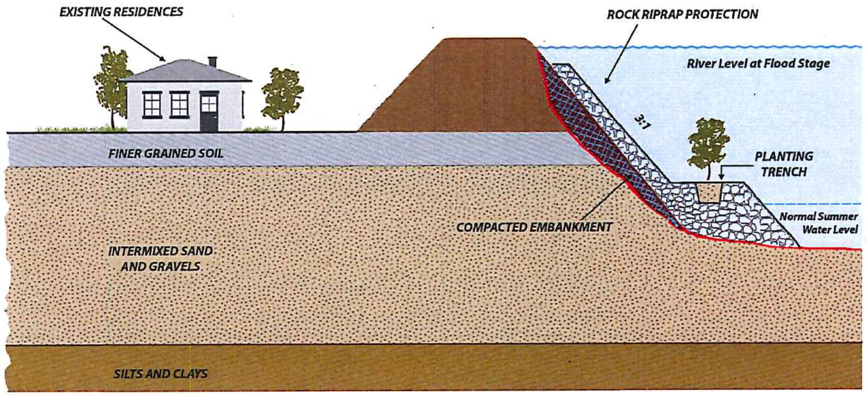
SAFCA
Sacramento Area Flood Control Agency

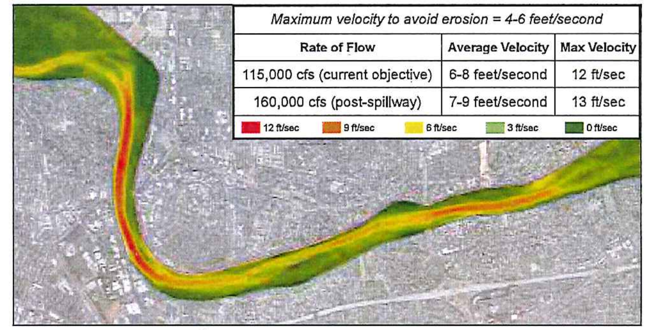
Erosion Addressed



Levee Erosion:

Primarily addressed by placing rock riprap revetment either on channel bank or at toe of levee. Construction from barge preferred, where practical.

Velocity:

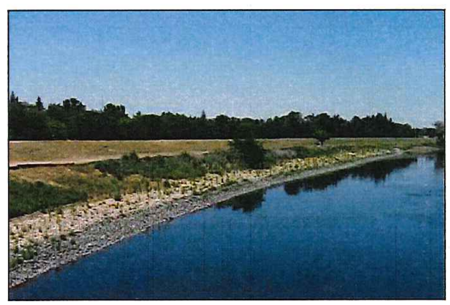


Maximum velocity to avoid erosion = 4-6 feet/second

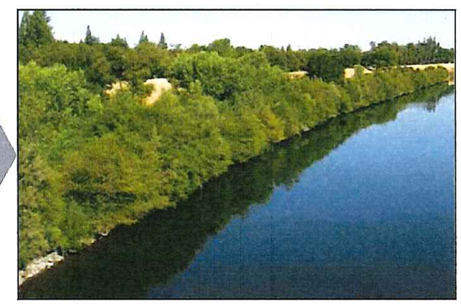
Rate of Flow	Average Velocity	Max Velocity
115,000 cfs (current objective)	6-8 feet/second	12 ft/sec
160,000 cfs (post-spillway)	7-9 feet/second	13 ft/sec

Levees were historically constructed from highly erodible mining deposits and sands, close to the main channel so more land was available for urban development. The American River downstream of Folsom Dam is very steep, creating faster, stronger stream flows confined between levees that could promote erosion. History shows that a levee can fail because of erosion on American River, and Sacramento will experience significant flood risk reduction when the issue is addressed.

Typical bank protection placing rock riprap revetment from barge



Typical bank protection as constructed at Lower American River Site 4 between Guy West bridge and H Street Bridge in 2001



Lower American River Site 4 in 2010

US Army Corps of Engineers

SAFCA

Height Addressed: Bypass vs. Levee Raise

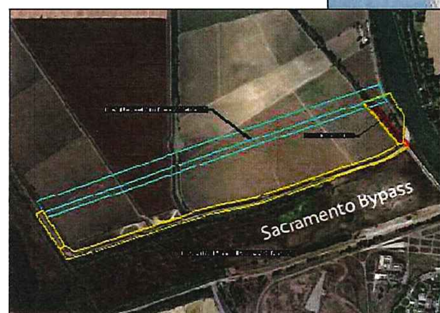
Sacramento Area Levee Improvements

In order to convey a flood event with an annual chance of exceedance of 1 in 200, the Sacramento River downstream of the American River requires either eight miles of levee to be raised or a combination of conveyance improvements with less than one mile of levee raising.

Alternative 1 (NED plan) shows approximately 8 miles of levee raises.

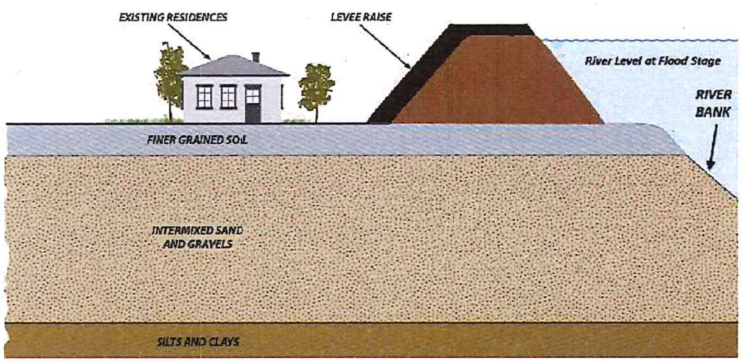
Alternative 2 (recommended plan) relies upon widening the Sacramento Weir and Bypass, reducing the need to raise the levees identified in the NED plan. Less than one mile of levee raising would still be necessary.

Alternative 2 is recommended because it requires less raise construction and improves the operational flexibility provided by widening the Sacramento Weir and Bypass.



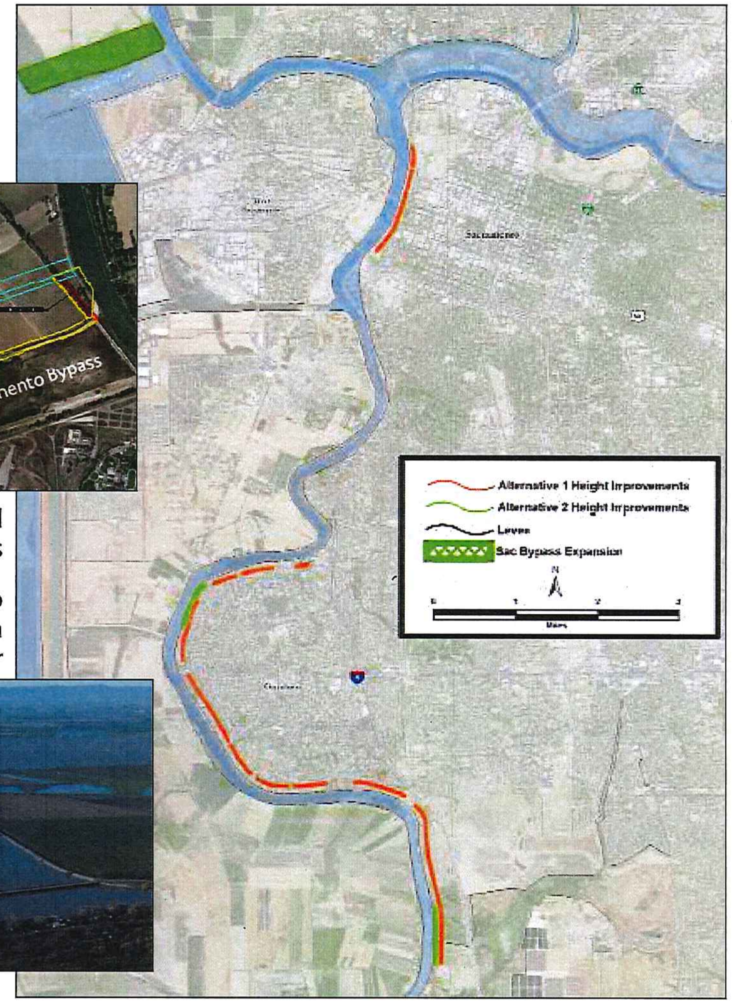
ABOVE: Drawing of widened Sacramento Weir & Bypass

BELOW: Aerial of Sacramento Weir and bypass from Sacramento River



Levee Height:

Primarily addressed by raising levee with soil or constructing a floodwall on top of levee. In some cases, the need to increase levee height can be reduced by diverting flow away from the river such as by widening Sacramento Weir & Bypass.

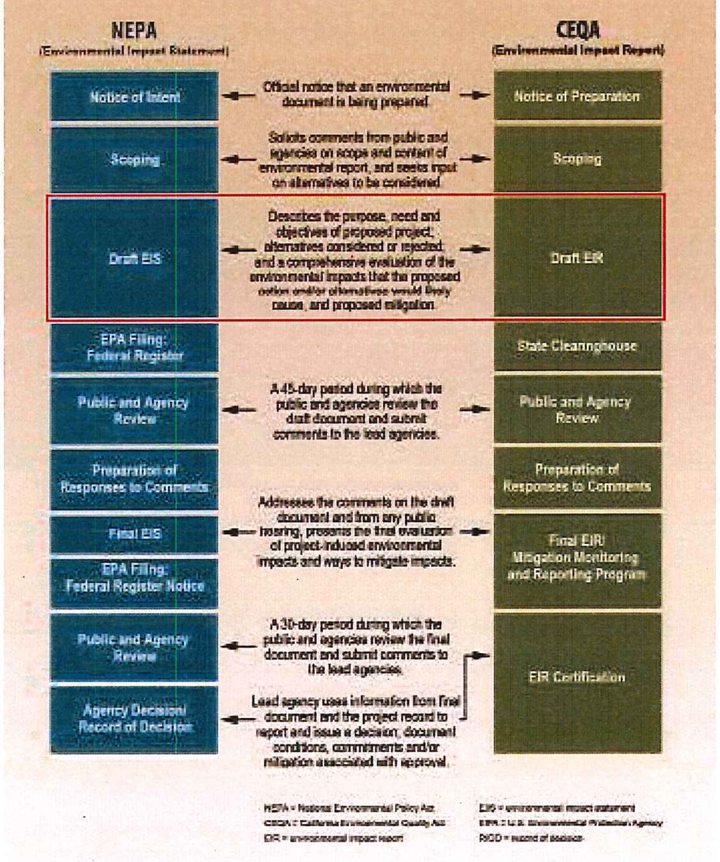


US Army Corps of Engineers

SAFCA

NEPA/CEQA

Understanding the environmental review processes



Environmental Topics Addressed:

Air Quality, Noise, Traffic and Water Quality

- Temporary effects during construction.
- Best management practices and environmental commitments for construction will reduce localized construction effects.

Biological Resources

- Compliance with Corps Levee Safety policy requires vegetation to be removed from the levees, however:
    - Acquisition of a variance from the policy would allow vegetation to remain on the lower waterside slopes to protect habitat for listed species.
    - Locals will implement a Systemwide Improvement Framework (SWIF), to allow vegetation to be addressed on a "worst-first" basis.
    - Vegetation will only be impacted in the construction footprint; approximately the upper half of the levee slope.
- Vegetation removal could adversely impact listed species, such as the valley elderberry longhorn beetle and Swainson's hawk.
- Other construction activities could adversely impact giant garter snake, vernal pool crustaceans, and listed fish species such as salmon, steelhead, sturgeon, and Delta smelt.

Cultural Resources

- Potential effects on archaeological resources. A Programmatic Agreement between the Corps, the CVFPB, and State Historic Preservation Officer will govern the phased approach to comply with Section 106 of the National Historic Preservation Act.
- Ongoing coordination with tribal representatives will continue throughout implementation of the Programmatic Agreement.

US Army Corps of Engineers.

SAFCA

Public Comments Received on the ARCF GRR

A	Verbal Comments Received at Public Meeting on Wednesday April 8, 2015 at Joe Mims Jr. Community Center
B	Verbal Comments Received at Public Meeting on Thursday April 9, 2015 at Sacramento Elks Lodge #6
C	Verbal Comments Received at Public Meeting on April 15, 2015 at Sacramento Library Galleria
D	Verbal Comments Received at Public Meeting on April 17, 2015 at Arden-Dimick Library
E	Public Meeting Comment Card from Lissa McKee
F	Public Meeting Comment Card from Carolyn Baker
G	Public Meeting Comment Card from Ellen Broms
H	Public Meeting Comment Card from Mary M. Schwartz
I	E-mail from Dan Kopp
J	E-mail from Stan Jones
K	E-mail from Janet Fullwood
L	E-mail from James Geary
M	E-mail from Maggie Beddow
N	E-mail from United Auburn Indian Community of the Auburn Rancheria
O	Letter from the California Department of Transportation
P	Letter from the California Department of Fish and Wildlife
Q	Letter from the U.S. Department of the Interior
R	Letter from the Sacramento County Department of Transportation
S	Letter from the Sacramento Metropolitan Air Quality Management District
T	Letter from the California State Lands Commission
U	Letter from Tremaine & Associates
V	Letter from Tremaine & Associates
W	Letter from the Delta Stewardship Council
X	Letter from the Delta Stewardship Council
Y	Letter from the Delta Protection Commission
Z	Letter from the Metropolitan Water District of Southern California
AA	Letter from the U.S. Environmental Protection Agency
BB	Letter from the Central Valley Regional Water Quality Control Board
CC	Letter from the Sacramento Regional County Sanitation District
DD	Letter from Joseph E. O'Connor Jr.
EE	Letter from Friends of the River, Habitat 2020, and Save the American River Association
FF	Letter from Save the American River Association
GG	Letter from James Morgan
HH	E-mail from Gay Jones
II	Letter from the State Water Resources Control Board
JJ	Letter from Sacramento County
	Letter from Ken Cooley

PUBLIC MEETING FOR
NORTH SACRAMENTO STREAMS,
SACRAMENTO RIVER EAST LEVY,
LOWER AMERICAN RIVER,
AND RELATED FLOOD IMPROVEMENTS PROJECT

--oOo--

Wednesday, April 8, 2015
5:00 p.m.

--oOo--

Joe Mims Jr. Community Center
3271 Marysville Boulevard
Sacramento, CA 95834

--oOo--

PUBLIC COMMENTS

Reported by: CATHERINE D. LAPLANTE
CSR License No. 10140

COURT REPORTER DEPOT
Phone (877) 808-3376 Fax (973) 353-9445
www.courtreporterdepot.com

A-1

MS. MAXWELL: My name is Sandra Maxwell, S-A-N-D-R-A, M-A-X-W-E-L-L. I am a resident. I live on Verano Street. V, as in Victor, E-R-A-N-O, Street. It's --

How do I explain this?

Periodically we get high water. In '95 because of a tree falling down along -- further on down the creek, and then it rained like crazy, the house flooded, and I was out of my house for five months.

Luckily, my mother -- I mean, it was her house. I was living with her because she had Alzheimer's. Luckily she had flood insurance, so we were okay, except financially -- except we were out of the house for five months, and if you've ever dealt with an Alzheimer's patient, it's traumatic.

So all these years I've carried flood insurance. Now, I have been notified by the flood insurance people, FEMA, that I'm losing my discount, but there's no -- there's no explanation as to what happens after that loss.

So we came over tonight when Arcade Creek was mentioned. Runs along the back of the property. Was that going to effect us in any rate? Didn't really get that answered.

But I have a phone number and a name, and I'm going to give him a call and see if they have any information.

The levy work that they're talking about does not appear to affect my house. It's not going to be in that area. It's to the west of us, which solves the problem of them cutting down trees, which I read that in the paper. That's not a worry.

I still don't know whether I'm considered in the flood plain or not, that the flood insurance people are concerned about.

A-1 (Cont.)

Is the work that they're going to be doing going to make the bank and the flood insurance people happier?

Is the City going to come in and clean all the silt out that has built up over the years?

I mean, it didn't rain very much in February, but the creek almost went over into my backyard because it's so shallow back there because of the crude buildup of silt.

So I solved the problem by being the squeaky wheel every year. I start in the spring, come clean the creek out, and in October they usually show up. They didn't this last year.

So that's where I'm at.

The City fenced off years ago, years ago fenced

A-1
(Cont.)

off the creek, so the homeowners can't get back there, and cut down weeds and clean up trash and do anything.

We can't get back there and get -- the City doesn't adequately take care of what they fenced off.

Okay.

THE REPORTER: Is there a number that they can reach you at?

MS. MAXWELL: Area code 916-922-3176. And they can --

I rarely answer the phone. If I don't recognize the phone number, I don't answer, but I will call back when they leave a message.

Okay. Thank you very much. Thank you.

(Conclusion at 7:00 p.m.)

REPORTER'S CERTIFICATE

I, CATHERINE D. LAPLANTE, a Certified Shorthand Reporter for the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing was reported in shorthand by me, CATHERINE D. LAPLANTE, a Certified Shorthand Reporter of the State of California, and thereafter transcribed into typewriting; that the foregoing is a true and correct record given.

IN WITNESS WHEREOF, I hereby certify this transcript at my office in the County of Placer, State of California, this 15th day of April, 2015.

CATHERINE D. LAPLANTE, CSR #10140

PUBLIC MEETING FOR
NORTH SACRAMENTO STREAMS,
SACRAMENTO RIVER EAST LEVY,
LOWER AMERICAN RIVER,
AND RELATED FLOOD IMPROVEMENTS PROJECT

--oOo--

Thursday, April 9, 2015
5:00 p.m.

--oOo--

Sacramento Elks Lodge #6
6446 Riverside Boulevard
Sacramento, CA 95831

--oOo--

PUBLIC COMMENTS

Reported by: CATHERINE D. LAPLANTE
CSR License No. 10140

COURT REPORTER DEPOT
Phone (877) 808-3376 Fax (973) 353-9445
www.courtreporterdepot.com

B-1

MS. NASON: My name is Beverly, B-E-V-E-R-L-Y. Last name is Nason, N-A-S-O-N. And I live at 6728 Benham, Way, B-E-N-H-A-M, Way, and that's 95831.

And my e-mail address is [redacted], [redacted].

And my comment is we have been at our house like 30, 35, 36 years, so we've gone through a lot of -- two times digging down the slurry.

Our house backs up to the levy, and so they've done two times with the -- down the middle of the levy, and if it rains a foot, which I'm grateful of.

I don't know how many years ago that was, the last incident, which quite made me come to this, is they put, I guess, erosion, the cement, the big barges came, and then they would dump the -- the big cement. I guess they were for erosion, which I was glad they were doing but didn't realize it was cracking our house, which it did.

We have a stucco house, and it got cracked.

I didn't know anything about it. I was just glad they were doing the work that I wouldn't get flooded again.

And my friend lived about half a mile in the new section, and they're three houses from the levy. Our house backs up to the levy. Hers, the new units, are the levy, and they're three houses in. All three houses from the levy had cracked damage, and they were all fixed. They put in a complaint, and they were all fixed.

I did not know to do that, so that's why I'm here today, so in case that was going to happen again, I would know who to call.

So I appreciate the meeting tonight so that I'm a more-informed consumer. Yeah.

So that's what it's all about because I didn't get it done, and I should have because I was a victim of, but I'm glad to see it raised, glad to see it was not going to flood again.

B-1
(Cont.)

Glad everyone did it, but I wished I would have put in for the damage. I did have damage.

So now I have a card, and I will be able to -- if they do do that.

I didn't think it was going to be done again because they've done it, erosion correction, that's where the big cement, that's where the vibration cracked the houses, damage was done from the -- I guess the soil is such that --

So now I'm glad that we had this meeting.

Thank you.

* * * * * * * * * * *

B-2

MS. BIGELOW: Pamela Bigelow. B-I-G-E-L-O-W. Address [redacted], Sacramento, just the number [redacted]

The first thing I want to say is I have a walnut tree within 15 feet of the levy that I would like removed. It has the family of squirrels that live in it. You can replace it with another tree, that's just fine.

It is, however, on City property, but there are quite a few squirrels that have lived there for many, many years, so I'm sure there are a lot of burrows there.

Right behind it is a large oak tree, which they live in. The squirrels live in the oak tree because they eat the acorns, and they eat the walnuts.

Second thing is I'd like consideration for not having -- for not having a staging area on the big lot next to Marlton Court.

We had one there in the early '90s, and we think we've done our duty, so if you could please find another place for a staging area, we would very much appreciate it.

Third thing, which goes to the City of Sacramento, the cul-de-sac and levy need to have the grass cut on a monthly basis rather than an annual

B-2 (Cont.)

basis. The group of neighbors in our cul-de-sac is paying a gardener to cut the levy grass because it's a fire hazard, and it's dangerous, and people fall down the levy all the time because they can't see where they're going because the grass is so tall.

So we would like to request the grass be cut much more often.

That's it.

* * * * * * * * * * *

B-3

MS. SHORT: My name is Shirley. Last name Short, S-H-O-R-T, and I live along the river and brick yard, and I don't want to be contacted. There's no reason to.

I was just disappointed, that my impression was this was going to be a meeting tonight, and that there was going to be a presentation by the agencies involved, and we would have an opportunity to ask questions, and we have had an opportunity to ask questions, and they've provided a lot of really good information.

But I think a meeting where they gave us a presentation would have been more helpful to us, and some -- you know, some things to take away, some handouts would have also been more helpful.

I was disappointed. I thought this was going to be a meeting. That's what they told us it was going

B-3
(Cont.)

to be, so why didn't they have a meeting?

That's my comment.

* * * * * * * * * * *

MR. CARROLL: Craig, C-R-A-I-G, Carroll, C-A-R-R-O-L-L. [redacted].

B-4

My first concern is the vegetation, the existing vegetation that is on the water side of the levy behind my property.

Prior to any removal of the vegetation, will there be a report or a document available on which trees or which -- what vegetation will be removed prior to the removal in the event that I can challenge, legally challenge whether or not it meets the criteria of a hazardous tree or the question -- the reason for the removal.

I know the trees are tagged, and I would like to see in the proposal that these tag numbers be included on which trees will be removed and which trees won't be removed.

My piece of property is actually between Reach 15 and 16. That's the first concern.

And the second will be the privacy issue. Right now we're not allowed to have privacy fences because of the regulations on the fence sizes, heights, has to be see-through.

Whether or not there's going to be any screens or any sort of privacy protection, so while we're enjoying our pool or backyard during the construction phase of it, whether or not we just have to live with one or two, three months, however long the project is, of people in our backyard with little or -- giving us little or no privacy are my two biggest concerns.

So vegetation removal and the privacy issue are my two issues with this particular project.

Also, the existing permits, the use permits that we have on our piece of property, if they encroach -- for the encroachment permits, if they encroach into the area of the levy that will be constructed or affected by the construction, and it's required to be removed.

B-4
(Cont.)

A, who's going to pay for the cost of removal, and, B, whether or not it will be replaced after the construction's over, and the cost to that, and whether or not I'll have to reapply for a new permit, or if I can use the existing permit and reconstruct what was in there.

So the three issues are cost of removal, the cost of replacing it after the construction is over, and whether or not I will be able to get a permit, or if I can use -- if I'll have to apply for a permit all over

B-4
(Cont.)

again, or if I can just use the existing permit to
repair what was removed.

(Conclusion at 7:00 p.m.)

REPORTER'S CERTIFICATE

I, CATHERINE D. LAPLANTE, a Certified Shorthand Reporter for the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing was reported in shorthand by me, CATHERINE D. LAPLANTE, a Certified Shorthand Reporter of the State of California, and thereafter transcribed into typewriting; that the foregoing is a true and correct record given.

IN WITNESS WHEREOF, I hereby certify this transcript at my office in the County of Placer, State of California, this 15th day of April, 2015.

____
CATHERINE D. LAPLANTE, CSR #10140

---oOo---

PUBLIC COMMENT TRANSCRIPT

SAFCA MEETING

APRIL 15, 2015

---oOo---

COURT REPORTER DEPOT
Phone (877) 808-3376 Fax (973) 353-9445
www.courtreporterdepot.com

C-1

JOHN LUNDGREN: On behalf of the county's regional parks director, Jeff Leatherman, I'm just a little bit concerned about a lack of specificity for the improvements along the American River because it makes it hard for us to evaluate the impacts to American River Parkway. We're specifically concerned about a loss of revenue from parkway fees and sales of annual passes, and we're concerned about a loss of use, meaning that that park won't be available for the regular users.

We agree with the draft document that the impacts to recreation will be significant and unavoidable, but we would like to see more specific mitigation with performance criteria. We're also concerned that the Campus Commons Golf Course will be impacted, and we're not sure we saw that in the document to date, and with past Corps projects in the parkway, we've experienced some confusing information from the contractor when directing parkway users around closed areas and would like extra effect and coordination in the future to work on a more consistent, unified public information system.

C-2

Okay. Now the comments are from me, so I'm representing the county's mining program. And the SAFCA portion of the project has several borrow sites identified. For those sites within unincorporated

C-2
(Cont.)

Sacramento County, they will need to obtain a borrow site permit pursuant to county code and the State Surface Mining and Reclamation Act, SMARA, S-M-A-R-A. Please leave enough time in the process to coordinate permitting with the county. We're available to assist with early consultation to streamline the process.

Some of the areas may not require a borrow permit, but still will require a grading permit. If the specific impacts of that grading are not analyzed in this document, you will need to leave time in the process for analyzing them under a future CEQA document. There's a potential borrow site identified in the Dry Creek Parkway. Please be aware that the area is particularly sensitive for cultural resources and may be regulated by the Dry Creek Parkway Plan.

COURT REPORTER'S CERTIFICATE

STATE OF CALIFORNIA)
) ss.
COUNTY OF PLACER)
_________________________)

I, Lindsey R. Perry, hereby certify:

I am a duly qualified Certified Shorthand Reporter, in the State of California, holder of Certified Shorthand Reporter Certificate No. 12806 issued by the Court Reporters Board of California and which is in full force and effect.

I am the reporter that stenographically recorded the comment in the foregoing transcript, and the foregoing transcript is a true record of the comment given.

Dated: April 27, 2015

____

LINDSEY R. PERRY, CSR NO. 12806, CRR, RPR

D

---o0o---

SAFCA & US ARMY CORPS OF ENGINEERS

HELD AT THE DIMICK LIBRARY

891 WATT AVENUE

SACRAMENTO, CALIFORNIA 95834

FRIDAY, APRIL 17, 2015

5:00 P.M.

---o0o---

REPORTED BY: JILLIAN M. SUMNER, CSR No. 13619

COURT REPORTER DEPOT
Phone (877) 808-3376 Fax (973) 353-9445
www.courtreporterdepot.com

BE IT REMEMBERED, that on Friday, April 17th, 2015, commencing at the hour of 5:00 p.m., at the Dimick Library, 891 Watt Avenue, Sacramento, California before me, JILLIAN M. SUMNER, a Certified Shorthand Reporter in and for the county of Sacramento, state of California, was present and recorded verbatim the following proceedings:

COMMENTS BY THE PUBLIC:

(Comments made by Pat Hara and Jack Burrows, collectively:)

PAT HARA:

D-1

Basically, we live in -- what is it -- Walnut View Estates. That's off of Sierra Boulevard. And my flood insurance goes up 100 bucks a year, $1,700. And I'm going, that's just -- what can we do?

So we talked to Pete about the issues of the flooding in that area and the drainage issues, and I need to find a way to get my flood insurance down, if at all possible.

D-1
(Cont.)

JACK BURROWS:

What Pete was telling us was that what was really required is a larger pump capacity. But the cross-benefit analysis is not there. So he's recommending that we get something from the County, meet with a man by the name of George Booth to evaluate her elevation.

Because I'm not paying any flood insurance in my home. I have another home a few houses down that I'm paying 400 and something. Jane is paying -- across the street from me -- paying 400 and something.

PAT HARA:

And the kids are right next to the canal. So, yeah, that's the issue.

We originally wanted to have to put up another Cal Expo to pump water out of the slough when the water backs up. But obviously that's not going to work. We have too many issues working against us there.

JACK BURROWS:

So Pete said to bring the comment to your attention, and he'll bring it to the County's --

D-1
(Cont.)

George Booth and the County to see if there's anything we can do. And we'll bring it to his attention also.

Thank you.

(Next commenter:)

D-2

JUDITH SCOTT:

I just wanted to say everybody was very helpful and friendly, and I love the charts. And several people answered a lot of questions that we've had.

And another neighbor came in, and we picked Pete's brain, and heard we're supposed to talk to George -- somebody.

It was all very well done and everybody was very helpful. We got our questions answered. But we're not as affected as the other people here are.

(Whereupon, the meeting concluded at 7:00 p.m.)

REPORTER'S CERTIFICATE

STATE OF CALIFORNIA)
) ss
COUNTY OF SACRAMENTO)

I, JILLIAN M. SUMNER, a Certified Shorthand Reporter, licensed by the state of California and empowered to administer oaths and affirmations pursuant to Section 2093 (b) of the Code of Civil Procedure, do hereby certify:

The said proceedings were recorded stenographically by me and were thereafter transcribed under my direction via computer-assisted transcription;

That the foregoing transcript is a true record of the proceedings which then and there took place;

That I am a disinterested person to said action.

IN WITNESS WHEREOF, I have subscribed my name on April 25, 2015.

JILLIAN M. SUMNER
Certified Shorthand Reporter No. 13619

E

US Army Corps of Engineers

SAFCA

Public Comment Sheet

NAME: Lissa McKee

POA for Ann McKee

PHONE: [redacted]

ADDRESS: [redacted]

E-MAIL: [redacted]

we have no dock

we have erosion

COMMENT/QUESTION: we are interested in restoration of cottonwood

F

US Army Corps of Engineers

SAFCA

Public Comment Sheet

NAME: Carolyn Baker PHONE: [redacted]

ADDRESS:

E-MAIL: [redacted]

COMMENT/QUESTION:

Very concerned about vegetation removal - trees, shrubs + habitat for threatened/endangered species. Hopeful ACE will rethink philosophy & allow majority/most of veg to remain. Prefer SAFCA approach. ACE needs to update its printed materials (poster boards) to reflect more enlightened reality, not "slash & burn" mentality that all veg in footprint will be removed. Hope SAFCA gets there first & gets the job done.

G

US Army Corps of Engineers

Public Comment Sheet

NAME: Ellen Broms PHONE: [redacted]

ADDRESS: [redacted]

E-MAIL: [redacted]

COMMENT/QUESTION: I am a senior and not in the best health + I am concerned about the proposed staging area behind my house. Please don't have it there. That is my major concern. ALSO, The trees (walnut) (orange) + the grassy area at the foot of the area are a concern as well. What does SAFCA propose to do about that + other vegetation that attracts burrowing animals like squirrels + voles.

H

US Army Corps of Engineers

SAFCA

Public Comment Sheet

NAME: Mary M. Schwartz PHONE: [redacted]

ADDRESS: [redacted]

E-MAIL: None

COMMENT/QUESTION:

I Live across at the corner of Ironwood + Riverdale Way + have since 11/70. I did not get a notice, I found the Meeting and the presenters knowledgeable + interesting: The big black mark is Not all residents - including me - can walk about + stand for 5+ minutes + speak to a Presenter. I thought public information meetings had to be handicapped friendly

~~The City Councilmen~~ District ~~Jennings is not here~~

I would like clarify that the levy system in the worst or N in the USA and now "the powers to be" say it can't be fixed until 2017!

If I can help get this through sooner sooner - let me know!

11/11/15

From: Dan Kopp [redacted]
Sent: Tuesday, April 07, 2015 3:35 PM
To: Baker, Anne E SPK
Subject: RE: [EXTERNAL] American river Common Features Project (UNCLASSIFIED)

I

Hi Anne,

I already sent the following question/comment to a DWR contact several days ago; I made it a bit less caustic at the end for you:

My home abuts the levee on the south side of the American River Parkway bewteen Howe and Watt Ave., and I noticed trees were tagged several years ago, I believe 30 feet away from the toe on the river side and 20 feet or so on the residential side; does this project intend to remove trees? If so, how many and why? I-1

If there is a tree removal component to this project, have measures been put in place to manipulate vegetation outside the breeding season for birds (starting in January for Great-horned Owls and Anna's Hummingbirds; beginning late February/early March for songbirds and continuing through August)? I can see an active Swainson's Hawk nest from my living room, and there are noise buffers that are usually put in place for this listed California Threatened species. I-2

Also, I noticed at the bottom of page 13 of the Environmental Site Assemssment, under Sacramento East Maps, the last bullet states:

I-3

The Sacramento East map of 1975 was a photo revision of the 1967 edition and added a crossing at Howe Road.

I am a firm believer in getting the small details correct, especially in a project like this, so when I see that Howe Avenue was mis-named as Howe Road, even though it was correct in the bullet right above, it makes me wonder if any other details were mixed-up in the analysis.

Anyway, those are my main concerns: unnecessary tree removal (from my perspective) and limbing/tree removal during the avian nesting season.

The comment reflects my duties as an editorial board member for the Central Valley Bird Club Bulletin, where I read every word to help ensure everything is as grammaticaly and factually correct as possible. It is not meant as a personal attack; just an observational extrapolation.

Thanks,

Dan Kopp

Sacramento

> From: Anne.E.Baker@usace.army.mil
> To:[redacted]
> Subject: RE: [EXTERNAL] American river Common Features Project
(UNCLASSIFIED)
> Date: Tue, 7 Apr 2015 21:39:09 +0000
>
> Classification: UNCLASSIFIED
> Caveats: NONE
>
> Hi Dan,
>
> You can send your comments to me via e-mail. I will look forward to seeing
them!
>
> Thank you,
>
>
> Anne E. Baker
> Environmental Manager
> Environmental Analysis Section, Planning Division
> Sacramento District, US Army Corps of Engineers
> 1325 J Street
> Sacramento, CA 95814-2922
> (916) 557-7277
>
>
>
> -----Original Message-----
> From: Dan Kopp [redacted]]
> Sent: Tuesday, April 07, 2015 2:10 PM
> To: Baker, Anne E SPK
> Subject: [EXTERNAL] American river Common Features Project
>
> Anne,
>
> Can I send my comments about the DEIS/DEIR via email or do I need to send
them in the regular mail?

>
> Thanks,
>
> Dan Kopp
> Sacramento
>
>
> Classification: UNCLASSIFIED
> Caveats: NONE
>
>

From: Stan Jones [redacted]]
Sent: Friday, April 10, 2015 12:10 PM
To: Baker, Anne E SPK
Cc: Stan Jones
Subject: [EXTERNAL] Sac. River Levee Work

J

Hi,
Thank you for providing an opportunity to comment on the proposed levee upgrades. I have a few thoughts on this.

The public should be able to see what we're getting for the millions & millions being spent. I propose some "viewing areas" along the levee during the work, to see what's being done. These should be accessible to the public. Maybe a sign or 2 explaining what is being done. J-1

Get rid of all the gates & fences that criss/cross the levees in South Sacramento. They are an "attractive nuisance" to kids, who have been seen climbing on them. Some fences have barbed wire, another has 'concertina wire' at the top. This could be a huge liability. Most all of the fences can be bypassed by walking down to the water's edge and going around them, so they don't really accomplish anything. Most of the fences do not have legally valid permits anyway. Removal of all the gates & fences will certainly make the repair work easier and more efficient. J-2

There are a number of dead & sick trees along the Pocket and Little Pocket areas of the levee. Also a number of trees infested with mistletoe that need attention. Were any of these dead trees to topple over in a storm, they might take out a huge rootball of dirt and rock, and leave a large gaping hole in the side of the levee. This work should receive a high priority. J-3

I live 3 blocks from the Sacramento River, and enjoy walking and bike riding on the levee, and kayaking on the Sacramento River. We are very much in favor of stronger levees! I'd be happy to provide additional information to you if requested.
Best Regards,

Stan Jones

K

From: Janet Fullwood [redacted]
Sent: Friday, April 10, 2015 5:08 PM
To: Baker, Anne E SPK
Subject: [EXTERNAL] public comment - levee reinforcement

Hello there - I would like to submit the following public comments regarding levee improvements in the Pocket Area. Would you please forward to Tyler Stalker, who is evidently the person collecting them? That's who the hand-out forms on the table at the Elk's Club last night were addressed to. But email is much more efficient than filling out a form by hand and mailing by snail mail......

Name: Janet Fullwood
Address: 6470 Surfside Way 95831
Phone: 916.718.5666
Email: jfullwood@me.com

Comment No. 1:

The last round of levee reinforcement, in 2007, stopped at my house on the downstream end (My property is at the intersection of Surfside and Cruise Way). Only one time since has the river come up high enough for the effectiveness of the repairs to be tested, that being during the high-water winter of 2010-2011. Before the reinforcement, water seeped and weeped from the sidewalks in front of every river-side house on my block. This last time: every sidewalk on the street was dry except mine, which wept just as badly as before. I also had water pooled under my house that had to be pumped out via the sump installed after the 1997 floods that brought eight inches of water under my house (neither federal or homeowners flood insurance would pay for repairs by the way; hydrostatic seepage is not covered, only breaches in the levee). Evidently the water is creeping in through angled sediments. Please make note of this and get in touch if you need more detail. K-1

Comment No. 2:

During the 2007 repairs, new sod was planted on the river side of the levee. Unfortunately, what came up was two species of spear grass, colloquially known as foxtails, that are lethal to animals. Every farmer and rancher in the state is trying to get rid of this invasive, unwanted stuff, and we get stuck with a sea of it. The explanation I've gotten is that the seeds were embedded in "imported" soil. Imported from where, I don't know, but these invasive species are an unwelcome hazard. Last year, the levee was not mowed until after the awns had set and it was bad news for a number of pets that were infected and incurred huge vet bills.Who knows how many wild animals were hurt, too?. When the next round of repairs is made, can we please kill that stuff off and replant with certified weed-free native grasses? Something needs to be done; it's s shameful situation. K-2

That's all for now. My thanks to all the Corps and SAFCA and city representatives who turned out last night at the Elk's Lodge and for all the great graphics and explanations.

Sincerely,

Janet

L

From: James Geary [redacted]]
Sent: Saturday, April 11, 2015 12:38 PM
To: Baker, Anne E SPK
Subject: [EXTERNAL] Public Workshop with SAFCA & the Army Corp of Engineers at Elk's Lodge #6, 4/14/15

As part of these projects, neither SAFCA or the Army Corps should replace any of the nine fences that presently cross the levees in the Pocket areas. None of the fences are in compliance with their permits and most of the permits are not held by the present homeowners. No government agency should be engaged in replacement of obstructions on the levee that are illegal and add to the danger of the flooding in the Pocket area.

James Geary
[redacted]

From: Maggie Beddow [redacted]
Sent: Sunday, April 12, 2015 3:03 PM
To: Baker, Anne E SPK
Subject: [EXTERNAL] SAFCA public comment feedback

M

Hello Ms. Baker,

I am writing to provide SAFCA public comment on the upcoming levee project. As a resident of Sacramento and the Pocket community, I would like to strongly urge that the fences across the levee NOT not be replaced during this levee improvement as each one of those fences are illegal and/or are not properly permitted by SAFCA. Replacing the illegal fences will only further exacerbate community concerns about levee access, impartiality, and objectivity. With this new levee project, SAFCA has a perfect opportunity to not only save taxpayer dollars, but to also disengage in any activity that replaces illegal fences with more illegal fences.

Thank you for your consideration.

Respectfully submitted,

Dr. Maggie Beddow, Pocket resident

N

From: Marcos Guerrero [redacted]
Sent: Thursday, April 16, 2015 4:00 PM
To: Montag, Melissa L SPK; Erin.Brehmer@water.ca.gov; Baker, Anne E SPK
Cc: Jason Camp; Danny Rey; TribalpreservationDG
Subject: [EXTERNAL] DEIR/DEIS ARCF General Reevaluation Report, CVFPB

Hello All, please see UAICs comments to the DEIR ARCF General Reevaluation Report, CVFPB, Sacramento County, Ca.

After an internal review of the project documentation the DEIR/DEIS for the Project has some significant deficiencies beyond those already noted.

1. DEIR/DEIS does not appear to contact an Environmentally Preferred Alterative that is required under CEQA Guidelines 15126.6(e)(2) and NEPA. The tribe would like to be allowed to microsite or get other design features incorporated to reduce the potential for direct cultural impacts. N-1 N-2

2. UAIC left out of DEIR/DEIS analysis as Tribe, government or partner. There is no discussion of the Tribe/tribal values in areas of controversy, construction timing, project and alternatives screening criteria (i.e., a tribal burial mound avoidance alternative), environmental commitments for cultural resources, social effects, environmental justice or identified as a viewer group for visual impacts. The UAIC requests to be allowed to participate in the EIR analysis. N-3 N-4 N-5

4. On Alternatives, it appears that very little consideration was given to any others. The rationale for rejecting other design features and preservation in place falls short of what the Tribe considers a minimum level of effort. The Tribe requests a complete and full analysis of such preservation in place and avoidance alternatives as setback levees, and seepages and stability berms. N-6

5. If the USACE/CVFPB materially revises any section of the DEIR/DEIS then the document should be recirculated. USACE/CVFPB shall evaluate, determine effects, and develop treatment before the project construction activities begin. The tribe does not consider data recovery appropriate which is in fact a negative effect and direct impact to the cultural resources. The DEIR/DEIS addresses solely scientific archeology, there is zero discussion regarding tribal cultural values, sanctified cemeteries, or cultural landscapes. Include a section on why preservation in place is a feasible alternative. DEIR/DEIS does not admit that human remains could be impacted and that state law would be followed. N-7 N-8 N-9 N-10

6. The DEIR/DEIS also will any new sections on PG&E utility relocation be in the DEIR/DEIS? Especially of this work includes use of cranes, land leveling, poll removal and relocation, tree replanting and vegetation removal - all activities that could have significant impacts on cultural resources. N-11

7. The cumulative impact section is wholly deficient and also contains improper analysis such as cultural resources are typically not subject to cumulative effects which is unsupported in CEQA/NEPA. Yet DEIR/DEIS then admits impacts are cumulatively significant but then offers no mitigation for that impact. Again, there is no mention of tribes or cultural landscapes, the latter is especially relevant when dealing with cumulative effects or effects across several phases or projects over wide geography. N-12

8. Specific borrow and staging sites were not identified in the DEIR/DEIS. N-13

9. Will there be a section on Wetland delineation. N-14

10. will the project be avoiding FEMA land use restrictions and are barges included in the project - use of barges could help to reduce impacts on cultural resources? N-15

11. Other interesting points, we would like to discuss are:

· Admits no further federal action assumed, raises question of whether feds could assume the project without reopening the environmental review; N-16

· No analysis of vibration or compression effects on project on cultural resources; N-17

· No analysis of vegetation impacts that relate to native or cultural plants including those that might have been part of the burial mounds or part of the tribal cultural landscape; N-18

· Will there be conservation bank purchased for giant garter snake - why not for cultural landscape; N-19

· Please note that post approval technical studies are not okay; N-20

· No section in climate change discussing whether it makes sense to raise structure instead of hardening levees. N-21

· No text references to NPS Bulletin 38 (TCPs) or ACHP guidance on cultural landscapes, document takes a very stilted view of what Section 106 means. We understand this may be in the DEIS, yet to be developed, but it would be good to include the important of place, setting, landscape, to the Tribe. N-22

· NAHC not listed as a trustee agency. N-23

We will also be submitting additional comments and would like to schedule a government to government meeting to discuss this project.

Marcos Guerrero, RPA

Cultural Resources Manager

United Auburn Indian Community of the Auburn Rancheria

[redacted]

O

DEPARTMENT OF TRANSPORTATION
DISTRICT 3 – SACRAMENTO AREA OFFICE
2379 GATEWAY OAKS DRIVE, STE 150 – MS 19
SACRAMENTO, CA 95833
PHONE (916) 274-0635
FAX (916) 263-1796
TTY 711

Serious drought.
Help save water!

April 27, 2015

032015-SAC-0059
03-SAC-50 / PM 3.6
SCH# 2005072046

Ms. Alicia E. Kirchner
Environmental Resources Branch Sacramento District
U.S. Army Corps of Engineers,
1325 J Street
Sacramento, CA 95814-2922

American River Water Shed Common Features, General Reevaluation Report - Draft Environmental Impact Statement, Environmental Impact Report (DEIR/EIS)

Dear Mr. Johnson:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. Alternative 1 of the project involves the construction of fix-in-place levee remediation measures to address seepage, slope stability, erosion, and overtopping concerns. Alternative 2 of the project seeks to improve levees and widen the Sacramento Weir and Bypass. The study area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Dry, Robla, and Arcade Creeks and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento.

Caltrans new mission, vision, and goals signal a modernization of our approach to California's transportation system. We review this local development project for impacts to the State Highway System (SHS) in keeping with our mission, vision, and goals for sustainability/livability/economy, and safety/health. We provide these comments consistent with the State's smart mobility goals that support a vibrant economy, and build communities, not sprawl. The following comments are based on the DEIR/EIS.

Levee Stability

Caltrans recognizes the importance of levee improvements to the mobility of travelers using the SHS. The continued stability of the levee is necessary to prevent a complete levee failure, which would result in the harm, and perhaps total destruction of a highway segment. Additionally, levee work is necessary to prevent seepage, which could undermine a substantial section of the adjoining highway.

Bridge Structures and Maintenance

Below is the list of bridges in Sacramento County in which Caltrans has identified as scour critical. A complete modeling of any affected bridge may be required for Alternatives 2 and 3.

O-1

Bridge No.	Feature Intersected	Dist	Cnty	Route		Mile Post	Insp Date	Structure Name
240001L	**AMERICAN RIVER**	**03**	**SAC**	**00160**	**R**	**44.47**	**05/28/2013**	**AMERICAN RIVER (160 SB)**
24 0020L	COSUMNES RIVER	03	SAC	00099		8.40	01/29/2014	COSUMNES RIVER
24 0020R	COSUMNES RIVER	03	SAC	00099		8.40	01/29/2014	COSUMNES RIVER
24 0021R	COSUMNES RIVER OVERFLOW	03	SAC	00099		7.92	01/29/2014	COSUMNES RIVER OVERFLOW
24 0045L	LAGOON CREEK	03	SAC	00099		4.98	01/24/2014	LAGOON CREEK
24C0004	COSUMNES RIVER	03	SAC	00000		.00	04/09/2013	COSUMNES RIVER
24C0080	ARCADE CREEK	03	SAC	00000		.00	01/16/2014	ARCADE CREEK
24C0293	ELDER CREEK	03	SAC	00000		.00	11/18/2014	ELDER CREEK
24C0328	CHICAGO CREEK	03	SAC	00000		.00	04/15/2014	CHICAGO CREEK

Caltrans routinely inspects bridges for the purposes of bridge maintenance. Therefore, bridge
O-2 engineers and other authorized workers require access to the underside of the bridges. In the path of
levees or flood wall height increases, a Caltrans-approved method of bridge access needs to be
designed and installed.

A bridge embankment seepage analysis, including any mitigation, needs to be submitted to Caltrans
O-3 for review.

Any new bridge or existing bridge modification needs to be designed based on the current Caltrans
O-4 Bridge design codes.

O-5 Flood walls or levees cannot exceed the bridge embankment in height proportionally.

Construction Traffic

As identified by this project's traffic study, this project plans to transport 1 million yards of borrow material and 2.8 million tons of rock for construction. The construction period is estimated to take approximately 10 years. As the result, there will be substantial increases in traffic on local roadways associated with truck haul trips during construction activities. In addition, traffic controls would cause, or contribute to, temporary substantial increases in traffic levels and speed differentials on several roadways, as traffic is detoured or slowed. Traffic controls could cause delays particularly during the morning and evening peak commute hours.

O-6 The project sponsor would require the contractor to prepare a Traffic Control and Road Maintenance Plan to address its construction traffic impacts. Caltrans requests the project sponsor to haul its building materials by barges as much as possible to reduce truck trips. If the building materials could be hauled by barges, this would reduce the project's traffic impacts significantly. Caltrans would like to review the Traffic Control and Road Maintenance Plan.

Bicycle and Pedestrian Travel on Levees

O-7 The Pocket levees are a well-used recreational and commute bicycle route. Please consider providing convenient alternate means of travel for bicyclists and pedestrians during construction of the levees. Also, please consider providing for connected bicycle and pedestrian access along the levees following construction. The levee paths provide important parallel alternatives for non-motorized travel and help reduce demand on the SHS.

O-8 Please provide our office with copies of any further actions regarding this project. We would appreciate the opportunity to review and comment on any changes related to this development.

If you have any questions regarding these comments or require additional information, please contact Larry Brohman, Intergovernmental Review Coordinator, at (916) 274-0627 or by email at: larry.brohman@dot.ca.gov.

Sincerely,

Eric Fredericks

ERIC FREDERICKS, Chief
Office of Transportation Planning – South

c: Scott Morgan, State Clearinghouse

State of California - Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
North Central Region
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670-4599
916-358-2900
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

P

April 27, 2015

Erin Brehmer
Department of Water Resources
3464 El Camino Avenue Room 200
Sacramento, CA 95864

Subject: DRAFT ENVIRONMENTAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPORT FOR THE AMERICAN RIVER COMMON FEATURES PROJECT, SCH # 2005072046.

Dear Ms. Brehmer:

The California Department of Fish and Wildlife (Department) has reviewed the draft environmental impact statement/draft environmental impact report (DEIS/DEIR) from the Army Corps of Engineers (ACOE) and the Central Valley Flood Protection Board regarding the American River Common Features Project (Project).

As a trustee for California's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (Fish & G. Code, § 1802). The Department may also act as a Responsible Agency (Cal. Code Regs., § 21069) for a project where it has discretionary approval power under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.) and the Lake and Streambed Alteration (LSA) Program (Fish & G. Code, § 1600 et seq.). The Department also administers the Native Plant Protection Act (NPPA), Natural Community Conservation Program (NCCP), and other provisions of the Fish and Game Code that afford protection to California's fish and wildlife resources.

The Department offers the following comments and recommendations for this Project in our role as a trustee and responsible agency pursuant to the California Environmental Quality Act (CEQA).

PROJECT DESCRIPTION AND ALTERNATIVE ANALYSIS

The Project intends to reduce the overall flood risk within the city of Sacramento and surrounding areas. The DEIS\DEIR identifies three alternatives, the No Action Alternative, Alternative 1 Improve Levees, and Alternative 2 Improve Levees and Widen the Sacramento Weir and Bypass (Tentatively Selected Plan).

Alternative 1 involves the construction of fix-in-place levee remediation measures to address seepage, slope stability, erosion, and overtopping concerns identified for the

American and Sacramento River, Natomas East Main Drainage Canal, Arcade, Dry/Robla, and Magpie Creek levees. A vegetation variance would be sought to allow for vegetation to remain on the lower portion of the waterside levee slope.

Alternative 2 would include all of the levee improvements discussed in Alternative 1, except levee raises along the Sacramento River would be included to a lesser extent. Instead of the full extent of levee raises, the Sacramento Weir and Bypass would be widened to divert more flows into the Yolo Bypass. The levees along the American River, NEMDC, Arcade, Dry/Robla, and Magpie Creek, would be improved to address identified seepage, stability, erosion, and height concerns. The levees along the Sacramento River would be improved to address identified seepage, stability, and erosion concerns. A small amount of levee raising would be required on the Sacramento River. Due to environmental, real estate, and hydraulic constraints within the study area, the majority of the levees would be fixed in place.

ENVIRONMENTAL SETTING

The final environmental document should include a complete assessment of the existing biological conditions within the Project area including but not limited to the type, quantity and locations of the habitats, flora and fauna. Adequate mapping and information regarding the survey efforts should be included within the document. The DEIS\DEIR only identifies impacts to riparian habitat. The environmental document needs to clarify what type of riparian habitats will be impacted by the proposed Project. The Department recommends the use of A Manual of California Vegetation 2nd Edition (Sawyer and Keeler-Wolf 1995, and Sawyer, Keeler-Wolf and Evens 2009).

P-1

To identify a correct environmental baseline, the final EIS/EIR should include a complete and current assessment of the habitats, flora, and fauna within the Project area. The DEIS\DEIR lacks analysis of other sensitive species, and locally unique species such as but not limited to white-tailed kite (*Elanus leucurus*), burrowing owl (*Athene cunicularia*), Cooper's hawk (*Accipiter cooperii*), purple martin (*Progne subis*), Sanford's arrowhead (*Sagittaria sanfordii*), woolly rose-mallow (*Hibiscus lasiocarpos*).

CEQA guidelines Section 15125, subdivision (c) requires lead agencies to provide special emphasis to sensitive habitats and any biological resources that are rare or unique to the area.

IMPACT ANALYSIS AND MITIGATION MEASURES

<u>Sensitive Species and Habitats</u>

The final EIS/EIR should include an impact analysis to other sensitive species as identified in the Environmental Setting Section that could be present within the Project
P-2 limits and could be impacted by the proposed Project. Avoidance, minimization, and/or mitigation measures should be proposed if any potential significant impacts to other sensitive species and/or their habitats are identified. The Department recommends that

P-2 (Cont.) maps showing the different habitats and the Project impacts are included in the final environmental document.

Fisheries

P-3 The Department is concerned that Project impacts caused by widening the Sacramento Weir and Bypass are not fully analyzed in the DEIS/DEIR. An impact analysis with respect to the potential entrainment of adult and juvenile listed fish species should be included in the environmental document. The DEIS/DEIR should analyze how listed fish species are able to egress out of the Sacramento Bypass to continue their migration once entrained. This is especially important since the document does not include any activities that could reduce the entrainment potential within the Sacramento Bypass.

The operation of the weir directly alters juvenile salmonid emigration routes. Juvenile salmonids have access to the Sutter bypass when the Sacramento bypass is active, increasing the length of the Sacramento Bypass weir will provide a greater chance of juvenile entrainment in both bypasses. While it is shown that some salmonids may use the bypasses to rear when given access (wet years), some juvenile salmon become trapped in swales within the bypasses when flows recede. The Department frequently performs fish rescue activities within the Project area where sturgeon and salmon species are relocated from swales and depressions present within the Project vicinity. The Department recommends that the proposed Project include activities to eliminate swales and depressions that could strand and isolate fish species within the Sacramento Bypass. Any areas that may be flooded as a result of this Project should be designed in a way that the area will drain completely to avoid the creation of predatory fish habitat.

P-4 The Department is concerned about placing rock boulders at erosion sites along the Sacramento and American Rivers. Rock boulders constitute good habitat for predatory fish species that prey on juvenile listed species. The EIS/EIR should analyze potential impacts caused by the installation of rock boulders within the wetted portions of the levees. Additional avoidance, minimization and/or mitigation measures should be proposed if these impacts are deemed significant.

P-5 The DEIS/DEIR states that the ACOE will request a vegetation variance so the waterside vegetation on the lower one-third of the waterside of the levee will be protected along American and Sacramento Rivers. The Department recommends that the EIS/EIR describe what would occur if the variances are not obtained.

P-6 The Department recommends that the EIS/EIR includes specific mitigation measures to offset the proposed Project long term effects to listed fish species. The Department recommends that filling existing swales within the Sacramento Bypass is included in the DEIS/DEIR as a potential mitigation measure to offset long term effects to listed fish species.

Sacramento Weir and Bypass

P-7 The DEIS/DEIR states that the expansion of the Sacramento Weir will impact rice fields and canals. There is no rice grown in the 1,550 feet footprint north of the bypass levee only dryland annual row crops in this area. Please revise the document accordingly. The Department recommends that the new area that will be added to the Sacramento P-8 Bypass is incorporated to the existing wildlife area to enhance recreational activities and to provide a consistent land management of the Sacramento Bypass.

The Sacramento Bypass Wildlife area is a great asset to the public and gets over 1,500 user days per year. It is very important that the recreation opportunities are not affected by the Project. If impacts to recreational wildlife viewing, hunting, and fishing aspects are determined significant additional mitigation is required. Please contact the P-9 Department to develop specific measures to ensure that recreation activities are not impacted by the Project. If the main parking lot located at the north levee of the Sacramento Bypass will be impacted by the Project, alternative public parking should be proposed on the new north levee to enhance parking and public access to the area.

Major hunting seasons and high use days expand from September 1st until January 31st. The Department recommends that construction around the Sacramento Bypass should P-10 avoid this timeframe as much as possible. In addition to this, turkey hunting season starts in mid-March and extends until May.

The final environmental document should include specific information regarding what activities will occur within the over 300 acres that will be impacted by the widening of the P-11 weir. The canals constitute a valuable habitat for species like giant garter snake (GGS) (*Thamnophis gigas*) and potential Project related impacts should be disclosed in the final environmental document. The Department is concerned that leaving land that will only be flooded sporadically will promote the introduction of invasive species in the P-12 area. The EIS\EIR should include specific impact analysis and proposed additional avoidance, minimization, and/or mitigation measures to offset these impacts.

The Department recommends that any depressions created by the Project within the P-13 land that will be added to the Sacramento bypass should be filled to avoid listed fish entrainment. The new area that will be added to the bypass should be sloped to the south to allow fish to find the toe drain when flows subside in the bypass.

P-14 The DEIR should include additional information about the future north levee within the Sacramento Bypass to better analyze any impacts to listed species from the Project action. The Biological Assessment (BA) also identifies a hazardous, toxic, and radiological waste site near the existing north levee. The environmental document P-15 should include an impact analysis of the remediation activities that will be conducted as part of the Project.

Borrow sites

P-16 Figure 2 of the BA shows potential for borrow sites in the Yolo Bypass. There is a potential for environmental damage to the Yolo Bypass Wildlife Area (YBWA) as a borrow site. The EIS\EIR should include information about the borrow sites and analyze the potential impacts caused by the borrow sites. Additional avoidance, minimization, and/or mitigation measures may be required to offset borrow sites impacts. These borrow sites could be in conflict with requirements for the 2009 National Marine Fisheries Service Operational Criteria and Plan Biological Opinion for the Yolo Bypass.

P-17 The BA also states that the "borrow sites would be returned to their existing use whenever possible, or these lands could be used to mitigate for Project impacts, if appropriate." The EIS/EIR needs to include information of the existing condition in the proposed borrow sites and proposed specific mitigation measures. Restored borrow site habitat should not count as mitigation for riparian habitat removed during Project operations.

P-18 Borrow sites should not occur along side of levees, in river channels, flood plains or bypass areas. As water recedes after flood events, all fish species are subject to becoming entrained in borrow pits.

The Department also has the following specific comments:

DEIS/DEIR

P-19
1. Page, 61, Section 3.3.1: The DEIS\DEIR should include that the Sacramento Bypass is operated by the Department as a Wildlife Area and provides access to the public.

P-20
2. Page 102, Section 3.6.1: Please replace "Refuge" with "Area". Please change the word throughout the document. If the additional land incorporated to the Sacramento Bypass becomes open space it could potentially create difficulties managing the properties cohesively with the Sacramento bypass since similar habitats would get different land designation.

P-21
3. Page 109, Section 3.7.1: It is unknown if most juvenile fish emigrate from the Sacramento Bypass after it spills. Please clarify what analysis or studies have been conducted to confirm that most fish move out of the Sacramento Bypass prior to drying up. Additionally, in spring of 2011, a total of 25 adult green sturgeons and 20 adult white sturgeons were rescued from Fremont Weir and several swales within the Yolo Bypass. The DEIS/DEIR should include and /or reference the assurances and analysis that was conducted to show that survival of both juvenile and adult listed species will not be jeopardized with the Project.

P-22
4. Page 114, Section 3.7.5: The Knaggs Ranch study utilized hatchery origin fish in a controlled setting. Though they experienced considerable growth, there is no

P-22 (Cont.) mention as to what the mortality rate was for the fish. Furthermore, there is no assurance as to how the fish can egress from the Yolo Bypass to reach the Delta. Widening the Sacramento Bypass will only create additional floodplain during periods when high flow conditions exist; however, the DEIS/DEIR does not indicate how these fish can leave the floodplain during these high flow conditions. It is very important that the Project is designed in a way that will allow listed fish to migrate from floodplains to the Delta. These activities should be identified and analyzed in the environmental document.

P-23

5. Page 115, Section 3.7.6: Avoidance, Minimization, and Mitigation Measures. Section 3.3.6 should be Section 3.7.6. The proposed construction window is incorrect. Adult Chinook salmon spawning in the lower American River spans from October through December with peak spawning occurring mid-November. The Department recommends that the construction period avoid peak spawning.

Appendix G Draft Biological Assessment

P-24

6. Page 20, Section 2.2.3: The planting berm should be constructed in a way to prevent any stranding of juvenile listed species as the water recedes.

P-25

7. Page 33, Section 2.5.1: The BA should include the citations for the compensation time periods included in this section.

P-26

8. Page 47, Section 3.3.1: The life history subsection includes information about juvenile Chinook salmon outmigration past Red Bluff Diversion Dam. The construction site is located up to 200 miles from the diversion dam. The document needs to identify when juvenile outmigration occurs at the construction sites near Sacramento in order to identify any impacts to listed species. Data collected by the Department in the Sacramento River near Knights Landing suggests that juvenile salmonids (federally listed endangered winter-run Chinook salmon) are present in October in the Sacramento River. The study cited in this section, Sommer et al. (2001), found high growth and survival rates for fall-run Chinook salmon and not winter-run. Please note that juveniles may rear on inundated floodplains during high flow events when they occur although survival is not fully understood due to isolation and stranding in swales and from farm road crossings.

P-27

9. Page 66, Section 4.2.2: It should be noted that although all four runs of Chinook salmon may enter the Yolo Bypass during intermittent high winter and spring floods, survival is not fully understood due to stranding and isolation in swales and between farm road crossings within the bypass.

P-28

10. Page 66, section 4.2.3: It should be noted that although green sturgeon can inhabit the Sacramento Bypass, when flooded, survival is not fully understood due to isolation and stranding in swales and at farm road crossings.

P-29

11. Page 79, Section 5.2.1: The Juvenile Rearing and Migration section states that juvenile winter run Chinook salmon moving downstream peaks at Red Bluff in September and October and continues until mid-March in drier years. This section should include what the peak observation of winter-run are at the construction site. Because downstream migration may be triggered by storm events, winter-run Chinook salmon may be in the vicinity of the proposed construction site in greater numbers than foreseen and could negatively impact the winter-run. This is similar for juvenile spring-run Chinook salmon, specifically for those that migrate as yearlings (October through March).

P-30

12. Page 79, Section 5.2.1: Figures 11-14: This Section of the environmental document states that riparian vegetation within a levee can be restored to a level that could benefit Chinook salmon within 5 years. Please clarify if sampling occurred at these sites to verify if juvenile Chinook salmon were utilizing these areas for rearing. The Department recommends that monitoring be done at these sites to verify their utility in providing a positive effect.

P-31

Please note that when acting as a responsible agency, CEQA guidelines Section 15096, subdivision (f) requires the Department to consider the CEQA environmental document prepared by the lead agency prior to reaching a decision on the Project. Addressing the Department's comments and disclosing potential Project impacts on CESA-listed species in any river, lake, or stream, and provide adequate avoidance, minimization, mitigation, monitoring and reporting measures; will assist the Department with the consideration of the DEIR and reduce potential delays when issuing an Incidental Take Permit under CESA and/or an LSA Agreement.

Thank you for the opportunity to comment on the DEIS/DEIR for the Project. If you have any questions regarding these comments please contact please contact Juan Lopez Torres at (916) 358-2951 or Juan.Torres@wildlife.ca.gov.

Sincerely

FOR

Tina Bartlett
Region Manager

ec: Jeff Drongesen
Isabel Baer
Juan Lopez Torres
Michael Healey
Josh Bush
Chris McKibben
Department of Fish and Wildlife

Q

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Pacific Southwest Region
333 Bush Street, Suite 515
San Francisco, CA 94104

IN REPLY REFER:
(ER 15/0183)

Filed Electronically

4 May 2015

Ms Anne Baker
U.S. Army Corps of Engineers,
Sacramento District
1325 J Street
Sacramento, CA 95814

Subject: Review of Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the American River Watershed Common Features General Reevaluation Report.

Dear Ms. Baker:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the American River Watershed Common Features General Reevaluation Report.

We have the following comments to assist your preparation of the Final EIS.

The National Park Service's (NPS)'s primary interest in the proposed project relates to its potential impact on the Lower American River. The Lower American River is a designated National Wild and Scenic River (WSR) and is also included in the California State Wild and Scenic River program.

NPS is the federal river administering agency for the Lower American River and, as such, is the reviewing authority for "water resource projects" proposed within the WSR boundary. This boundary extends ¼ mile from the ordinary high water mark on either side of the river. The proposed projects, irrespective of the final selected alternative, clearly meet this standard.

In its role to oversee the protection and enhancement of the Lower American River, NPS considers the impacts of water resource projects on free flow, water quality, and outstanding remarkable values (ORV). The ORVs for the Lower American River are fish (anadromous species) and recreation.

The American River Common Features (ARCF) Project impacts both banks of the Lower American River for some 12 miles upstream from the river's confluence with the Sacramento

River. Erosion of the Lower American River levees has been a problem for decades and NPS has reviewed previous levee expansion and improvement projects on the Lower American River where similar vegetation removal has taken place. We have weighed in on the impacts of various levee stabilization and improvement projects through the years.

Generally, we support the selection of Alternative 2, which decreases erosion while improving the levees' stability with the construction of bank protection and launchable rock trench. We should note that, as affects the Lower American River, the protections afforded under Alternative 1 are generally the same as those under Alternative 2 (which includes the Sacramento Weir and Bypass widening), so either alternative may have been acceptable.

We note that riparian vegetation along the Lower American River is classified as "valuable shaded riverine aquatic habitat" for the federally listed (anadromous) fish species which form the basis for one of the River's outstandingly remarkable values and its original designation as a National WSR. We further note that Alternative 2 limits negative impacts to the shaded riverine aquatic habitat with the riparian zone to a "single construction season", while acknowledging indirect effects to the habitat due to vegetation removal and more direct effects due to placement of rock at bank protection sites.

Q-1

However we are aware of the protracted nature of the construction period common in this region, and recommend that the duration of time that constitutes a "season" be specified.

We are pleased to note that the ARCF project is receiving consultation with the National Marine Fisheries Service (NMFS) per Section 7 of the Endangered Species Act. We generally defer to NMFS for biological determinations on projects' effect on anadromous fish. We assume that NMFS's assessment will address our concerns for impact on fish, regardless of which alternative is ultimately adopted.

We note that there has been a history of controversy and considerable concern regarding this, and past, projects' effect on recreation, another ORV for which the Lower American River was designated as a WSR. One important component of this ORV, the Jedediah Smith Recreation Trail which lies within the American River Parkway, extends throughout the 12 mile affected area of the ARCF project.

Recreational activities take place throughout the Parkway, including the bulk of actual access to the river which occurs between the levees and the bed and banks of the River. According to the Report, Alternative 2 will result in temporary closure of the Parkway during construction including the bike and hiking trails, boat launches, and other river access sites. This is deemed to be significant effect. Notification and coordination with users and user groups and traffic control around construction areas are noted as mitigations.

Q-2

NPS strongly urges that these mitigation steps (which include signage, detours, flaggers, and fencing) be strictly adhered to in view of the large population that uses the Parkway. While no cumulative effect to recreation is cited, we are again concerned about the length of the construction "season", accordingly public notice should be provided throughout the entire recreational use period.

A large part of the recreational experience includes the aesthetic quality of visual resources along the American River Parkway and from the vantage of the river itself. We note that, here again, the effect is substantial in that vegetation loss or construction along the Parkway will disrupt the Q-3 existing riverside visual conditions. We recommend that all contractors associated with the project adhere to best management practices (including replanting of displaced trees and reseeding with native grasses) in the course of construction to limit this disruption.

Q-4 §3.14.1 Recreation, Environmental Setting - The National Wild and Scenic Rivers Act (Public Law 90-542; 16 U.S.C. 1271 et seq.) should be specifically cited.

§6.3 Coordination With Other Federal, State, and Local Agencies - This section should also Q-5 emphasize consultation and coordination with NPS. Again, as the federal administering agency for the Lower American River, NPS should be consulted regarding consistency of the ARCF projects with the WSR Act.

Almost the entire project lies within the ¼ mile boundary of the Lower American WSR and, based on the specific location of areas affected by construction on the levees, many elements of the project will have at least an indirect effect on the ORVs and water quality. As an example, activities associated with bank stabilization may cause excessive turbidity which, however temporary, has a negative effect on water quality.

Ultimately, NPS is obligated to assess the potential effects of any proposed project on the Lower American River as they pertain to consistency with the WSR Act. Therefore, we appreciate the opportunity to review the Draft EIS for the American River Watershed Common Features General Reevaluation Report and provide these comments.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: OEPC Staff Contact: Lisa Treichel, (202) 208-7116, Lisa_Treichel@ios.doi.gov
NPS Staff Contact: Barbara Rice, (415) 623-2320, Barbara_Rice@nps.gov
NPS NEPA Contact: Alan Schmierer, (415) 623-2315, Alan_Schmierer@nps.gov

R

Department of Transportation
Michael J. Penrose, Director

Divisions
Administration
Maintenance & Operations
Engineering & Design

County of Sacramento

May 1, 2015

Ms. Anne Baker
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814
Anne.E.Baker@usace.army.mil

Erin Brehmer
Department of Water Resources
3464 El Camino Avenue Room 200
Sacramento, CA 95821
erin.brehmer@water.ca.gov

SUBJECT: COMMENTS ON NOTICE OF AVALIABLITY (NOA) OF DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR) AND GENERAL REEVALAUTION REPORT (GRR) FOR AMERICAN RIVER COMMONS.

Dear Ms. Baker and Ms. Brehmer:

The Sacramento County Department of Transportation (SACDOT) has reviewed the NOA of the DEIR and GRR for American River Commons, dated March 2015. We appreciate the opportunity to review this document. We have following comments to offer:

R-1

1. **General.** The proposed levee improvements require the transport of approximately one million yards of soil and nearly three million tons of rock over Sacramento County roads to various levee sites within Sacramento County. The high volume of trucks and heavy weight associated with these trucks will significantly degrade affected County roadways and shorten the life of these haul roads. Due to the roadway impacts site specific studies should be done for each levee improvement area. The study should contain detailed truck traffic information including haul routes, haul volumes per truck (soil and rock), associated haul truck types, number and frequency of trucks, proposed hauling hours, and associated roadway traffic volumes. Based on the results of the project specific reports, the project applicant should provide to Sacramento County a summary of the roadway impacts and proposed remediation efforts that will be undertaken by the project sponsor to account for County roadway degradation and damage.

R-2

2. **General.** Please coordinate with the SACDOT staff in implementing the Traffic Safety and Control Plan for construction related truck traffic and any bike trail and/or roadway closures.

If you have any questions please call me at (916) 875-2844.

Sincerely,

Kamal Atwal

Kamal Atwal, P.E.
Associate Transportation Engineer
Department of Transportation

KA/mp

c: Matt Darrow, DOT
Dean Blank, DOT

SACRAMENTO METROPOLITAN
AIR QUALITY
MANAGEMENT DISTRICT

Larry Greene
AIR POLLUTION CONTROL OFFICER

May 4, 2015

Ms. Anne Baker
U.S. Army Corp of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814

Ms. Erin Brehmer
California Department of Water Resources
3464 El Camino Avenue, Room 200
Sacramento, CA 95821

American River Common Features General Reevaluation Report Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (SAC201301442)

Dear Ms. Baker and Ms. Brehmer:

Thank you for providing the draft EIS/EIR for the American River Common Features (ARCF) General Reevaluation Report to the Sacramento Metropolitan Air Quality Management District (SMAQMD) for review. SMAQMD staff comments on the air quality and climate change sections of the draft EIS/EIR follow.

S-1
1. Clarify which model year on-road haul trucks will be used for the project, 2007 and newer or 2010 and newer (pages 188, 190, 196, 199 and Appendix D).

S-2
2. The emissions discussion for Alternative 2 refers to Tables 30 and 31, the emissions estimates for Alternative 1 (page 198). Since the two alternatives would result in different emissions due to expansion of the Sacramento Weir in Yolo County and reduction of levee work in Sacramento County, separate emissions tables should be provided for Alternative 2.

S-3
3. Requiring contractors to do particulate matter "dispersion" modeling prior to starting construction is not generally recommended (page 201). Emissions modeling conducted for the project assumes construction would disturb approximately 7 acres/day, which is below the 15 acres/day level that triggers dispersion modeling (Appendix D). SMAQMD's recommended fugitive dust control mitigation measures (basic and enhanced) are included in the project, therefore additional dispersion modeling is not necessary.

S-4
4. Clarify which mitigation measure is being required for off-road equipment, Tier 4 standards or SMAQMD's enhanced exhaust controls (20% NOx and 45% PM reduction) (pages 188 and 202). Is the mitigation for Alternative 1 different from Alternative 2?

S-5
5. Clarify that SMAQMD adopted GHG significance thresholds in October 2014 that can be used in subsequent environmental analyses for ARCF projects (page 212).

S-6
6. Although greenhouse gas emissions were analyzed and determined to be less than significant, a list of measures were included that "may be considered to lower GHG" emissions during construction including the purchase of offsets for GHG emissions that exceed future significance thresholds (page 215). Since the SMAQMD has an adopted construction threshold for GHG emissions and this document already referenced the 10,000 metric ton Bay Area threshold, all reference to a 7,000 metric ton presumptive threshold should be removed from the measure.

S-7
7. Appendix D references Tables 1a and 1b, which don't appear to be included in the document.

S-8
8. All projects are subject to applicable SMAQMD rules in affect at the time of construction. A list of the most common rules that apply to construction projects is attached for your convenience. SMAQMD rules can be obtained on the SMAQMD's webpage: www.airquality.org.

If you have any questions regarding these comments please contact me at (916) 874-4881 or khuss@airquality.org. I look forwarding to receiving the final EIS/EIR.

Sincerely,

Karen Huss

Karen Huss
Associate Air Quality Planner/Analyst

Attachment

Cc: Larry Robinson, SMAQMD

ATTACHMENT - SMAQMD Rules & Regulations Statement (revised 3/12)

*The following statement is recommended as standard condition of approval or construction document language for **all** development projects within the Sacramento Metropolitan Air Quality Management District (SMAQMD):*

All projects are subject to SMAQMD rules in effect at the time of construction. A complete listing of current rules is available at www.airquality.org or by calling 916.874.4800. Specific rules that may relate to construction activities or building design may include, but are not limited to:

Rule 201: General Permit Requirements. Any project that includes the use of equipment capable of releasing emissions to the atmosphere may require permit(s) from SMAQMD prior to equipment operation. The applicant, developer, or operator of a project that includes an emergency generator, boiler, or heater should contact the SMAQMD early to determine if a permit is required, and to begin the permit application process. Portable construction equipment (e.g. generators, compressors, pile drivers, lighting equipment, etc.) with an internal combustion engine over 50 horsepower are required to have a SMAQMD permit or a California Air Resources Board portable equipment registration. Other general types of uses that require a permit include, but are not limited to dry cleaners, gasoline stations, spray booths, and operations that generate airborne particulate emissions.

Rule 403: Fugitive Dust. The developer or contractor is required to control dust emissions from earth moving activities, storage or any other construction activity to prevent airborne dust from leaving the project site.

Rule 414: Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 BTU PER Hour. The developer or contractor is required to install water heaters (including residence water heaters), boilers or process heaters that comply with the emission limits specified in the rule.

Rule 417: Wood Burning Appliances. This rule prohibits the installation of any new, permanently installed, indoor or outdoor, uncontrolled fireplaces in new or existing developments.

Rule 442: Architectural Coatings. The developer or contractor is required to use coatings that comply with the volatile organic compound content limits specified in the rule.

Rule 460: Adhesives and Sealants. The developer or contractor is required to use adhesives and sealants that comply with the volatile organic compound content limits specified in the rule.

Rule 902: Asbestos. The developer or contractor is required to notify SMAQMD of any regulated renovation or demolition activity. Rule 902 contains specific requirements for surveying, notification, removal, and disposal of asbestos containing material.

Naturally Occurring Asbestos: The developer or contractor is required to notify SMAQMD of earth moving projects, greater than 1 acre in size in areas "Moderately Likely to Contain Asbestos" within eastern Sacramento County. Asbestos Airborne Toxic Control Measures, Section 93105 & 93106 contain specific requirements for surveying, notification, and handling soil that contains naturally occurring asbestos.

T

STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

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Established in 1938

***Contact Phone:* (916) 574-1890**
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May 4, 2015

File Ref: SCH #2005072046

Ms. Erin Brehmer
Department of Water Resources
3464 El Camino Avenue, Room 200
Sacramento, CA 95821

Subject: Draft Environmental Impact Statement/Report (Draft EIS/EIR) for the American River Common Features General Re-evaluation Report, Sacramento County

Dear Ms. Brehmer:

The California State Lands Commission (CSLC) staff has reviewed the subject Draft EIS/EIR for the American River Common Features General Re-evaluation Report (Project), which is being prepared by the Central Valley Flood Protection Board (CVFPB), as the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.), and the U.S. Army Corps of Engineers (Corps) as the lead agency under the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.). The CSLC is a trustee agency for projects that could directly or indirectly affect sovereign lands and their accompanying Public Trust resources or uses. Additionally, because the Project involves work on sovereign lands, the CSLC will act as a responsible agency. Comments on the Notice of Preparation were provided on March 28, 2008 (attached).

<u>CSLC Jurisdiction and Public Trust Lands</u>

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

Based on the information submitted in the Draft EIS/EIR, portions of the Project are or may be located on State-owned sovereign land in the Sacramento River and the American River. Portions of the Project that are located in the American River may also be on sovereign land granted to the city of Sacramento pursuant to Chapter 519, Statutes of 1868. To the extent the proposed levee improvement project involves State-owned sovereign lands in the Sacramento River and the American River, a lease will be required. Staff of the Commission will need to review each of the specific proposed project sites prior to determining whether the project site involves land under the granted or ungranted jurisdiction of the CSLC, and whether a lease is required.

T-1

Portions of the Project located in Natomas East Main Drainage Canal are not under CSLC jurisdiction and therefore do not require a lease. Portions of the proposed Project including Arcade Creek, Dry Creek, Robla Creek, Magpie Creek and the Sacramento Weir and Bypass may involve sovereign land under the jurisdiction of the Commission, however, we are currently unable to determine the extent or location of any sovereign ownership interests of the State in these project areas, so no lease will be required for these areas of the Project. If you have any questions, please contact Wendy Hall, Public Land Management Specialist (see contact information below) to discuss the Commission's leasing requirements.

T-2

Please also be advised that the waterways involved in the Project are subject to a public navigational easement. This easement provides that the public has the right to navigate and exercise the incidences of navigation in a lawful manner on State waters that are capable of being physically navigated by oar or motor-propelled small craft. Such uses may include, but are not limited to, boating, rafting, sailing, rowing, fishing, fowling, bathing, skiing, and other water-related public uses. The activities completed under the Project must not restrict or impede the easement right of the public.

T-3

Project Description

The Project area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Dry, Robla, and Arcade Creeks and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento.

The purpose of the Project is to reduce the overall flood risk within the study area. The study area includes the city of Sacramento and surrounding areas. An unacceptably high risk of flooding from levee failure threatens the public safety of approximately 530,000 people, as well as property and critical infrastructures throughout the study area. Additionally, the State Capitol and many State agencies reside within the study area. Historic flooding events have caused loss of life and extensive economic damages. Approximately 83,000 structures throughout the study area are at risk of flooding in a 100-year event (1% annual change of flooding). This Draft EIS/EIR evaluates the potential significant environmental impacts of the alternatives discussed in the American River Common Features (ARCF) General Re-evaluation Report (GRR) (ARCF GRR). If the ARCF GRR is authorized by Congress, the Corps would begin construction to implement the Project. Alternative 2, Improve Levees and Widen the Sacramento Weir and Bypass has been identified as the Tentatively Selected Plan (TSP) and as the least environmentally damaging alternative as it results in less riparian habitat removal along the Sacramento River.

Environmental Review

CSLC staff requests that the lead agencies consider the following comments on the Project's Draft EIS/EIR.

General Comments

T-4

1. On page ES-1, the Draft EIS/EIR makes a statement in regards to purposes and intended uses of the EIS/EIR. CSLC staff requests that this paragraph be revised as shown below, to provide a clearer understanding of the Commission's role in the proposed Project.

   This ~~D~~EIS/~~D~~EIR will also be used by CEQA lead agencies, such as the CVFPB and Central Valley Regional Water Quality Control Board (RWQCB), Sacramento Area Flood Control Agency (SAFCA), and trustee and responsible *agencies, such as the California Department of Fish and Wildlife (CDFW)* and the California State Lands Commission (CSLC)*, to ensure that they have met the requirements of CEQA before deciding whether to issue discretionary permits* or leases *over which they have authority.*

Water Quality

T-5

2. Mercury/Methylmercury: Section 3.5 of the Draft EIS/EIR study area discusses mercury and methylmercury in the Sacramento and American Rivers. As noted on page 90, the placement of revetment along the river banks would temporarily generate increased turbidity in the immediate vicinity. Although section 3.5.6 (Avoidance, Minimization, and Mitigation Measures) does state that the Project would not exceed the Basin Plan turbidity objectives, and does provide for water quality testing, CSLC staff requests that the Draft EIS/EIR also include specific measures to control sediment release (and the subsequent release of mercury/methyl mercury) into waterways and onto State lands underlying those waterways, to further prevent exceedance of the turbidity objectives.

On April 22, 2010, the Central Valley Regional Water Quality Control Board (CVRWQCB) identified the CSLC as both a State agency that manages open water areas in the Sacramento-San Joaquin Delta Estuary and a nonpoint source discharger of methylmercury (Resolution No. R5-2010-0043), because subsurface lands under the CSLC's jurisdiction are impacted by mercury from legacy mining activities dating back to California's Gold Rush. Pursuant to a CVRWQCB Total Maximum Daily Load (TMDL), the CVRWQCB is requiring the CSLC to fund studies to identify potential methylmercury control methods in the Delta and to participate in
T-6 an Exposure Reduction Program. The goal of the studies is to evaluate existing control methods and evaluate options to reduce methylmercury in open waters under jurisdiction of the CSLC. Any action taken that may result in mercury or methylmercury suspension within the Sacramento-San Joaquin Delta Estuary may affect the CSLC's efforts to comply with the CVRWQCB TMDL.

Cultural Resources

3. Title to Resources: CSLC staff requests that Page 172 of the Draft EIS/EIR (under Avoidance, Minimization, and Mitigation Measures), and the programmatic
T-7 agreement that has been developed by the Corps in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation, include a statement that the title to all archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC (Pub. Resources Code, § 6313). CSLC staff also requests that the following statement be included in EIR's Mitigation and Monitoring Plan: "The final disposition of archaeological, historical, and
T-8 paleontological resources recovered on State lands under the jurisdiction of the CSLC must be approved by the Commission." Finally, CSLC staff requests that the lead agencies consult with Assistant Chief Counsel Pam Griggs (see contact
T-9 information below) should any cultural resources on State lands be discovered during construction of the proposed Project.

Climate Change

4. Sea Level Rise: Although sea level rise is mentioned in section 3.12 of the Draft EIS/EIR, there is no discussion of how the Project would address this potential issue. A tremendous amount of State-owned lands and resources under the Commission's jurisdiction will be impacted by rising sea levels. With this in mind, the lead agencies should consider discussing the effects of sea level rise on all resource
T-10 categories potentially affected by the proposed Project in the Draft EIS/EIR. Because of their nature and location, these lands and resources are already vulnerable to a range of natural events. Note that the State of California released the final "Safeguarding California: Reducing Climate Risk, an Update to the 2009 California Climate Adaptation Strategy" (Safeguarding Plan) on July 31, 2014, to provide policy guidance for state decision-makers as part of continuing efforts to prepare for climate risks. The Safeguarding Plan sets forth "actions needed" to safeguard ecosystems and resources as part of its policy recommendations for State decision-makers.

In addition, at its meeting on December 17, 2009, the CSLC approved the recommendations made in a previously requested staff report, "A Report on Sea Level Rise Preparedness" (Report), which assessed the degree to which the CSLC's grantees and lessees have considered the eventual effects of sea level rise on facilities located within the CSLC's jurisdiction. (The Report can be found on the CSLC's website, www.slc.ca.gov.) One of the Report's recommendations directs CSLC staff to consider the effects of sea level rise on hydrology, soils, geology, transportation, recreation, and other resource categories in all environmental determinations associated with CSLC leases. When considering lease applications, CSLC staff will (1) request information from applicants concerning the potential
T-11 effects of sea level rise on their proposed projects, (2) if applicable, require applicants to indicate how they plan to address sea level rise and what adaptation strategies are planned during the projected life of their projects, and (3) where appropriate, recommend project modifications that would eliminate or reduce potentially adverse impacts from sea level rise, including adverse impacts on public access.

Thank you for the opportunity to comment on the Draft EIS/EIR for the Project. As a responsible and trustee agency, the CSLC will need to rely on the Final EIR for the issuance of any lease as specified above and, therefore, we request that you consider our comments prior to certification of the EIR. Please send copies of future Project-related documents, including electronic copies of the Final EIS/EIR, Mitigation
T-12 Monitoring and Reporting Program (MMRP), Notice of Determination (NOD), CEQA Findings and, if applicable, Statement of Overriding Considerations when they become available, and refer questions concerning environmental review to Cynthia Herzog, Senior Environmental Scientist, at (916) 574-1310 or via e-mail at Cynthia.Herzog@slc.ca.gov. For questions concerning archaeological or historic resources under CSLC jurisdiction, please contact Assistant Chief Counsel Pam Griggs at (916) 574-1854 or via email at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Wendy Hall, Public Land Management Specialist, at (916) 574-0994, or via email at Wendy.Hall@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
C. Herzog, CSLC
W. Hall, CSLC
W. Crunk, CSLC
P. Griggs, CSLC

Attachment

STATE OF CALIFORNIA — ARNOLD SCHWARZENEGGER, *Governor*

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March 28, 2008

File Ref: SCH# 2005072046

Annalena Bronson
Central Valley Flood Protection Board
3310 El Camino Avenue, Room LL-40
Sacramento, CA 95821

Subject: American River Common Features General Re-evaluation Report

Dear Ms. Bronson:

The State acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all the people of the State for statewide Public Trust purposes which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The landward boundaries of the State's sovereign interests in areas that are subject to tidal action are generally based upon the ordinary high water marks of these waterways as they last naturally existed. In non-tidal navigable waterways, the State holds a fee ownership in the bed of the waterway between the two ordinary low water marks as they last naturally existed. The entire non-tidal navigable waterway between the ordinary high water marks is subject to the Public Trust Easement. Both the easement and fee-owned lands are under the jurisdiction of the State Lands Commission. The locations of the ordinary high and low water marks are often related to the last natural conditions of the river, and may not be apparent from a present day site inspection.

To the extent the proposed levee improvement project involves State-owned sovereign lands in the Sacramento River, American River or the Natomas Basin, a lease will be required. Staff of the Commission will need to review each of the proposed sites prior to making the determination that a lease is required. If you have any questions, please contact Diane Jones, Public Land Manager, at 916-574-1843, to discuss the Commission's leasing requirements.

<u>Environmental Planning and Management Comments:</u>

The State Lands Commission recommends any of the proposed mitigation and project construction activities consider timing of the proposed work to account for state and federally listed endangered species. All arrangements with pertinent regulatory agencies should coincide with specific protection policies regarding incidental take and avoidance measures. Consideration should include, but not be limited to, seasonality of migratory or nesting species within the footprint of the project (i.e. Swainson's Hawks, Salmonids, etc.). Any construction activities along the water-side bank of restoration or flood protection improvements shall consider water quality issues affecting clarity and chemical reactions within the waters and make all the necessary arrangements to reduce or mitigate for these concerns.

In addition, greenhouse gas emissions information consistent with the California Global Warming Solutions Act (AB 32) should be included. This would include a determination of the greenhouse gases that will be emitted as a result of construction and ongoing operations and maintenance, a determination of the significance of the impact, and mitigation measures to reduce that impact.

If you have any questions with the environmental review, please contact Christopher Huitt, Staff Environmental Scientist, at 916-574-1938, to discuss these comments or questions.

Sincerely,

Marina R. Brand

Marina R. Brand, Assistant Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
State Clearinghouse

Diane Jones, CSLC
Christopher Huitt, CSLC

TREMAINE & ASSOCIATES
Archaeology GIS Geophysics

4 May 2015

Anne Baker
Department of the Army
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Re: ARCF Draft EIR/EIS Comments

Dear Ms. Baker,

I reviewed the Cultural Resources Section in light of recent discoveries along the Feather River levees during degrading operations in preparation for improvements to address levee deficiencies. It is my understanding that the Sutter Buttes Flood Control Agency encountered nine buried American Indian midden sites within a nine-mile stretch in Butte County alone, some including human burials. Cultural deposits ranged anywhere from 9 to 18 feet below levee grade.

Historically, sites along the river were situated on high ground (the natural levees) in the form of mounds. As such, it stands to reason that when Euro-Americans began raising these embankments to combat floods, archaeological sites were incorporated, if possible, to save on the cost of construction efforts. Such early improvements to natural levees were then subsequently raised, enlarged, and bolstered with slope stability berms, essentially covering over any evidence pointing to the existence of cultural resource today.

U-1 My concern is that *some* sites within the ARCF study area are likely to have remained unidentified during this initial stage of the Section 106 process, given that investigations were restricted to surface observations. Mitigation Measure CR-3, Archaeological Monitoring, while addressing the possibility for undiscovered resources, essentially serves to defer the identification effort. Unfortunately, post-review discoveries occur during critical construction operations when it is too late to treat them properly and delays can be ill-afforded. I am not suggesting this mitigation measure be removed… only that, in addition, subsurface investigations be required to ensure that sites are found prior to construction when it is still possible to avoid or limit impacts. This proactive approach can be achieved through geophysical survey and ground-truthing.

Sincerely,

Kim Tremaine

Kim Tremaine

Address: 1220 Smith Court, Dixon, CA 95620 Phone: 916-637-9717

TREMAINE & ASSOCIATES
Archaeology GIS Geophysics

4 May 2015

Anne Baker
Department of the Army
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Re: ARCF Draft GRR Comments

Dear Ms. Baker,

V-1 I have reviewed portions of the Draft GRR related to Geotechnical Risk Analysis. It focused on three failure modes taking into account existing base conditions revealed through a methodology heavily dependent upon limited bore log data. From this, strengths and weaknesses of various reaches were calculated and prioritized. As one of the Independent External Peer reviewers in 2009 commented, the methods used faithfully followed USACE guidance in ETL 1110-2-547 and ETL-1110-2-556. It was, at that time, a sufficient level of analysis. In the interim, however, the National Levee Safety Program has been reevaluating their guidance and is now advocating Total Conditional Performance Analysis (i.e., the combined probability of *all* failure modes). Does the USACE plan to require the analysis be updated accordingly?

V-2 DWR, in a state-led effort to improve levee safety through new urban levee design criteria, now recognizes that urban areas are more likely to contain numerous associated embedded deteriorating features related to infrastructure and flood defenses that are potentially 100 years or older. As such, they recommend civil engineers use or conduct land-based continuous levee crown geophysical methods to assess the levee material and the upper 20 feet of foundation materials to identify unknown penetrations in an effort to meet the urban level of flood protection (Section 7.13 of their 2012 guidance). This is because aging penetrations, under certain load conditions, can result in transient and progressive interior damages, leading to localized instabilities and piping (recognized as the prime failure mechanism for almost all levee systems). Does the USACE plan to require an update of existing conditions to included fine-grained geophysical data to reduce uncertainty in performance risk assessments?

Sincerely,

Kim Tremaine

Kim Tremaine

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DELTA STEWARDSHIP COUNCIL

A California State Agency

May 4, 2015

U.S. Army Corps of Engineers, Sacramento District
Attn: Ms. Anne Baker
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Sacramento, California 95814-2922
Anne.E.Baker@usace.army.mil

RE: Draft American River Watershed Common Features General Reevaluation Report

Dear Ms. Baker:

Thank you for the opportunity to comment on Draft American River Watershed Common Features General Reevaluation Report (GRR). As you may be aware, the Delta Stewardship Council (Council) is an independent state agency and the Council's primary mission is to further the achievement of the coequal goals of water supply reliability for California and protecting and restoring the Delta ecosystem while protecting and enhancing the Delta as an evolving place (Water Code section 85054).

The Council has a legally enforceable management framework for the Delta and Suisun Marsh called the Delta Plan. The Delta Plan applies a common sense approach based on the best available science to restore habitat, increase the diversity and efficiency of California's water supplies, enhance floodplains, improve the Delta's levee system, and preserve the Delta's agricultural values. In many cases, the Delta Plan calls for balancing competing needs in the Delta, e.g., protecting habitat while reducing flood risk. In addition, the Delta Reform Act requires the Council to develop an investment strategy for project and non-project levees in the Delta to protect people, property and the State's interests (Water Code sections 85305(a) and 85306).

The Delta Plan contains an interim set of priorities for levee investments in the Delta. These priorities, in combination with the Council's authority to assure that State agencies act consistently with the Delta Plan, ensure that levee spending by the California Department of Water Resources and the Central Valley Flood Protection Board reflects the Delta Plan's priorities. The Council is currently updating this investment strategy to better define the State's interests. The updated strategy will incorporate information on proposed projects based on system-wide risk evaluations such as the one described in this draft document. Since some of the proposed GRR project activities lie within the Delta and play an important role in maintaining the integrity of the Delta levee system, it is essential that our agencies continue to coordinate closely on these types of efforts.

Comments on the Draft General Reevaluation Report

Comments in this letter are focused primarily on our concerns with the overly narrow definition of federal interest in the project area, uncertainty regarding achieving the urban level of flood protection for the Sacramento Metropolitan area, and mitigation of impacts to biological resources. In a separate letter to the California Central Valley Flood Protection Board (CVFPB) on the companion draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for this draft document, we provide comments specifically on the consistency of this project with the Delta Plan's 14 regulatory policies. A copy of this letter will be provided to your agency as well.

Overly Narrow Definition of Federal Interest

We are concerned about policy constraints and planning processes that have resulted in the definition of an overly narrow federal interest in the Delta. As stated in the draft GRR, the U.S. Army Corps of Engineers (USACE) is working on the Central Valley Integrated Flood Management Study (CVFIMS), which is a federal companion document to the Central Valley Flood Protection Plan of 2012 (CVFPP), Regional Flood Management Plans, and Integrated Regional Watershed Management Plans. The CVIFMS shares the CVFPP's vision of a multi-objective watershed study focused on integrated water resource management for flood risk management, ecosystem restoration, and other water resource purposes. In addition, the federal Energy and Water Development Appropriations Act of 2012 (Title II of the Consolidated Appropriations Act of 2012 [PL 112-074]) contains, in pertinent part, the following:

> *The Federal policy for addressing California's water supply and environmental issues related to the Bay-Delta shall be consistent with State law, including the coequal goals of providing a more reliable water supply for the State of California and protecting, restoring, and enhancing the Delta ecosystem....(Section 205).*

The multi-objective approach of these planning activities are also aligned with the State's two coequal goals as part of the Delta Reform Act of 2009 – providing a more reliable water supply for the Delta and protecting, restoring and enhancing the Delta ecosystem (Public Resources Code section 29702). The objectives inherent in these goals include restoring the Delta ecosystem and reducing risks to people, property and state interests in the Delta (Water Code section 85020).

The Tentatively Selected Plan (TSP), however, was developed based on the USACE's single objective of regional flood risk reduction while the GRR evaluates the flood risk management system for the American River, Sacramento River and additional five (5) adjacent small channels. We believe this is also inconsistent with USACE's *Civil Works Strategic Plan 2014-*

2018, which calls for the use of Integrated Water Resources Management, a holistic approach that considers economic benefits, ecosystem quality, and health and public safety in project formulation. Failure to include multiple objectives in the planning process results in a lost opportunity to implement projects that provide multiple benefits.

W-1 We understand that the conclusions of the GRR, along with other recently completed feasibility studies such as the West Sacramento General Reevaluation Study, Sacramento River Bank Protection Project, and the Delta Islands and Levees Feasibility Study, will support the development of the CVFIMS. Therefore, for this GRR, USACE should include a system-wide evaluation with a multi-benefit approach for the alternatives screening process to support a broader definition of the federal interest.

Clarification of Urban Level of Flood Protection

The objective of the non-federal sponsors, the State of California and Sacramento Area Flood Control Agency (SAFCA), is to meet the requirements of California Senate Bill (SB) 5 and the Central Valley Flood Protection Act to achieve an urban level of 200-year flood protection, including the Urban Levee Design Criteria (ULDC). One purpose of the ULDC requirement is to increase the likelihood that the levee will hold water until it overtops without a catastrophic breach, providing additional levee reliability and time for evacuation. It is unclear in the draft GRR whether this urban level of protection will be achieved by the TSP. According to the risk analyses from the GRR, with the TSP in place, the flood protection assurance (i.e. non-exceedance probability) for the Pocket Area of Sacramento, given a 200-year flood event, is 94%. In addition, given the project conditions, the risk analyses also show that a levee segment along the America River South Reach (index point A) around River Mile (RM) 8.9 can only provide 65% assurance, given a 200-year flood event. The results of the risk analyses from the GRR for the America River South Reach concluded that the Annual Exceedance Probability (AEP) for the America River South Reach as a whole is 1 in 147. Even with a 94% flood protection assurance, given the elevations of the natural terrain and the indicated weak link of the levee system at the RM 8.9 along the America River, we are concerned that the W-2 Pocket Area in the Delta may not attain the state-required 200-year level of flood protection. However, the GRR states that the TSP meets the goal of attaining FEMA level accreditation and meets the SB 5 criteria for urban level of protection. In the final GRR, please clarify the current annual chance of flooding, the resulting annual chance of flooding under each alternative, and whether the TSP can provide 200-year protection according to the USACE risk evaluation guidelines and state requirements. This analysis should be agreed upon by USACE and local communities.

Sacramento Weir and Bypass Widening

As the draft GRR states, widening the Sacramento Weir and Bypass as a part of the TSP will
W-3 reduce the regional flood risk by lowering the flood stage during a flood event greater than a 1/100 Annual Chance Exceedance (ACE) event. It is unclear whether there is coordination

W-3 (Cont.) between the GRR work and the Department of Water Resources (DWR) Sacramento River Basin-Wide Feasibility Study effort (including the scales and configurations for the Sacramento Weir and Bypass improvements and the analyses of potential impacts and benefits on a system-wide scale), and the draft 2017 Central Valley Flood Protection Plan Conservation Strategy. In the final GRR, please address this concern by providing additional information on current coordination between these efforts. Coordination among the USACE, CVFPB, and DWR is critical in evaluating possible measures to protect existing developed areas along the Sacramento and the American River.

Biological Resources

Our primary concerns related to this section of the draft GRR are the impacts to riparian vegetation and associated impacts on special status species as a result of the TSP and the USACE's levee vegetation policy. Dynamic complexes of riparian woody and scrub habitat along river channels and associated floodplains, particularly in areas where there is connectivity between such habitats, provide a suite of ecosystem benefits to on-site and downstream environments. Riparian vegetation provides habitat for terrestrial species, such as Swainson's hawk, white-tailed kite, yellow breasted chat, yellow-billed cuckoo, and valley elderberry longhorn beetle. For aquatic species, including various life stages of Chinook salmon, Central Valley steelhead, splittail, and sturgeon, established woody riparian vegetation provides refuge from currents and predators, and serves as a source of organic carbon in support of the aquatic food web. Riparian areas can reduce non-point source pollution from pesticides, herbicides, and nutrients from fertilizers by serving as transition zones between upland urban/agricultural areas and adjacent waterways. Additional water quality benefits include improved levels of dissolved oxygen and moderation of water temperature. Riparian areas also provide the public with opportunities for active and passive recreation, such as hiking, boating and bird watching. According to the draft GRR, the proposed project would need to remove levee vegetation in consideration of the criteria of the SAFCA Vegetation Management Decision Key, the variance for the USACE Engineer Technical Letter (ETL) 1110-2-583 Vegetation Free Zone requirements, and the USACE System-Wide Improvement Framework (SWIF) agreement. Along the main stem of the Sacramento River, the proposed vegetation removal under the TSP could result in the loss of 750 riparian trees, as well as extensive removal of shaded riverine aquatic habitat associated with placement of rock fill along nine miles of river channel. The impacts to these habitats are expected to adversely affect the special status species that depend upon them, including Chinook salmon and Swainson's hawk. W-4 If a USACE vegetation variance is approved, it would allow vegetation to remain on the lower waterside levee slope and prevent additional impacts on riparian trees and shaded riverine aquatic habitat. In the final GRR, USACE should provide assurance of granting the vegetation variance or include the status of the USACE vegetation variance application process.

Given the tremendous investment by state, federal, and local agencies, as well as nonprofit organizations and individuals, to promote recovery of salmonids and other threatened and endangered species that use the Sacramento and American Rivers as migratory corridors, it is essential to make every effort to avoid or minimize these impacts. The benefits to special status species provided by the proposed mitigation measures in the draft GRR are unclear. We recommend that, to the maximum feasible extent, any impacts to the channel margin habitat along important salmonid migratory corridors should be mitigated on-site. In the event that off-site mitigation is necessary, we also suggest that any off-site mitigation occurs in close proximity and along the same waterway as where the impacts would occur to demonstrate that the mitigation is restoring equivalent, in-kind habitat. In the final GRR or the associated EIS/EIR, please identify and include the details of the mitigation measures with or without the USACE vegetation variance and/or the SWIF in place, and describe how they would address impacts to special status species, such as salmonids and Swainson's hawk.

W-5

Other recent USACE flood-risk reduction feasibility studies/plan, including the Sacramento River Bank Protection Project and the Lower San Joaquin River Project Integrated Interim Feasibility Report, also involve substantial removal or degradation of riparian and shaded riverine aquatic habitat within the Delta. We recommend that, as the USACE develops the CVIFMS, the cumulative impacts of levee improvement and maintenance projects on riparian and shaded riverine aquatic habitat be assessed. The study should analyze whether the collective loss of those habitat types will adversely affect the achievement of the coequal goal of ecosystem restoration of the Delta. Additionally, we recommend that the CVIFMS assess the cumulative impacts that proposed placement of miles of rock revetment along salmonid migration corridors for levee bank erosion control measures will have on juvenile salmonid rearing and outmigration success.

W-6

According to the draft GRR, the Benefit-Cost (B/C) ratio of the TSP is 4.3 and the TSP is also the Local Preferred Plan (LPP). If additional funding is available, the project team should reconsider including additional alternatives or objectives with lower but acceptable B/C ratios, given the planning constraints. These alternatives could include additional project features that may restore and improve shaded riverine aquatic habitat for the study area, since the riparian habitat along the Sacramento River and the American River is important for native terrestrial and aquatic wildlife. For example, the project can evaluate the use of setback levees as a part of the alternatives, where feasible, to increase floodplains and riparian habitats. The Delta Plan recommends areas of the Delta for evaluating the feasibility of using setback levees for levee projects within the Sacramento River watershed, including urban levee improvement projects in Sacramento.

W-7

Next Steps

We look forward to continuing to work with your agency on this project. I encourage you to contact You Chen (Tim) Chao (916-445-0143) at YouChen.Chao@deltacouncil.ca.gov or Daniel Huang at Daniel.Huang@deltacouncil.ca.gov with your questions, comments, or concerns. We look forward to working with you to ensure consistency of the American River Watershed Common Features General Reevaluation Report Project with the Delta Plan while also avoiding, minimizing, or mitigating potential environmental impacts. We also look forward to continued discussions with the USACE and the CVFPB regarding this proposed project as well as the development of the CVFIMS and how these activities can be incorporated into the updated Delta levees investment strategy.

Sincerely,

Cindy Messer

Cindy Messer
Deputy Executive Officer
Delta Stewardship Council

cc: Ms. Erin Brehmer, California Department of Water Resources

X

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DELTA STEWARDSHIP COUNCIL
A California State Agency

May 4, 2015

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RE: Draft American River Watershed Common Features General Reevaluation Report Project Environmental Impact Statement/Environmental Impact Report, SCH #2005072046

Dear Ms. Brehmer:

Thank you for the opportunity to comment on the draft American River Watershed Common Features General Reevaluation Report (GRR) Project Environmental Impact Statement/Environmental Impact Report (EIS/EIR), prepared by the U.S. Army Corps of Engineers (USACE). The Delta Stewardship Council (Council) staff is pleased to see that this project is being proposed to improve the regional levee system and its existing conditions to reduce flood risk in the Sacramento area.

The Council has a legally enforceable management framework for the Delta and Suisun Marsh called the Delta Plan. The Delta Plan applies a common sense approach based on the best available science to restore habitat, increase the diversity and efficiency of California's water supplies, enhance floodplains, improve the Delta's levee system, and preserve the Delta's agricultural values. In many cases, the Delta Plan calls for balancing competing needs in the Delta, e.g., protecting and restoring habitat while reducing flood risk. Since part of the proposed GRR project activities lie within the Legal Delta and play an important role in maintaining the integrity of the Delta levee system, it is essential that our agencies continue to coordinate closely on these types of efforts.

Delta Plan Covered Actions and Certification of Consistency

Through the Delta Reform Act, the Council was granted specific regulatory and appellate authority over certain actions that take place in whole or in part in the Delta and Suisun Marsh. The Council exercises that authority through development and implementation of the Delta

Plan. State and local agencies are required to comply with the set of 14 regulatory policies contained within the Delta Plan.
According to the Delta Reform Act, it is the state or local agency approving, funding, or carrying out the project that must determine if a project is a "covered action" subject to regulations of the Delta Plan, and if so, certify consistency of the project with Delta Plan policies (Water Code Section 85225). Generally, the California Environmental Quality Act (CEQA) lead agency makes the determination if a project is a covered action, which in the case of this project is the Central Valley Flood Protection Board (CVFPB). If it is determined that the project is a covered action, CVFPB will need to complete a certification of consistency that demonstrates that the project is consistent with the regulatory policies of the Delta Plan. (Please refer to our website at http://deltacouncil.ca.gov/covered-actions for more information about the covered action process.) Information and analysis needed to support a consistency certification could be taken directly from the EIS/EIR.

X-1

Council staff has reviewed the draft EIS/EIR and has found that several of the proposed risk reduction measures are within the legal Delta and this proposed project may be a "covered action" and, therefore, subject to Delta Plan regulations, although that determination ultimately resides with CVFPB. Consequently, we have identified the issues below that we believe you should consider, for the purposes of compliance with both the Delta Reform Act and CEQA.

Comments on the Draft EIS/EIR

For this letter, our comments are organized by subject area. Within each subject area we have included information on the Delta Plan policy (or policies) possibly implicated by this project and the requirements of these policies, as well as specific comments on the draft EIS/EIR. Where appropriate, we have also provided information on mitigation measures from the Delta Plan's EIR that should be considered for this project if it is deemed a covered action. In a separate but related letter to the USACE on the draft GRR, we provide comments specifically on the process of identifying the federal interest in the project. A copy of this letter will be provided to your agency as well.

Delta Plan EIR Mitigation Measures

Delta Plan Policy **G P1** (23 CCR Section 5002) requires that actions not exempt from CEQA and subject to Delta Plan regulations must include applicable feasible mitigation measures consistent with or more effective than those identified in the Delta Plan Environmental Impact Report (EIR). The Delta Plan's Program EIR provides a list of mitigation measures to address, including those to address impacts to biological resources and agricultural resources. (Mitigation measures can be found in the Delta Plan Mitigation and Monitoring Reporting Program document, http://deltacouncil.ca.gov/sites/default/files/documents/files/Agenda%20Item%206a_attach%202.pdf.) The Delta Plan mitigation measures most relevant to this project are discussed under the relevant subject area headings below.

Risk Reduction

Delta Plan Policy **RR P1** (23 CCR Section 5012) calls for the prioritization of State investments in Delta flood risk management, including levee operation, maintenance and improvements. This policy includes interim priorities categorized as specific goals to guide budget and funding allocation for levee improvements and to assist California Department of Water Resources (DWR) and the CVFPB in achieving a balance in funding the various goals. In consultation with DWR, CVFPB, Delta Protection Commission, and other state and local agencies, the Council is currently updating this investment strategy to better define the State's interests. The updated strategy should incorporate information on proposed projects such as the one described in this draft document.

The draft EIS/EIR states that the purpose of the proposed action under CEQA is to reduce flood risk to the Sacramento area by improving the levees that surround the study area. The draft GRR further states that the objective of the non-federal sponsors, the State of California and Sacramento Area Flood Control Agency (SAFCA), is to meet the requirements of California Senate Bill (SB) 5 and the Central Valley Flood Protection Act to achieve an urban level of protection. The non-federal sponsors' goal is consistent with one of the goals contained in Delta Plan Policy RR P1: to "Protect existing urban and adjacent urbanizing areas by providing 200-year level flood protection."

The Sacramento area, according to the draft EIS/EIR, is one of the most at risk areas for flooding in the United States, and there is a high probability of levee failure when flood waters flow in either the American or Sacramento Rivers, which stress the network of levees protecting the study area. Based on our review of the draft GRR, it is unclear if the proposed project can effectively reduce the flood risk for the region and assist local communities in achieving the urban level of flood protection as required by the State. According to USACE's risk analyses from the draft GRR, the results of the risk analyses for the American River South Reach concluded that the Annual Exceedance Probability (AEP) for the American River South (ARS) Reach as a whole is 1 in 147. These results demonstrate that the flood risk for the ARS region would be reduced with the Tentatively Selected Plan (TSP) in place, but this information is insufficient for concluding that the proposed project can achieve the non-federal sponsors' goal.

X-2

In the final EIS/EIR, the results of risk analyses of multiple alternatives should be included and clearly presented according to the USACE standards and State's urban level of flood protection criteria. This information will be essential for assessing consistency with Delta Plan Policy RR P1. Also, the final EIS/EIR should include the potential effects on existing conditions or adjacent upstream and downstream flood control systems. These additional analyses will not only enhance the environmental impact assessments for the proposed alternatives but may also be beneficial to USACE's ongoing Central Valley Integrated Flood Management Study, DWR's 2017 Central Valley Flood Protection Plan update, and the Council's development of the Delta Levees Investment Strategy.

The draft EIS/EIR states that the operation and maintenance (O&M) of the improved levee segments and the modified Sacramento Weir/Bypass are the responsibility of the local maintaining agencies, including the American River Flood Control District, DWR's Maintenance Area 9, and the City of Sacramento. The final EIS/EIR, or subsequent environmental evaluation documents, should include the details of the O&M plan, along with mitigation

X-3 measures, for each levee improvement site and the modified Sacramento Weir/Bypass with well-defined measurable performance standards. This should be included in addition to the Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project.

Habitat Restoration

The comments regarding habitat restoration pertain to the Sacramento River East Levee work and proposed associated off-site mitigation sites, since these areas are located within the legal Delta. There are two regulatory policies in the Delta Plan related to ecosystem restoration actions. Delta Plan Policy **ER P2** (23 CCR Section 5006) states that habitat restoration must be consistent with Appendix 3 of the Delta Plan regulations, which is an excerpt from the 2011 Draft Ecosystem Restoration Program Conservation Strategy. Delta Plan Policy **ER P4** (23 CCR Section 5008) calls for levee projects to evaluate and where feasible incorporate alternatives, including the use of setback levees, to increase floodplains and riparian habitats. The policy also calls for the evaluation of setback levees of certain areas of the Delta, including the urban levees addressed in this EIS/EIR.

The proposed project will involve extensive levee improvement work along the east bank of the Sacramento River and the American River. The TSP includes a suite of erosion protection measures for identified levee segments which include placement of rock fill above and below the low summer/fall waterline, placement of a launchable rock trench, and substantial removal of levee vegetation.

According to the draft EIS/EIR, the Local Maintaining Agency would address vegetation issues under the System Wide Improvement Framework (SWIF) agreement, with the assumption that the USACE would approve a variance for USACE Engineer Technical Letter (ETL) 1110-2-583 Vegetation Free Zone requirements. Even with a USACE approved vegetation variance, the proposed vegetation removal under the TSP could result in the loss of 750 riparian trees along the main stem of the Sacramento River, as well as extensive removal of shaded riverine aquatic habitat associated with placement of rock fill along nine miles of river channel. The impacts to these habitats are expected to have adverse effects on the special status species that depend upon them, including Chinook salmon and Swainson's hawk. CVFPB should work

X-4 with USACE to obtain a vegetation variance and include the status of the variance application process in the final GRR and associated final EIS/EIR.

As acknowledged in the draft EIR under Impact AG-2, the project proposed in the GRR is expected to have potentially significant impacts on riparian habitat. This would be due to removing established riparian vegetation and shaded riverine aquatic habitat through placement of rock fill and its vegetation management plan to remove trees and shrubs it considers detrimental to maintaining levee integrity. The Delta Plan's EIR Biological Resources Mitigation Measure 4-3 calls for proponents to design projects that avoid impacts that would lead to substantial loss of fish and wildlife habitat. If there will be a loss of habitat for fish and wildlife species from a project, Mitigation Measure 4-3 calls for proponents to replace, restore, or enhance habitats for those species and preserve in-kind habitat.

Given the tremendous investment by State, federal, and local agencies, as well as nonprofits, to promote recovery of salmonids and other threatened and endangered species that use the Sacramento and American Rivers as migratory corridors, it is essential to make every effort to avoid or minimize impacts to these riparian and channel margin habitat. The benefits to special status species provided by the proposed mitigation measures in the draft EIS/EIR are unclear. X-5 We recommend that, to the maximum extent feasible, any impacts to the channel margin habitat along important salmonid migratory corridors should be mitigated on-site. In the event that off-site mitigation is necessary, we also suggest that any off-site mitigation occurs in close proximity and along the same waterway as where the impacts would occur to demonstrate that the mitigation is restoring equivalent, in-kind habitat.

X-6 In the final draft EIS/EIR or additional environmental evaluations, please identify and include the details of the mitigation measures with or without the USACE vegetation variance and/or the SWIF in place, and describe how they would address impacts to special status species, such as salmonids and Swainson's hawk. X-7 If additional funding is available, and a lower benefit-cost ratio of the project is acceptable to USACE and non-federal sponsors, additional alternatives that offer opportunities to restore and improve shaded riverine aquatic habitat important for native terrestrial and aquatic wildlife should be considered.

Invasive Species

Delta Plan Policy **ER P5** (23 CCR Section 5009) calls for avoiding introductions and habitat improvements for invasive nonnative species. This policy states, "The potential for new introductions of or improved habitat conditions for nonnative invasive species, striped bass, or bass must be fully considered and avoided or mitigated in a way that appropriately protects the ecosystem." Analysis on this matter should address both nonnative wildlife species (e.g., introduced sport fish species), as well as nonnative vegetation, including both aquatic and terrestrial weeds. X-8 In-water rock fill often provides cover for nonnative predators like striped bass, but is often negatively associated with native fish species like Chinook salmon. In the final EIR, please describe how the project will avoid or mitigate permanent impacts associated with in-water rock fill, including the creation of habitat conducive to invasive fish predators which could impact listed native fish.

X-9 Delta Plan Biological Resources Mitigation Measure 4-1 includes a requirement that an invasive species management plan shall be developed and implemented for any projects where construction or operation could lead to introduction or facilitation of invasive species establishment. Based on the concerns raised above regarding invasive species, we believe that such a plan is necessary and should be developed soon to help guide site-specific levee

X-9 (Cont.) improvement designs. This plan is to be developed in consultation with Department of Fish and Wildlife (DFW), U.S. Fish and Wildlife Service, National Marine Fisheries Service, and local experts. The invasive species management plan is to include the following elements: nonnative species eradication methods, nonnative species management methods, early detection methods, notification requirements, best management practices for preconstruction, construction, and post construction periods, monitoring, remedial actions and report requirements; and provisions for updating the target species list over the lifetime of the project as new invasive species become potential threats to the integrity of the local ecosystems.

Best Available Science and Adaptive Management

X-10 Delta Plan Policy **G P1** (23 CCR Section 5002) also states that actions subject to Delta Plan regulations must document use of best available science, as defined by Appendix 1A of the Delta Plan (refer to http://deltacouncil.ca.gov/sites/default/files/documents/files/AppB_Combined_2013.pdf). Additionally, this policy calls for water management and ecosystem restoration projects to include adequate provisions for continued implementation of adaptive management, appropriate to the scope of the action. This requirement can be satisfied through the development of an adaptive management plan that is consistent with the framework described in Appendix 1B of the Delta Plan (refer to http://deltacouncil.ca.gov/sites/default/files/documents/files/AppB_Combined_2013.pdf), along with documentation of adequate resources to implement the proposed adaptive management process. This policy is most applicable to the habitat restoration planned as mitigation for the environmental impacts of the levee projects.

Based on the draft GRR and the draft EIS/EIR, we understand that no monitoring or adaptive management plans have been developed related to the proposed habitat mitigation and enhancement activities. Prior to implementation of these habitat related actions, USACE, CVFPB, and potential local levee maintaining partners should develop adaptive management plans consistent with the Delta Plan; particularly the Plan's Appendix C. The uncertainty of whether the proposed habitat mitigation and enhancement measures are able to offset the impacts of the project and provide net benefits for native fish and wildlife species highlights the need for an effective adaptive management strategy and associated monitoring framework. Council staff is available to assist you in developing an adaptive management plan as part of early consultation to promote consistency with the Delta Plan. We suggest including documentation of best available science and an adaptive management plan as an appendix to the final EIS/EIR in order to have it available for use in a consistency certification.

Inconsistencies with the Delta Plan

X-11 The final EIS/EIR should discuss any inconsistencies between the proposed plan and the Delta Plan, as required by 15125(d) of the CEQA Guidelines. Please note that the CEQA guidelines' Appendix G states that a project that is inconsistent with any applicable land use plan, policy, or regulations may result in a finding of significant impact on biological resources.

X-11 (Cont.) Based on our initial review of the project, we have found potential inconsistencies with Delta Plan Policies **RR P1, ER P5**, and **G P1,** as described above.

Early Consultation

The Council strongly encourages all agencies who propose to approve, fund, or carry out an action in the Delta, as early in the project's development as possible, to consult with the Council and ensure the project (whether it is a covered action or not) is consistent with the Delta Plan. If CVFPB staff chooses to engage in early consultation, the Council staff will meet with you and offer guidance on determining whether the project meets the definition of a covered action, provided that the ultimate determination in this regard must be made by your agency. Council staff will also work with you to ensure consistency between the project and the Delta Plan's policies and recommendations. We also can help guide you through the certification process.

As mentioned above, Delta Plan Policy **G P1** requires that water management projects document use of best available science and include an adaptive management plan when filing a certification of consistency with the Delta Plan. We recommend that adaptive management for this project incorporate a monitoring, evaluation and reporting program that evaluates whether the project is successfully achieving the goals and objectives for the project. Delta Stewardship Council staff, including staff from the Delta Science Program, can provide early consultation to help in your preparation of documentation of use of best available science and adaptive management.

Next Steps

We look forward to continuing to work with your agency and other local, state, and federal agencies on this project. I encourage you to contact You Chen (Tim) Chao (916-445-0143) at YouChen.Chao@deltacouncil.ca.gov or Daniel Huang at Daniel.Huang@deltacouncil.ca.gov with your questions, comments, or concerns. We look forward to working with you to ensure consistency of the GRR Project with the Delta Plan while also avoiding, minimizing, or mitigating potential environmental impacts.

Sincerely,

Cindy Messer

Cindy Messer
Deputy Executive Officer
Delta Stewardship Council

cc: Ms. Anne Baker, U.S. Army Corps of Engineers, Sacramento District

Y

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May 4, 2015

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Erin Brehmer
Department of Water Resources
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Re: American River Common Features General Reevaluation Report Draft Environmental Impact Statement/Environmental Impact Report (SCH # 2005072046)

Dear Ms. Baker and Ms. Brehmer:

Thank you for providing the Delta Protection Commission (Commission) the opportunity to review the Draft Environmental Impact Statement/Environmental Impact Report for the American River Common Features General Reevaluation Report Project (Project).

The Commission is charged with ensuring orderly, balanced conservation and development of Delta land resources and improved flood protection. Proposed local government projects within the Primary Zone of the Legal Delta must be consistent with the Commission's Land Use and Resource Management Plan (LURMP). The Commission also provides comments on proposed projects in the Secondary Zone that have the potential to affect the resources of the Primary Zone. Portions of the Project are located within the Primary and Secondary Zones of the Legal Delta.

Proposed USACE and CVFPB actions are not subject to consistency requirements with the LURMP since the Project is sponsored by a federal and state agency. However, the Commission reviewed the EIS/EIR for possible impacts on the resources of the Primary Zone. We find that the Project provides necessary improvements to the Delta's levees and flood management system that promote the protection of life and property. We urge the U.S. Army Corps of

Y-1

Engineers (USACE), Central Valley Flood Protection Board (CVFPB), and Sacramento Area Flood Control Agency to minimize potential impacts to aesthetic, biological, cultural, and recreational resources where feasible.

In addition, the Great California Delta Trail Act (Chapter 839, statutes of 2006) directed the Commission to develop and adopt a plan and implementation program for a continuous regional recreational corridor extending throughout the five Delta Counties linking to the San Francisco Bay Trail and Sacramento

River Trail. In support of this objective, the Commission approved a resolution that encourages the incorporation of improved bicycle lanes as Delta levees are designed, engineered, and upgraded, taking
Y-2 into account the concerns of local residents and the viability of the Delta economy. Please consider incorporating improvements to accommodate bike lanes along the Sacramento River.

Thank you for the opportunity to provide input. Please contact Blake Roberts, Associate Environmental Planner, at 916-375-4237 for any questions regarding the comments provided.

Sincerely,

Erik Vink
Executive Director

cc: Don Nottoli, Sacramento County Board of Supervisors

Z

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Office of the General Manager

May 4, 2015

VIA EMAIL AND U.S. MAIL

U.S. Army Corps of Engineers
Attention: Anne E. Baker
1325 J Street
Sacramento, CA 95814-2922
Anne.E.Baker@usace.army.mil

Dear Ms. Baker:

Comments on the Draft Environmental Impact Statement/Environmental Impact Report: American River Watershed Common Features Project-General Reevaluation Report (SCH No. 2005072046)

The Metropolitan Water District of Southern California (Metropolitan) has reviewed the Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared by the two lead agencies, U.S. Army Corps of Engineers and Central Valley Flood Protection Board, to comply with the National Environmental Policy Act and the California Environmental Quality Act, respectively. As proposed, the subject project would provide flood risk management to the city of Sacramento by improving the levees that surround the city. This letter contains Metropolitan's comments on the EIS/EIR as a stakeholder in the State Water Project (SWP) and the Sacramento-San Joaquin Delta (Delta).

Southern California has an important stake in the Delta region and its existing infrastructure. As a SWP contractor, Metropolitan has invested and will continue to invest significantly in the SWP, efforts to restore sensitive fish populations in the Delta watershed, and scientific research into the causes of decline in fish native to the Delta. Even with the diversification of its supply sources and water use efficiency and conservation efforts, the SWP will remain a critical source of water supply for Metropolitan's service area. Hence, strategic levee protection measures are vital in protecting lives, infrastructure, and water quality in the Delta. However, should Alternative 2 of the subject project become the preferred alternative, then additional analyses should be conducted in support of the Folsom Dam Water Control Manual Update.
Z-1 These evaluations should consider flow frequency, duration, rate, and stage of American River Common Feature Project and Folsom Dam operations as they effect the Sacramento River, Yolo Bypass and related Delta water operations. Such analyses would ensure that habitat restoration opportunities in the Yolo Bypass, including the Cache Slough area, are not potentially compromised.

We appreciate the opportunity to provide input to your planning process and we look forward to receiving future information concerning this proposed project. If we can be of further assistance, or if you would like to discuss Metropolitan's comments, please contact me at sarakawa@mwdh2o.com or Mr. Randall Neudeck at rneudeck@mwdh2o.com.

Very truly yours,

Stephen N. Arakawa

Stephen N. Arakawa
Manager, Bay-Delta Initiatives

DWS:rrw

cc: Ms. Erin Brehmer
California Department of Water Resources
3464 El Camino Avenue, Suite 200
Sacramento, CA 95821
Erin.Brehmer@water.ca.gov

AA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

May 4, 2015

U.S. Army Corps of Engineers
Sacramento District
Attention: Anne Baker
1325 J Street
Sacramento, California 95814-2922

Subject: American River Watershed Common Features General Reevaluation Report Draft Environmental Impact Statement/Environmental Impact Report, Sacramento and Yolo Counties, California [CEQ #20150071]

Dear Ms. Baker:

The U.S. Environmental Protection Agency has reviewed the above referenced document. Our review and comments are provided pursuant to the National Environmental Policy Act, the Council on Environmental Quality's NEPA Implementation Regulations at 40 CFR 1500 - 1508, and our review authority under Section 309 of the Clean Air Act.

The Draft Environmental Impact Statement evaluates alternatives to provide flood risk management to the city of Sacramento by improving the levees that surround the city. The Tentatively Selected Plan -- Alternative 2-Sacramento Bypass and Improve Levees -- appears to be the least environmentally damaging alternative as it results in less riparian habitat removal along the Sacramento River and creates additional floodplain acreage. EPA has rated the Tentatively Selected Plan and the Draft EIS as EC-2 -- Environmental Concerns-Insufficient Information" (see Enclosure 1: "Summary of EPA Rating Definitions").

Our concerns are based on the need for remediation of the Old Bryte Landfill in the proposed Sacramento Bypass expansion area, as well as the potential for construction emissions to contribute to violations of the National Ambient Air Quality Standard for oxides of nitrogen (NOx). We recommend that the Final EIS include additional information on cleanup plans for the landfill. We also recommend that, if NOx emissions would exceed the *de minimis* threshold under the Tentatively Selected Plan, the Final EIS demonstrate that the project would conform to the State Implementation Plan and include a draft conformity determination. Furthermore, we recommend that the Final EIS include additional information regarding wetlands and riparian habitat, climate change, mitigation measures, and the project's ability to meet flood protection levels required by California Senate Bill 5. Please see the enclosed detailed comments (Enclosure 2) for additional concerns and recommendations.

We appreciate the opportunity to review this Draft EIS. Please send one hard copy and one CD of the Final EIS to this office (mailcode ENF-4-2) when it is officially filed with EPA's *e-NEPA*. If you have any questions, please call me at (415) 972-3521 or contact Jeanne Geselbracht, our lead NEPA reviewer for this project, at geselbracht.jeanne@epa.gov or (415) 972-3853.

Sincerely,

Kathleen Martyn Goforth

Kathleen Martyn Goforth, Manager
Environmental Review Section

Enclosures:
(1) Summary of EPA Rating Definitions
(2) EPA's detailed comments on the American River Watershed Common Features Draft EIS

cc: Erin Brehmer, Central Valley Flood Protection Board
Peter Buck, Sacramento Area Flood Control Agency
Howard Hold, Central Valley Regional Water Quality Control Board

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment

Hazardous Materials

The Old Bryte Landfill is located immediately adjacent to the land side of the northern levee of the Sacramento Bypass and the eastern levee of the Yolo Bypass Flood Channel. This landfill area would become part of the expanded Sacramento Bypass floodway when the existing northern Sacramento Bypass levee is removed and relocated 1,200 feet farther north. The Draft Environmental Impact Statement (p. 272) states that the landfill would be completely remediated in accordance with Federal, State, and local laws by the non-federal partner prior to construction.

The Old Bryte Landfill is the subject of a Preliminary Assessment Report prepared for the EPA in February 2012. According to the Preliminary Assessment Report (p. 8), sampling results showed the presence of elevated levels of lead, zinc, dioxins, and polychlorinated biphenyls (PCB). Lead was detected in all samples at concentrations ranging from 13 milligrams per kilogram (mg/kg) to 22,000 mg/kg. The average lead concentration of 4,285 mg/kg exceeded the Total Threshold Limit Concentration (TTLC) of 1,000 mg/kg. The average Waste Extraction Test (WET) concentration for lead of 64 milligrams per liter (mg/L) exceeded the Soluble Threshold Limit Concentration (STLC) of 5.0 mg/L. Zinc was detected in one soil sample at 17,000 mg/kg, exceeding the TTLC of 5,000 mg/kg. PCBs were detected in five soil samples ranging from 0.50 to 0.98 mg/kg. Dioxins were detected in one soil sample at 0.14 mg/kg. TTLC and STLC are used for hazardous waste characterization under California State regulations. Trench logs indicate an overall waste depth from ground surface to 13 feet with an average waste depth ranging from 5.9 to 7.2 feet, and the estimated volume of the waste is approximately 127,107 cubic yards. In 2001, the California Integrated Waste Management Board concluded that the burn ash material would likely be classified as a California hazardous waste if it were to be excavated for disposal.

AA-1 The Draft EIS neither describes how the landfill would be remediated and the materials disposed, nor identifies applicable cleanup standards, confirmation testing, or agencies responsible for overseeing the remediation before the weir construction and bypass expansion can be completed.

Recommendation: Include the above information in the Final EIS.

Air Quality

EPA's guidance on General Conformity applicability analyses states, "the Federal agency can take measures to reduce its emissions from the proposed action to in fact below *de minimis* levels and, thus, the rule would not apply. The changes must be State or Federally enforceable to guarantee that emissions would be below *de minimis* in the future."[1] The Draft EIS is unclear regarding the assumptions, including the enforceability of emissions controls, that were factored into the emissions estimates for the truck delivery scenario and the barge delivery scenario under the project alternatives.

Table 31 of the Draft EIS indicates that Year 2 total oxides of nitrogen (NOx) emissions would exceed the *de minimis* General Conformity threshold for the Sacramento Area under the barge delivery scenario. In addition, Table 30 indicates that, under the truck delivery scenario, NOx emissions would

[1] General Conformity Guidance: Questions and Answers (Response to Question 29), July 13, 1994 http://www.epa.gov/air/genconform/documents/gcgqa_940713.pdf

be less than, but quite close to, the *de minimis* threshold. The Draft EIS (pp. 196 and 199) states that, with the implementation of the Sacramento Metropolitan Air Quality Management District's Enhanced Exhaust Control Practices for off-road equipment and using only on-road heavy-duty diesel trucks or equipment that comply with EPA 2007 on-road emission standards, annual construction emissions would be reduced to below *de minimis* thresholds. It appears, however, that the emissions estimates in tables 30 and 31 already account for emission reductions from these measures, since the methodology section (Draft EIS, p. 188) indicates that the air quality emissions analysis was based, in part, on an assumption that "all project plans and specifications will require that construction contractors use only off-road equipment that implements the SMAQMD Enhanced Exhaust Control Practices and only use on-road hauling equipment that was manufactured in 2010, or later."

In addition, the Draft EIS implies that a 20 percent reduction in NOx from off-road equipment, relative to the emissions provided in tables 30 and 31, would be applied to the project. The SMAQMD Enhanced Exhaust Control Practices for off-road equipment require demonstrating that the heavy-duty off-road vehicles will achieve a project wide fleet-average 20 percent NOx reduction and 45 percent particulate reduction *compared to the most recent California Air Resources Board fleet average*. It is unclear what assumptions for fleet averages were used in the emissions analyses, and whether the 20 percent NOx reduction mentioned on pp. 194 and 198 is in reference to, or in addition to, this Enhanced Exhaust Control Practice.

The Draft EIS (p. 202) states that the use of Tier 3 and Tier 4 standards for newly built marine engines would be encouraged under the barge delivery scenario. The Draft EIS (p. 202) also states that, under the barge delivery scenario, off-road diesel-powered construction equipment greater than 50 horsepower shall meet Tier 4 off-road emission standards at a minimum, and on-road heavy-duty diesel trucks or equipment with a GVWR of 19,500 pounds or greater shall comply with EPA 2007 on-road emission standards for PM and NOx.

Recommendations:

AA-2
- In preparing the Final EIS, please consult with Tom Kelly, EPA Region 9 Air Division, on the requirements of EPA's General Conformity Rule. He can be reached at (415) 972-3856 or kelly.thomasp@epa.gov.

AA-3
- Clarify in the Final EIS the measures and assumptions that were factored into the emissions estimates in tables 30 and 31, and provide any recalculations if needed.

AA-4
- Clarify the mechanisms that would be used to ensure that emissions reductions are enforceable (e.g., included in contract specifications?) and achievable.

AA-5
- Estimate in the Final EIS the additional emission reductions that would accrue to each scenario with application of all enforceable mitigation measures. If NOx emissions would exceed the *de minimis* threshold under the Tentatively Selected Plan, we recommend that the Final EIS include a draft conformity determination and demonstrate that the project would conform to the State Implementation Plan.

AA-6
- We encourage the use of marine engines meeting EPA's Tier 4 emissions standards for the barge delivery scenario, on-road trucks meeting EPA's 2007 emission standards for the truck delivery scenario, and off-road construction equipment meeting EPA's 2014 emissions standards, to the extent possible for both of these scenarios.

AA-7
- In the Final EIS, correct the following informational errors that appear in the Air Quality sections of the Draft EIS:

AA-7 (Cont.)

- Table 25 identifies a 24-hour sulfur dioxide National Ambient Air Quality Standard. On August 23, 2010, EPA revoked the 24-hour sulfur dioxide standard.
- Table 26 and p. 185, bullet 2: On October 28, 2013, the Sacramento PM10 nonattainment area was redesignated as an attainment area with an EPA-approved maintenance plan.
- Tables 28 and 31: The *de minimis* threshold for volatile organic compounds in the Bay Area Air Basin is 100 tons per year rather than 50 tons per year.

Flood Protection Level

The General Reevaluation Report (GRR, p. 2-3) identifies the California Senate Bill 5 requirement for urban areas to achieve a 200-year level of flood protection, and notes concern that improvements under the Federal plan might not achieve this standard. Table 3-19 of the GRR indicates that the American River South portion of the project would not meet this standard under the Tentatively Selected Alternative. We were unable to find a discussion in the Draft EIS of the requirements of SB 5 or of whether and how each alternative would meet its requirements. We also note that the list of significance thresholds for hydrology and hydraulics impacts (Draft EIS, p. 78), which is based on the environmental checklist in the California Environmental Quality Act Guidelines, does not include the project's ability to meet SB 5. The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act require that EISs address possible conflicts between the proposed action and the objectives of Federal, regional, State, and local land use plans, policies and controls for the area concerned.

AA-8

Recommendation: We recommend that the Final EIS discuss whether and how each alternative would meet SB 5, including a description of any additional measures that would be needed to meet the standard and identification of the parties responsible for implementing and funding them.

According to the Draft EIS (p. 102), operation of the new weir and Sacramento Bypass will be determined after construction is complete. It is unclear what this information would entail and why it is not described in the EIS.

AA-9

Recommendation: We recommend that the Final EIS describe operation of the new weir and expanded Sacramento Bypass, and any potential additional impacts associated with operations not already discussed in the Draft EIS.

Vegetation

The Draft EIS (p. 49) states that lands within the extended Sacramento Bypass could be used to compensate for some of the trees being removed from the levees, and that a hydraulic analysis would need to be done to determine to what extent planting could occur. Elsewhere (p. 97), the Draft EIS states that detailed wetland surveys in the bypass will be done prior to construction. These analyses are also needed for determination and disclosure of the anticipated effectiveness of mitigation opportunities in the bypass and whether additional offsite mitigation sites may be necessary to compensate for project-

AA-10

related losses of riparian and wetland habitat.

Recommendation: We recommend that the Final EIS discuss the results of the hydraulic evaluation and wetland survey in the expanded Sacramento Bypass area, including available

AA-10 (Cont.)

resources and opportunities to compensate for riparian and wetland habitat losses there, and the effectiveness of such compensation. If additional compensation areas would be needed, the Final EIS should identify those areas and the acreages needed.

Climate Change

The Draft EIS (p. 213) states, "project-wide GHG emissions would be well below the BAAQMD's GHG threshold of 10,000 MT CO2e per year, indicating that project-generated GHG emissions would not contribute to climate change." While the project-generated greenhouse gas emissions of approximately 3,400 metric tons of carbon dioxide equivalent emissions per year (Draft EIS, Table 34) are well below the Bay Area Air Quality Management District's GHG threshold, it is not accurate to indicate that the project-generated GHG emissions would not contribute to climate change, as all GHG emissions do contribute to climate change. Please note that, on December 18, 2014, the Council on Environmental Quality (CEQ) released revised draft guidance for public comment, which describes how Federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews, and specifically addresses incremental contributions to climate change. As noted in the draft guidance,

AA-11

> "CEQ recognizes that many agency NEPA analyses to date have concluded that GHG emissions from an individual agency action will have small, if any, potential climate change effects. Government action occurs incrementally, program-by-program and step-by-step, and climate impacts are not attributable to any single action, but are exacerbated by a series of smaller decisions, including decisions made by the government."

Recommendation: We recommend that the conclusion regarding the project's contribution to climate change be revised to indicate that all GHG emissions contribute to climate change.

BB

CALIFORNIA
Water Boards

Edmund G. Brown Jr.
GOVERNOR

Matthew Rodriquez
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Central Valley Regional Water Quality Control Board

29 April 2015

Erin Brehmer
Central Valley Flood Protection Board
3464 El Camino Avenue, Room 200
Sacramento, CA 95821

CERTIFIED MAIL
7014 2870 0000 7535 8331

COMMENTS TO REQUEST FOR REVIEW FOR THE DRAFT ENVIRONMENTAL IMPACT REPORT, AMERICAN RIVER COMMON FEATURES GENERAL REEVALUATION REPORT PROJECT, SCH# 2005072046, SACRAMENTO AND YOLO COUNTIES

Pursuant to the State Clearinghouse's 20 March 2015 request, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) has reviewed the *Request for Review for the Draft Environment Impact Report* for the American River Common Features General Reevaluation Report Project, located in Sacramento and Yolo Counties.

Our agency is delegated with the responsibility of protecting the quality of surface and groundwaters of the state; therefore our comments will address concerns surrounding those issues.

Construction Storm Water General Permit

BB-1 Dischargers whose project disturb one or more acres of soil or where projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction Activities (Construction General Permit), Construction General Permit Order No. 2009-009-DWQ. Construction activity subject to this permit includes clearing, grading, grubbing, disturbances to the ground, such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP).

For more information on the Construction General Permit, visit the State Water Resources Control Board website at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.

Phase I and II Municipal Separate Storm Sewer System (MS4) Permits[1]

BB-2 The Phase I and II MS4 permits require the Permittees reduce pollutants and runoff flows from new development and redevelopment using Best Management Practices (BMPs) to the maximum extent practicable (MEP). MS4 Permittees have their own development standards, also known as Low Impact Development (LID)/post-construction standards that include a hydromodification component. The MS4 permits also require specific design concepts for LID/post-construction BMPs in the early stages of a project during the entitlement and CEQA process and the development plan review process.

For more information on which Phase I MS4 Permit this project applies to, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/municipal_permits/.

For more information on the Phase II MS4 permit and who it applies to, visit the State Water Resources Control Board at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml

Industrial Storm Water General Permit

BB-3 Storm water discharges associated with industrial sites must comply with the regulations contained in the Industrial Storm Water General Permit Order No. 97-03-DWQ.

For more information on the Industrial Storm Water General Permit, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/industrial_general_permits/index.shtml.

Clean Water Act Section 404 Permit

BB-4 If the project will involve the discharge of dredged or fill material in navigable waters or wetlands, a permit pursuant to Section 404 of the Clean Water Act may be needed from the United States Army Corps of Engineers (USACOE). If a Section 404 permit is required by the USACOE, the Central Valley Water Board will review the permit application to ensure that discharge will not violate water quality standards. If the project requires surface water drainage realignment, the applicant is advised to contact the Department of Fish and Game for information on Streambed Alteration Permit requirements.

If you have any questions regarding the Clean Water Act Section 404 permits, please contact the Regulatory Division of the Sacramento District of USACOE at (916) 557-5250.

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[1] Municipal Permits = The Phase I Municipal Separate Storm Water System (MS4) Permit covers medium sized Municipalities (serving between 100,000 and 250,000 people) and large sized municipalities (serving over 250,000 people). The Phase II MS4 provides coverage for small municipalities, including non-traditional Small MS4s, which include military bases, public campuses, prisons and hospitals.

Clean Water Act Section 401 Permit – Water Quality Certification

BB-6 If an USACOE permit (e.g., Non-Reporting Nationwide Permit, Nationwide Permit, Letter of Permission, Individual Permit, Regional General Permit, Programmatic General Permit), or any other federal permit (e.g., Section 9 from the United States Coast Guard), is required for this project due to the disturbance of waters of the United States (such as streams and wetlands), then a Water Quality Certification must be obtained from the Central Valley Water Board prior to initiation of project activities. There are no waivers for 401 Water Quality Certifications.

Waste Discharge Requirements

BB-7 If USACOE determines that only non-jurisdictional waters of the State (i.e., "non-federal" waters of the State) are present in the proposed project area, the proposed project will require a Waste Discharge Requirement (WDR) permit to be issued by Central Valley Water Board. Under the California Porter-Cologne Water Quality Control Act, discharges to all waters of the State, including all wetlands and other waters of the State including, but not limited to, isolated wetlands, are subject to State regulation.

For more information on the Water Quality Certification and WDR processes, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/help/business_help/permit2.shtml.

Regulatory Compliance for Commercially Irrigated Agriculture

If the property will be used for commercial irrigated agricultural, the discharger will be required to obtain regulatory coverage under the Irrigated Lands Regulatory Program.
There are two options to comply:

BB-8

1. **Obtain Coverage Under a Coalition Group.** Join the local Coalition Group that supports land owners with the implementation of the Irrigated Lands Regulatory Program. The Coalition Group conducts water quality monitoring and reporting to the Central Valley Water Board on behalf of its growers. The Coalition Groups charge an annual membership fee, which varies by Coalition Group. To find the Coalition Group in your area, visit the Central Valley Water Board's website at: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/app_approval/index.shtml; or contact water board staff at (916) 464-4611 or via email at IrrLands@waterboards.ca.gov.

2. **Obtain Coverage Under the General Waste Discharge Requirements for Individual Growers, General Order R5-2013-0100**. Dischargers not participating in a third-party group (Coalition) are regulated individually. Depending on the specific site conditions, growers may be required to monitor runoff from their property, install monitoring wells, and submit a notice of intent, farm plan, and other action plans regarding their actions to comply with their General Order. Yearly costs would include State administrative fees (for example, annual fees for farm sizes from 10-100 acres are currently $1,084 + $6.70/Acre); the cost to prepare annual monitoring reports; and water quality monitoring costs. To enroll as an Individual Discharger under the Irrigated Lands Regulatory

Program, call the Central Valley Water Board phone line at (916) 464-4611 or e-mail board staff at IrrLands@waterboards.ca.gov.

BB-9

Low or Limited Threat General NPDES Permit

If the proposed project includes construction dewatering and it is necessary to discharge the groundwater to waters of the United States, the proposed project will require coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Dewatering discharges are typically considered a low or limited threat to water quality and may be covered under the General Order for *Dewatering and Other Low Threat Discharges to Surface Waters* (Low Threat General Order) or the General Order for *Limited Threat Discharges of Treated/Untreated Groundwater from Cleanup Sites, Wastewater from Superchlorination Projects, and Other Limited Threat Wastewaters to Surface Water* (Limited Threat General Order). A complete application must be submitted to the Central Valley Water Board to obtain coverage under these General NPDES permits.

For more information regarding the Low Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0074.pdf

For more information regarding the Limited Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0073.pdf

If you have questions regarding these comments, please contact me at (916) 464-4684 or tcleak@waterboards.ca.gov.

Trevor Cleak

Trevor Cleak
Environmental Scientist

cc: State Clearinghouse unit, Governor's Office of Planning and Research, Sacramento

CC

REGIONALSAN
TAKING THE WASTE OUT OF WATER
Sacramento Regional County Sanitation District

Main Office
10060 Goethe Road
Sacramento, CA 95827-3553
Tel: 916.876.6000
Fax: 916.876.6160

Treatment Plant
8521 Laguna Station Road
Elk Grove, CA 95758-9550
Tel: 916.875.9000
Fax: 916.875.9068

May 7, 2015

Ms. Anne Baker
U.S. Army Corps of Engineers – Sacramento District
1325 J Street – 11th Floor
Sacramento, CA 95814

Subject: **American River Common Features General Reevaluation Report – Draft Environmental Impact Report**

Dear Ms. Baker:

Sacramento Regional County Sanitation District (Regional San) has reviewed the subject report and has the following comments.

Regional San has numerous pipeline crossings of the American River that could potentially be impacted by the proposed erosion control work referenced within the subject report. The launchable rock trench, which is described as up to 10' in depth, may be in conflict with some of these facilities.

CC-1 Regional San requests that all design submittals for the proposed erosion control effort be reviewed and approved by Regional San for any reach of work that may potentially impact Regional San facilities.

If you have any questions or concerns regarding this letter, please feel free to contact me at (916) 876-6104.

Sincerely,

Robb Armstrong
Regional San Development Services & Plan Check

cc: Sarenna Moore – Regional San Long Range Planning

DD

Joseph E. O’Connor Jr.
[redacted]

14 May 2015

U. S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814

Subject: Draft Report, American River Watershed, Common Features, General Reevaluation Report, March 2015

I am submitting a response to the subject Draft Report for consideration regarding overtopping concerns at the east end of the south-side of the American River levee. More specifically, it’s the east end of the levee section known as the Mayhew Levee. When the entire Mayhew levee section was raised and upgraded it was noted that it did not tie into high ground at the east end, but instead left nearly a two-foot gap between the high levee top and lower adjacent ground to the rear where rising river water could prematurely pass. Members of our community, including myself, reported this to the Sacramento Area Flood Control Agency and the Corps of Engineers and requested a repair.

DD-1

This past November, the Corps of Engineers completed what they considered a repair; however, this minor repair, while reducing some of the shortfall, still falls short of tying the east end into high ground equal to the levee top. To address the shortfall in an emergency, the Corps of Engineers has introduced a plan involving adding a wall of sandbags to fill the low area around the rear of the levee’s east end. This would involve removing homeowner fences and building the sandbag wall across back yards. In such a dire emergency, flood control officials shouldn’t be concerning themselves with something that’s so easy to fix long before hand. The east end of the Mayhew Levee should tie into high ground equal to the top of the levee. A project to do this should be added to this General Reevaluation Report.

Sincerely,

Joseph E. O’Connor Jr.

EE

U.S. Army Corps of Engineers, Sacramento District
Attention: Ms Anne Baker
1325 J Street, Sacramento, CA 95814
and Central Valley Flood Protection Board
c/o U.S. Army Corps of Engineers, Sacramento District
1325 J Street, Sacramento, CA 95814

May 18, 2015

Re: American River Watershed, Common Features, General Reevaluation Report, Draft Report, March 2015.

This was an important document to read, with the key new element to the traditional Common Features Project, the expansion of the Sacramento River bypass, apparently well supported in the tentatively selected alternative. The other new elements, additional work on tributaries to the Natomas East Main Drain, was somewhat surprising, but this should have been expected since private-citizen forums for reviewing the detailed work of this lengthy draft General Reevaluation Report (GRR or Report) before the release of the draft GRR have been somewhat limited.

Regrettably, the short comment period for this GRR limits the scope of these comments. But before going to the meat of our comments on the Report, we'd like to highlight an important issue:

The GRR does and should recognize that bank protection and other land and river-edge and riparian-forest disturbing projects within the American River Parkway are of significant concern to the public. The GRR suggests that the project sponsors will work to address these concerns. However, the new Corps feasibility review process for submitting to Congress for authorization does not develop enough site-specific project detail for the public to engage effectively at this level of project characterization. The public and the authorizing bodies (including the Congress) are being asked to trust project sponsors that the final as-constructed projects will be good ones for the Parkway as well as community safety. An argument can be made that this trust has been earned. Perhaps this is correct. Perhaps not.

In these circumstances, assurances that the project sponsors can make that they will abide by relevant laws protecting the American River Parkway and wild & scenic river are important. We hope that you take our specific suggestions seriously. Accepting them may or may not require recirculation, but the Final GRR needs to successfully address the deficiencies of the draft.

EE-1

Our comments here address a few themes: (1) Let's get the history of the Sacramento River Basin and area floodwater-management projects right. These documents live on, so it's important to write carefully and communicate accurately at all the important levels. To do so, let's meet to discuss our offered comments. We want to avoid misunderstandings so that your responses to comments are on target. Don't bury any needed corrections to the GRR in the Response to Comments appendixes. We want to make sure if you don't get the words right in the draft Report, get them right in the final Report that people actually will read in the future (2) Make sure that you don't ignore or downplay your environmental responsibilities. Make it clear what they are, and tell us that you will abide by them.

EE-2

These comments cannot contain sufficient expert subject matter comments on the reach-by-reach vulnerability of river and creek levees affected by the project, or the project designs to avoid or robustly mitigate adverse impacts, as much as we would like to have delivered these comments. The GRR is not detailed enough and the comment period too short to review these critical project assumptions. The consequence may have to be that preconstruction engineering and design will need to be the robust "formal and informal" processes that the GRR commits to engage in. As you know, previous bank-protection projects on the Lower American River had and have been thoroughly vetted in the Lower American River Task Force formed in 1993. The setting of the GRR is now a wider one, but the Task Force is certainly a good place to start. In fact, starting this review early is a good idea. Failing a quick authorization by the Congress (their record does not inspire confidence), one or more than one of the project sponsors may wish to or should find the resources to engage in a collaborative advanced site design process.

EE-3

With that admonition, let's move on to the page-by-page comments on the Report.

EE-4

GRR p. PAC-18: The description of the purpose of the 1986 release from Folsom Dam above the objective release is misleading. It is true that "rapid inflow" was part of the decision to make the 134,000 cfs release, but the status of the reservoir and antecedant operational decisions were the real reasons for the departure from the objective release. As noted in the National Research Council (NRC) report referenced below, there would have been no reason to surcharge the reservoir and make a release in excess of the objective release if the Reservoir Water Control Manual had been followed. Of course the nerves of the dam operators were also tested by the failure to revise the Manual to account for the likely failure of the Auburn Coffer Dam at the halted construction site (suddenly releasing enough water to fill more than a quarter of Folsom's flood reservation) in an already significant high-water event. We excerpt some of the conclusions from the NRC here:

> On February 13 and 14 the California Department of Water Resources (CDWR) began preparations for a full flood fight, given computer projections of a[n] extraordinary storm

EE-4
(Cont.)

approaching the state from across the Pacific (CDWR, 1986). The American River flood flows began in earnest on February 15, with inflows rising to over 60,000 cfs early the next day, but Figure 2.1 shows that Folsom operators did not begin to evacuate the flood control storage volume, nor did releases from Folsom match the inflows to the lake. Operators expressed a major concern for the effect of large Folsom releases on recreational facilities in the lower American River floodway; releases were held to 20,000 cfs for 36 hours. This is inconsistent with the 1977 USACE flood control diagram in force at the time; the diagram states that when Folsom storage is in the flood control reservation the water "shall be released as rapidly as possible" subject to ramping limits. Even after increased releases from Folsom began on February 16, and before they reached the 115,000-cfs limit, Folsom releases continued to lag behind inflows into Folsom Lake by 30,000 cfs or more. USACE-prescribed ramping limits of "15,000 cfs during any 2-hour period" do not appear to have limited the rate of increase of Folsom releases during the 1986 flood, nor were physical release rate limits at Folsom Dam a constraint given the initial elevation of the reservoir.

Lesson: Procedures need to be adopted to ensure that flood releases are made as required by operating regulations if intended flood risk reduction is to be achieved.

Folsom operations were primarily based on the actual inflow to Folsom Reservoir calculated from lake level changes (Figure 2.1). This calculation ignored the accumulation of water in the cofferdam near the Auburn dam site above Folsom. Written operating procedures do not mention this accumulation of water. Because this cofferdam was designed to breach with the 30-year flood flow, its accumulation distorted the effective inflow to the Folsom-cofferdam system and the accumulated storage in the two reservoirs, which ended up in Folsom Reservoir when the cofferdam finally breached.

Lesson: Plans need to be updated to reflect changes in facilities in basins and "temporary" structures.

If the Bureau of Reclamation had been able to more closely match outflow to inflows while inflows were less than 115,000 cfs, then releases into the American River would not have exceeded 115,000 cfs during the 1986 flood using the nominal storage capacity of the reservoir, even without anticipation of the Auburn cofferdam failure. Fortunately, disaster was averted by the use of extra surcharge storage in Folsom and by the ability of the downstream channel and levee system to handle releases of 130,000 cfs. Lessons drawn from the 1986 experience should not be forgotten. (See National Research Council Committee on *Flood Control Alternatives in the American River Basin,* National Academy Press, Washington, D.C., 1995, pp. 44–48. We'd be happy to make these pages available if the planning team does not have them.)

Resuming our thoughts, the History of Project (PAC-18) implies that "rapid inflow"[1] was responsible for the 1986 release in excess of Folsom Reservoir's objective release. To the extent that readers draw the conclusion that the 1986 high water exceeded Folsom Dam's reservoir design flood, the project sponsors are rewriting the history of the 1986

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[1] The instantaneous peak inflow in 1986 was reported to be 900,000 cfs when 120,000 acre feet were released with the failure of the Auburn coffer dam. *Corps of Engineers. Sacramento District, Folsom Dam and Lake, American River, California, Water Control Manual*, Appendix VIII to Master Water Control Manual, Sacramento River Basin, California, 1987, pp. iv, IV-7–8.

EE-4 (Cont.)

American River flood event and failing to abide by the admonition of the NRC not to forget these lessons.[2]

GRR p. 1-18: The history of Folsom Dam's design is slightly over-simplified when it is reported that it was designed to meet the Standard Project Flood in existence at that time: instead, it was designed to handle the predecessor method to the Standard Project Flood. Here's the more detailed history as told by the U.S. Bureau of Reclamation (Reclamation):

EE-5

> "In the design of Folsom Reservoir, the Corps of Engineers recognized the need to provide protection against a very large winter rain flood. The flood of January 1862 was thought to be the largest experienced flood for which estimates could be made, and those estimates[3] were initially considered by the local Corps of Engineers' staff for the Folsom flood control design operation plan. Objections raised by higher echelons of the Corps of Engineers, based on flood control experience throughout the United States resulted in discarding the estimated 1862 flood hydrograph and preparing a revision of the design flood to assure that a higher or "project design" degree of protection would be provided by the flood control operation under consideration, when allowance for unforseen contingencies was included." (Corps of Engineers Comments on Draft of USBR 'Amendment to the Final Environmental Statement and Supplement on Auburn-Folsom South Unit,' " July 11, 1974, *Amendment to the Final Environmental Statement and Supplement on Auburn-Folsom South Unit, American River*

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[2] Reservoir design floods are the volume of water in a reservoir-specific hydrograph that can be safely stored and released downstream under a given set of initial-state conditions. Flood hydrographs with routings that, for example, cause a reservoir to surcharge or cause releases above a dam's objective release or downstream conveyance capacity would exceed the reservoir design flood. In practice, no American River flood has caused surcharge or release of more than the objective release with the exception of 1986, and this was because of operational irregularities described by the NRC. Folsom Dam's reservoir design-flood hydrograph is represented in a number of Corps documents, including *Corps of Engineers. Sacramento District, Folsom Dam and Lake, American River, California, Water Control Manual*, Appendix VIII to Master Water Control Manual, Sacramento River Basin, California, 1987, sheet 2 of 8, Plate 19. The hydrograph is a partially reregulated inflow into Folsom Reservoir. The peak of the design hydrograph is 340,000 cfs, which no unregulated (unimpaired) historic flood has approached. In recent decades, three-day unregulated inflow volumes have been the customary way to describe actual flood magnitudes experienced by section-7 reservoirs in this region. Three-day design floods have never been developed for the existing Folsom Dam and the various reservoir-regulation manuals that described its operations from 1955 to 1986 (a six-day volume and a peak inflow were developed), a period where the SMUD UARP and PCWA Middle Fork Projects were constructed. If a three-day volume (regulated or not) has been developed for Folsom's design flood for this period, the following period 1987–95, and the current variable storage period, we would appreciate it if this data and supporting assumptions could be shared with us. The estimate of the peak of the variable-storage Folsom Dam design hydrograph, 360,000 cfs, is from MBK, personal communication, 2006.

[3] We have the Corps of Engineers 1941 and 1943 Leslie E. Bossen American River 1862 flood-estimate memos. They are an interesting and valuable read, and a written review is under preparation, but the Bossen memos suffer from a lack of a hydrograph and documentation of the stage-discharge routings. We can share the Bossen memos with the GRR team if they have passed from collective memory of the Sacramento District. If the Corps or the Central Valley Flood Protection Board has additional library documentation of the 1862 flood or the detailed history of the design of Folsom Dam's reservoir design flood, please contact us. They belong in our library as well and would be of interest to academic researchers as well.

Division, Central Valley Project-California, Volume 2, Department of the Interior, USBR, p. 248)

A complementary take on the design flood comes from the California Department of Water Resources (DWR): the reservoir design flood for Folsom Dam was developed from statistically centering the 1937 large regional flood over the American River Basin and computing its outflow—developing a peak inflow of 340,000 cfs at the design hydrograph used at the time. (*A Preliminary Study of Flood Control Alternatives on the Lower American River*, California Department of Water Resources, Central District, September 1982, p. 7). The GRR should note that Folsom Dam's reservoir design flood peak flow or the crucial three-day volume has not been exceeded by recorded flows.

EE-5 (Cont.)

GRR p. 1-18's characterization of the SPF event frequency ("between the 250- and 500-year event") is perhaps a simplification of the annual flood frequency often found in (but not assigned to) modern SPFs, although the SPF is now a fairly unused concept.[4] Regardless as noted above, this frequency was not the statistical characterization of the "project design" flood hydrograph at the time that Folsom Dam was designed. In fact, as the authors of the GRR must know, probability characterizations of the SPF are not relevant to the creation of SPFs. Instead, particularly in the early years, SPFs were based on transposition of the historic regional flood hydrology over the basin of interest. In recent years, SPFs have tended to be scaled PMFs. Neither methodology bases its determinations on a statistical probability range for a hydrologic event.

For example, statistical analysis to characterize the Folsom Dam's design flood (the pre-SPF, but similar "project design" flood) at the time of initial design suggested that the dam and levee system could contain the modeled 1000-year flood (*A Preliminary Study of Flood Control Alternatives on the Lower American River*, California Dept. of Water Resources 1982, p. 7). When Folsom Dam was built, it was expected to provide 250-year protection (*ARWI Feasibility Report, Main Report*, Corps of Engineers, Sacramento District, 1992, p. III-5). But soon after the dam was constructed, a 120-year level of protection was modeled, an annual flooding risk of 0.7%.[5] Of course, as new statistical treatments resulting from high water in 1986 and 1997, along with new deterministic engineering criteria for levee competence, became incorporated, the modeled frequency of Folsom Dam's design flood has bounced around, something that continued as more

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[4] The standard project flood methodology was the subject of a Corps engineering manual: *USACE, ER 1105-2-101, 1952 revised 1965*. It has been updated subsequently.

[5] *A Preliminary Study of Flood Control Alternatives on the Lower American River*, California Dept. of Water Resources 1982, p. 7. The reports of this post-construction-era assessment varied. In the 1962 Letter From the Secretary of the Interior Transmitting a Report on the Auburn-Folsom South Unit Proposing Expansion of the Central Valley project in California, Pursuant to Section 9(a) of the Reclamation Act of 1939 (53 Stat. 1187), and Section 2 of the American River Basin Development Act of October 14, 1949 (63 Stat. 852), House Document #305, 87th Congress, 2nd Session, p. 16, the Department estimated the modeled level of protection at that time to be 200 years. (January 18, 1962)

annual flood records affected the statistical analysis and Common Features and reoperation projects came on line.

EE-5 (Cont.)

This should be expected. Unlike design floods (which are expressed in relevant volumes or peak discharges of the design hydrograph—and only change when topography or the flood-control facilities change), statistical characterizations of the "level of protection" or "return frequencies" or "annual exceedances" of this and other project design floods vary widely, depending on statistical methodologies and the underlying hydrology data set and engineering assumptions, which evolve with time. This should be particularly true for statistical estimates for the probability distribution of hypothetical flood magnitudes—which, after all, have never been experienced and the "true" probability distribution of which is speculative—but in practice is driven by the chosen statistical methodology, adopted skew, and even the low flow record events.

EE-6

Again on page 1-18, there is another error: that the emergency release for Folsom Dam is 152,000 cfs. It is not. It is most simply characterized as 160,000 cfs (See Corps of Engineers. Sacramento District, *Folsom Dam and Lake, American River, California, Water Control Manual, Appendix VIII to Master Water Control Manual, Sacramento River Basin, California,* 1987, chart A-9, Emergency Spillway Release Diagram, Operating Instructions). The 152,000 cfs number comes from the flows assigned to the original design minimum freeboard of the levees along the lower American River: 3 feet for 152,000 cfs or 5 feet at 115,000cfs.[6]

EE-7

P-1-19. It's an exaggeration to suggest that the 1986 134,000 cfs release was made "to manage the risk of dam failure" (the release was made to avoid higher regulated releases that might cause greater strain on the American River levees and banks) and that conditions "came dangerously close to requiring operation of the [three] emergency flood gates at flows in excess of 152,000 [sic] cfs." With a full or nearly full reservoir, the five operational gates can make a release considerably in excess of the 152,000 cfs, nor does the diagram contemplate making releases higher than the emergency release target of 160,000 cfs until circumstances become noticeably more dire than what occurred in 1986 (inflows were declining sharply during most of the 134,000 cfs release according to Figure 2.1 on page 48 of the NRC report and sheet 8 of 8, plate 19 of the Folsom Dam Water Control Manual).[7]

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[6] For a simple but informative discussion of American River design levee height and flow relationships, see pages 3-17–18 of the *Folsom Dam Raise & Auxilliary Spillway Alternative Project Alternative Solutions Study (Pass) II, Final Report*, June 2006, ACE, Rec Board, DWR, USBR, SAFCA.

[7] The U.S.A.C.E. Sacramento District, *Folsom Dam and Lake, American River, California, Water Control Manual, Appendix VIII to Master Water Control Manual, Sacramento River Basin, California,* 1987. Chart A-9, "Indicated Release for the Next Hour" diagram, displays the maintaining-no-more-than-160,000 cfs "rule" until there is four feet of surcharge (in 1986, Folsom Reservoir surcharged 1.56 feet according to the *Sacramento and San Joaquin River Basins, California, Post-Flood Assessment*, March 1999, U.S. Army Corps of Engineers p. 5-18), and chart A-5, Spillway Total Capacity Curve [without emergency gates], displays a gross-pool discharge capacity as approximately 280,000–300,000 cfs. Note

EE-8 GRR p. 1-29: The Central Valley Flood Protection Plan (CVFPP) 200-year standard for reduced floodplain management and proposed improvements for urban levees need not be based on Corps of Engineers statistical and engineering methodologies. The statute provides that DWR, not the Corps, determines the statistical and engineering-criteria methodologies to assess performance against a state 200-year standard for floodplain management restrictions under California state law, SB-5, state legislation passed in 2007 (Cal GC 65300.2(a)). The CVFPP echoes this.

EE-9 GRR p. 2-4: It's true to say that in 1986 the Sacramento River flood-control system was near or somewhat above capacity, which perhaps could be translated to the "Sacramento River flood control system was overloaded" statement contained in the report. But with the exception of the left-bank Yuba River levees, the project levees along the major rivers held[8], and the Yuba River levee on the descending limb of the flood hydrograph at 60% of design flow. We have not previously seen estimates that 1986 actual flows were meaningfully larger than design floodway capacities in this area until this report (650,000 cfs combined in the Yolo Bypass and Sacramento River in the GRR, against 600,000 cfs nominal and the 1991 Corps bypass-near-Lisbon and Sacramento-River-near-Freeport estimate of 605,000–614,000 cfs[9]). We are not aware of any releases in excess of tributary floodway capacity for any of the section-7 reservoir[10] tributaries to the Sacramento River, although the objective release was exceeded at Folsom Dam because of the previously mentioned operational irregularities.

It's barely correct to say that reservoirs in the Sacramento system "were filled beyond their design capacity" in 1986. Only one large reservoir was: Folsom Dam because of departures from operations prescribed in the Reservoir Regulation Manual. In fact, there were no exceedances of normal pools in the San Joaquin Valley section-7 reservoirs either.[11] It may be misleading and certainly vague to talk of "reservoirs

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that the emergency (auxiliary) spillway with its flip-bucket energy dissipater instead of a large stilling basin is "intended for use only during extreme flood periods." (*Folsom Water Control Manual, 1987*, II-2)

[8] *Sacramento and San Joaquin River Basins, California, Post-Flood Assessment*, March 1999, U.S. Army Corps of Engineers, table 5-15.

[9] *Draft Feasibility Report, American River Watershed Investigation, California, Documentation Report,* Volume 2 - Appendix K, p. K-8. Table 8 here is a comparison of design flows and stages and peak flows and stages during February 1986 flood event. It would be interesting to see if, how, and why these figures would differ from estimates in 2015.

[10] Section-7 of the Flood Control Act of 1947. Flood control operations of these reservoirs are regulated by the Army Corps of Engineers' Water Control Manuals.

[11] In 1986, the small Sacramento Valley coast-range reservoir, Black Butte Reservoir, exceeded its gross pool of 144,000 acre feet by 24,000 acre-feet. It made a spillway release of 3,900 cfs (presumably augmenting its 15,000 cfs objective release by that amount) *Black Butte Dam and Lake, Stony Creek, California Water Control Manual*, U.S. Army Corps of Engineers, Sacramento District, May 1987, p. III-6 and *Post-Flood Assessment*, March 1999, U.S. Army Corps of Engineers, p. 5-18, table 5-14. Comanche

produc[ing] river flows that exceeded the design capacity of downstream levees: water came within inches of overtopping levees protecting Sacramento" if Common Features riverside levees are being referred to, although the new Common Features flow estimate in the Yolo Bypass/Sacramento River would put the 1986 combined flow at more than eight percent above the design flow.

Turning back to the American River, post-flood descriptions of design freeboard for these levees and the 1986 freeboard/flow relationships were published in the January 1995 *Proceedings of Phase Two, The Lower American River Task Force*. The Proceedings assessed then-existing Project levee freeboard conditions at various flows along the American river and concluded the following:

EE-9
(Cont.)

> For a release of 115,000 cfs, the existing minimum [freeboard] is the same for both left and right bank [project] levees (about 6 feet). The 130,000 cfs release condition also has about the same freeboard at the lowest point (interpolated to about 5.5 feet). (p. L-2, L-3)

This is not inches. It seems difficult to see how the current Common Features GRR could differ so significantly from the *Proceedings*. We suspect that the *Proceedings*' more detailed and documented descriptions are more accurate than these undocumented assertions in the draft GRR, but look forward to reviewing these conclusions with the GRR team.

The "inches" description could refer to a different problem involving what are now Common Features levees but not the river levees. The 1986 flood did show a freeboard/discharge/backwater problem with the Natomas East Main Drainage Canal (NEMDC) levee, which failed to have the freeboard envisioned by their designers in 1986 (remaining freeboard on the NEMDC near Main Avenue and the Natomas Cross Canal was 0.5 foot to 2 feet[12]). The drainage canal also had a problem with its upstream-levee creek collectors system, which failed to extend far enough upstream. It was this condition that caused localized severe flooding behind the outflanked NEMDC (Steelhead Creek) levee (Strawberry Manor). These deficiencies were largely remedied by the Sacramento Area Flood Control Agency (SAFCA) North Area Project of the early 1990s, which had a design philosophy to achieve sufficient freeboard for a stage associated with a 180,000 cfs flow in the American River and the design flow in the Sacramento River. The SAFCA North Area Project Feasibility studies characterize the problem and their solution. Although SAFCA's projects were largely completed, the

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Reservoir (not included in either the Sacramento or San Joaquin Valleys) exceeded its gross pool of 430,000 acre-feet by 9,000 acre-feet. We have not seen documentation that Comanche Reservoir released more than its objective release as a result of this small surcharge. *Post-Flood Assessment*, March 1999, U.S. Army Corps of Engineers, p. 5-18, table 5-14.

[12] *Draft Feasibility Report, American River Watershed Investigation, California, Documentation Report,* Corps of Engineers, Part 1, April, 1991, p. III-14.

EE-9 (Cont.) Common Elements GRR recommends additional levee work in these upstream tributaries to the drain.

GRR p. 2-8: The Sacramento River Flood Control Project may have been "designed to pass the known flood of record," 1909, but since that time some major section-7 reservoirs have been constructed, allowing the 1909 Sacramento River flood system footprint to accommodate later high-flow events. It could be misleading to not mention these later additions to the floodwater-management system. It can also be misleading to state that "[t]he floods of 1986 and 1997 delivered much more water to the leveed
EE-10 reaches than they were designed to carry, resulting in levee failures." The connotations of the word "much" and perhaps "leveed reaches" are the issues here. Floodway design flows and design stages along major Project rivers and bypasses were not materially exceeded[13], however some tributary creek levees were overtopped or outflanked.[14] River levee failures here did occur, but at stages below design, such as the 1986 Peach Tree Mall Yuba River levee break, or estimated to be at the design stage, such as the 1997 Country Club Road Feather River levee break. We think it is undisputed that the 1986 and 1997 Sacramento Valley levee failures along major rivers or bypasses were because of engineering deficiencies associated with their original construction, foundation problems, or because of the consequences of nearby levee failures, not because their design stages were dangerously exceeded by flood-corridor river stages.

GRR p. 2-9: Far more than "the 200-year event design storm can be safely conveyed past the dam" once the Joint Federal Project (JFP) is completed; after all, Reclamation's
EE-11 goal is for Folsom Dam to pass the PMF without major damage to the Dam. A PMF is a highly improbable flood event that is the traditional standard for sizing spillways to avoid dam failure. A little more careful writing is warranted here since we suspect that the sought-for objective is to pass the GRR design storm without downstream levee failure or outflanking of tributary streams, not whether the flows can be conveyed safely past the dam.

GRR p. 2-13: Again we have the misleading at best and undocumented "inches from
EE-12 overtopping" statement for Sacramento area levees. It makes for dramatic reading, but engineers should strive for precision in language and avoid inaccurate or misleading statements. See above our comments on GRR p. 2-4 above.

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[13] *Draft Feasibility Report, American River Watershed Investigation, California,* Corps of Engineers, Volume 2 - Appendix K, April 1991, p. K-8. Table 8 here is a comparison of design flows and stages and peak flows and stages during February 1986 flood event. Design stages in parts of the project area river and bypass system were exceeded to some degree in half the table locations, but none of these representative locations, nor the locations they were surrogates for, experienced failure or risk of overtopping.

[14] Levees along two Sacramento Valley creeks were overtopped in 1997, and one was outflanked/ "overtopped" in 1986. The west levee of the Sutter Bypass failed in 1997. See tables 5-15 and 5-34 of the *Post Flood Assessment,* March 1999, U.S. Army Corps of Engineers.

EE-13

GRR p. 2-18–19: Modeling the Campus-Commons/Sacramento State University "raceway" section of the Lower American River does show high velocities in this, the most narrow reach of the Lower American River. We have not yet been able to review the velocity contour analysis for the more typical reaches. Since additional erosion protection is being advocated for more than just the "raceway" reach, it would be appropriate for the GRR to characterize the wider and presumably lower-velocity reaches of river that it is seeking bank-protection authority for. We understand that bank vulnerability analysis and the resulting project recommendation would be to have the subject of discussions during post-authorization preconstruction engineering and design (PED) but remain uneasy about the potential scope of the authorization.

GRR p. 2-30: The Report identifies a single planning constraint: not violating FAA restrictions on providing additional bird habitat around the Sacramento International Airport, which we believe in the past has been used to argue (whether meritoriously or unmeritoriously) against levee setbacks and more extensive riparian forests along the Sacramento and American Rivers. The Report appears to be silent on the Corps of Engineer's responsibility to comply with the National Wild & Scenic Rivers Act (WSRA), which states that federal agencies shall not undertake any of a wide range of water-resources-project actions that would have "a direct and adverse effect on the values for which the river was established" (§7a, WSRA).

EE-14

The Lower American River is a state and federal wild & scenic river. According to the introduction on §7 of the federal act in the *Wild & Scenic Rivers Reference Guide* of the Interagency Wild & Scenic Rivers Coordinating Council, "[T]his key provision directs federal agencies to protect the free-flowing condition and other values of designated rivers and congressionally authorized study rivers." According to §16b of WSRA, "Free-flowing, as applied to any river or section of a river, means existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway." The *Reference Guide* adopts the definition of water resources project published in regulations developed by the Secretary of Agriculture (36 CFR 297) as "construction of developments which would affect the free-flowing characteristics of a wild and scenic or congressionally authorized study river."[15]

Because the bank protection projects that are envisioned in the Common Features draft GRR are water resources projects as defined by statute, regulation, and federal agency guidance, the project should be expected to comply with the National Wild & Scenic Rivers Act. Specifically, it should meet the §7 standards as determined by the federal wild & scenic river manager, the National Park Service. These "no direct and adverse impact on the values for which the river was established" as measured in §7 are again defined in the *Guide* consistent with 36 CFR 297 and §1b of the Act: "as the river's free-flowing condition, water quality, and outstandingly remarkable values (ORVs)." The outstandingly remarkable values on the Lower American River are anadromous

[15] *The Reference Guide* has now been broken up into a series of sub-publications from the Council that continue to be found at http://www.rivers.gov/publications.php.

fisheries and recreation (*American River Parkway Plan* 2008, Sacramento County, p. 90).

Section 2(a)(ii) national wild and scenic rivers such as the Lower American River are, in general, to be managed by the state or its political subdivisions. The most recent state plan is the *Lower American River Parkway Plan* adopted by the legislature in 2009 (AB-889). Although the federal manager has an independent duty to determine whether specific projects comply with federal WSRA law, the adopted state plan is intended to provide guidance to the federal manager, as well as the state manager, Sacramento County, (*American River Parkway Plan* 2008, Sacramento County, pp. 89–92). This plan contemplates additional floodwater-management works and contains detailed flood-control policies (pp. 82–83), later discussed and displayed in the GRR draft EIS, to avoid or mitigate adverse impacts to wild & scenic river values and Parkway resources. It should also be noted that State agencies such as the Central Valley Flood Protection Board (the non-federal sponsor) and political subdivisions of the state such as Sacramento County or the Sacramento Flood Control Agency, have a duty to comply with the provisions of the California Wild & Scenic Rivers Act (See California Public Resources Code §5093.56, §5093.61, and see §5093.50 for some relevant provisions).

EE-14
(Cont.)

We do not argue here that the 2015 Common Elements Project cannot comply with these statutes, only that the state and federal agency sponsors must shape the projects to comply with their obligations under their respective statutes. It is important the GRR acknowledge those responsibilities, and since the GRR does not contain specific site designs, the GRR should acknowledge that specific site designs will be subject to compliance with state and federal WSRAs. Projects along the lower American River have done so in the past; they can do so in the future. But their design must reflect the obligations of the GRR sponsors, both state and federal.

EE-15

GRR p. 2-32: This could be a subtle point, but it's not apparent to us that the JFP is aimed at having the ability to pass an *objective* release of 160,000 cfs. That certainly is currently the traditional emergency release, and it's fair to say that the Long-Term Study (see references below) envisioned that releases above 115,000 cfs would be included in measures of project performance, but we would characterize the releases above 115,000 cfs as contingency releases to be made when conditions require them. The Long Term Study envisioned that a new Emergency Spillway Release Diagram (ESRD) (figure 4, p. B-20) would determine operations in this range, proposed a new diagram, and stated the following:

> "Before adoption of a new ESRD, the proposed ESRD will undergo refinement and thorough analysis to ensure that the procedures are well defined to assist in the precise operational decisions necessary to make the selected plan function effectively for a range of events near design magnitude through extreme floods." *Volume III: Appendix C, Engineering, American River Watershed, California, Long-Term Study, Final Supplemental Plan Formulation Report/EIS/EIR*, Corps of Engineers, SAFCA, California Reclamation Board, Feb 2002, p. B-6."

EE-15 (Cont.)

The revision to Folsom Dam's Water Control Manual is underway. We assume that it will be the mechanism to tackle how these releases are characterized and will, therefore, contain the definitive terms and accompanying definitions needed to describe Folsom Dam's future operations. We offer up our characterization here for use by the Corps reservoir regulation manual update team.

EE-16

GRR p. 3-2: The yield of Reclamation's Auburn Dam is characterized in the Report as 270,000 acre-feet per year. The latest update from Reclamation, in 2006, estimated average yield at 208,000 acre feet per year.[16] The Report characterizes the energy production at the authorized Auburn Dam as 600 megawatt hours per year. This is confirmed by DWR and Reclamation sources. DWR characterized the annual energy production of the original Auburn dam as 600 GWhs (*Auburn Dam, Reconnaissance Appraisal of Construction Under State Sponsorship*, DWR Division of Planning, 1987 p. 8). This was echoed by Reclamation in a report published the same year with a 607.8 GWh estimate, arguably an estimate with too many significant figures (*Auburn Dam Report, Auburn Dam Alternative Study*, Bureau of Reclamation, Mid-Pacific Region, 1987, table 11).[17]

EE-17

GRR p. 3-5: The Report states that the section-7 reservoirs in the Sacramento River Basin "were completed prior to the largest flood in Sacramento; therefore, their designs are based on hydrology that does not take these large floods into account." In addition to being somewhat off the mark[18], this statement can mislead: as discussed earlier, the

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[16] Reclamation made some sub-estimates as well: (1) American River deliveries, an increase of 21,000 acre feet or a 3% change, (2) CVP total deliveries, an increase of 138,000 acre feet or a 3% change, (3) SWP total deliveries, 70,000 acre feet or a 2% change, (4) CVP dry and critical year deliveries, 229,000 acre feet or a 5% change, and SWP dry and critical year deliveries, 114,000 acre feet or an increase in 4%. (*Auburn-Folsom South Unit Special Report, Benefits and Cost Update*, Central Valley Project California, U.S. Department of Interior, Bureau of Reclamation, Mid Pacific Region, December 2006, pp. TS-3, Table III-2).

[17] We do note parenthetically that Reclamation's 2006 report appears to upsize the generation plants and develop a range of estimates for a number of re-envisioned hypothetical unit number and configurations, making comparisons with the authorized project difficult. Moreover, Reclamation's 2006 Special Report was unable to firmly identify average annual energy production saying the following:

> [t]he power generation potential at a hydropower plant is unique to each facility. Extensive analysis is required to develop power generation equations for a specific facility. This type of analysis has not been completed for the proposed Auburn Reservoir power plant.

The 2006 Reclamation report demonstrated a re-envisioned annual power generation potential ranging from 1,667 to 3,618 GWhs but fails to explain this considerable departure from earlier estimates. (*Auburn-Folsom South Unit Special Report, Benefits and Cost Update, Central Valley Project California,* U.S. Department of Interior, Bureau of Reclamation, Mid Pacific Region, December 2006, pp. III-15–17).

[18] A review of the Sacramento Valley reservoir water control manuals suggests that neither the early twentieth century storms magnitudes nor the latter twentieth century storms were the controlling factors in the design of most of their reservoir design floods. As noted earlier, Folsom Dam's design flood was initially based on 1862-flood estimates, then upsized. Review of the other respective reservoir regulation

EE-17 (Cont.)

record does not show any inflow events to these section-7 reservoirs that would have required releases in excess of dam objective releases or surcharged these reservoirs.[19] Of course, the original reservoir design floods, spillway design floods, SPFs, & PMFs would now be assigned a more probable "return frequency," which is probably what the GRR authors intended to say. The Report then states that "reoperation of these upstream reservoirs would not substantially reduce the flood risk to the Sacramento area," implying that this is because "flood storage is a small component of these dams' storage, since they are water supply reservoirs." Again, in spite of the "*small* component" of reservoir storage dedicated to a flood-control reservation, since their construction, these dams have been able, or should have been able, to maintain regulated releases to within their objective releases, which are usually keyed to leveed river-corridor capacity, indicating the dams' importance to the current floodwater-management system.

The real reasons why reoperation of upstream section-7 dams does not materially affect the performance of the Common Features floodwater-management systems are more varied. (1) Folsom Dam is already being "reoperated," reserving in some conditions more than two thirds of the reservoir for flood space, (2) the effectiveness of Common

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manuals is instructive. New Bullards Bar Dam's flood reservation was designed, in concert with the authorized but still unconstructed Marysville Dam, to provide SPF protection to Marysville-Yuba City (p. 24, ¶27, 1972). Oroville Dam's flood space was designed to provide SPF protection to the Feather River basin (p. 15, ¶14, 1970). "Shasta Reservoir does not have a reservoir design flood," although the 1977 manual does note, in this case, that the dam could contain a 100-year flood within its flood space and not exceed nearby downstream flow objectives. The 1940s-era hydrologic basis for its design was to be a multipurpose reservoir and meet its authorized purposes and priorities (p. 9, ¶18 & p. 25, ¶24). The smaller Black Butte Project was authorized because "the required flood protection could be provided more effectively and economically" than downstream levee or channel improvement projects or small upstream reservoirs (p. III-1). Project objectives include protecting "the city of Orland from all reasonably probable rain floods," protecting downstream agricultural areas "during all but very large floods," and restricting releases from the dam to 15,000 cfs "insofar as possible" (p. VII-1, 1987). The 1970s-era Indian Valley Reservoir on the NF Cache Creek seems to be the only Sacramento Valley section-7 reservoir with a hydrologic basis for design based on a probability frequency that could be affected by more recent flood experience. Its small flood-space reservation of 40,000 acre-feet was based on "adequately contain[ing] all Indian Valley inflow for floods up to the 50-year flood until flows at Rumsey have returned to existing channel capacity of 20 cfs" (p. 9 ¶17, 1977).

[19] In the 1997 event, Oroville Dam operators made a release of 160,000 cfs, 10,000 cfs above the dam's objective release out of concern that pass-through operations were imminent. However, 1997 reservoir operations peaked with 206,000 acre feet of the standard 750,000 acre-feet flood control reservation and 150,000 acre-feet of objective-release-requiring surcharge operational space defined in the Water Control Manual still untouched. That's a 350,000 acre-feet cushion. Oroville Dam did not experience a reservoir design flood, and pass-through operations were not imminent. For a careful analysis of the Oroville Dam operations, see Motion to Intervene of Friends of the River, South Yuba Citizens League, and Sierra Club, Federal Energy Regulatory Commission, Project No 2100-52, October 17, 2005. Of course, two San Joaquin River Basin section-7 reservoirs filled and spilled in 1997, but given floodway constraints, this should not have been unexpected. Sacramento River Basin floodway capacities are an order of magnitude greater their southern neighbors. For a handy record of 1997 major section-7 reservoir operations, see the *Final Report, Governor's Flood Emergency Action Team*, The Resources Agency, May 10, 1997, Appendix B.

EE-17 (Cont.)

Features facilities is buffered from potential exceedances from dams upstream of the American River because these exceedances may be temporarily stored in upstream flood-deposition basins due to levee breaks or Butte Basin upstream weir operations, or mostly diverted into the Fremont and even Sacramento Weir and into the Yolo Bypass. (3) Shasta Dam and Oroville Dam have large flood reservations and substantial early-release capabilities now. The most deficient dam is New Bullards Bar Dam. It has the smallest flood-space reservation, even in percentage terms of any of these dams. It's early-release capabilities are limited enough that Yuba County Water Agency, the dam's owner, has undertaken preliminary design investigations to enlarge its low-level release capabilities to better enable the dam to conduct floodwater-management operations and benefit from a forecast-based reoperation. Physical modification to this dam and a modified Water Control Manual is a foreseeable circumstance, but their major benefits would mostly be improving regulation of flood stages along the Yuba and Feather Rivers for some floods and produce only attenuated benefits downstream, in part because most of these flows are diverted into the Yolo Bypass.

EE-18

GRR p. 3-6: As we recall the Corps 1991 ARWI alternative analysis, another reason the Corps did not carry forward the proposed Deer Creek offstream storage project was simple: the downstream channels needed to evacuate Deer Creek dam storage of antecedant flood events were too small. As a result, the Corps could not be confident that flood space there could be considered reliable during flood seasons like 1862 when large flows were experienced in multiple very large flood waves throughout the months of December and January. Sacramento River Basin flood corridors are a lot larger than more southerly corridors. That makes a huge difference in flood-space recovery times.

EE-19

GRR p. 3-7: The report notes "that some [study area] flood events were larger than those for which the flood control system was sized (1955, 1964, 1986, and 1997)." As noted earlier, Folsom Dam has never experienced a flood larger than its reservoir design flood (see attachments).[20] The JFP is designed to increase the Folsom Dam reservoir design flood in case flows larger than record or greater than reservoir-design-flood inflows occur. Common Features projects are designed to increase levee reliability at objective releases up to the emergency release target flow of 160,000 cfs (which may become a conditional release as well). Of course if the focus is on the Common Elements collector streams, these projects did not perform well during the 1986 flood and have been the focus of non-federal sponsor activity and this GRR to prevent the leveed corridors of upstream creeks from being outflanked or overtopped or failing during high-flow events, especially when high backwater conditions prevail. Nevertheless, these general

[20] We suspect that the metrics used to establish this assertion are six-day volumes. As noted earlier, the actual hydrograph may be best representation of a reservoir design flood. Failing that, three-day volumes have become the *lingua franca* of contemporary measures of reservoir flood-operations performance in this region. Design hydrographs that are challenged by three-day numbers are typically not very challenged by six-day flows given the large floodway capacities of Sacramento Valley reservoirs and typical runnoff patterns of the areas's great floods. In effect, the center-of-storm runnoff (3-day) metrics challenge flood space and timely reservoir operations, while long storm-sequence (6- or 14-day) metrics challenge downstream release and floodway capacities.

EE-19 (Cont.) statements should be made with more precision. Otherwise, they are subject to misinterpretation.

EE-20 GRR p. 3-20: Vegetation on or near levees can also reduce the probability of system failure by reducing water velocities at the bank or levee interface and by increasing levee or bank/berm cohesion. As noted in other areas of the Report, levee and near-levee vegetation-removal policies are a significant issue of public concern. That concern has resulted in a stand-down of enforcement of some of the Corps policies as a result of Congressional Action (WRRDA §3013) with a conforming court order (*Friends of the River v. U.S. Army Corps of Engineers,* Case 2:11-cv-01650-JAM-AC (E.D.Cal. Sept. 12, 2014). It would be helpful if the Project sponsor GRR presentations on this subject area were more balanced given the obvious local, state agency, and federal natural resources agency sensitivities to this issue while the Corps is reformulating its vegetation policies as discussed in WRRDA and the conforming court order.

EE-21 GRR p. 3-23: We concur with Table 3-6's assessment that the later not-carried-forward Upstream Storage on American River (Auburn Dam) alternative has demonstrated a lack of Congressional and public support. It's probably also true that there is no non-federal sponsor for this alternative. We are, therefore, curious why the same poor acceptability rating does not occur with the also not-carried-forward Maximum Plan alternative. It, too, also features the same upstream storage element as the previous (above) alternative and lacks any realistic potential non-federal sponsors.

EE-22 GRR p. 3-28: Regarding your Focused Alternative 5: Maximum Plan (later not carried forward) it would be helpful if the GRR discussion could include a caveat or two regarding the statistical meaningfulness of assigning apparently precise and therefore accurate probabilities to hypothetical never-before-experienced, particularly events considerably larger than recorded events. For example, the American River rain flood frequency analysis by the Corps of Engineers prepared with the advice of the National Research Council's Committee on American River Flood Frequencies does not extrapolate the frequency curve beyond 1 in 200.[21] While the Committee and we understand that assigning these rare probabilities to some hypothetical flows for some purposes is necessary, it would be appropriate to include the NRC's caution when discussing analyses concerning events modeled to be less probable than 1 in 200 in this watershed.

EE-23 GRR p. 3-38: The Vegetation and Access discussion of vegetation on and near levees begun here and carried through much of the rest of the Report seems curiously uninformed by WRRDA §3013 and the conforming court order. There are two relevant provisions neatly summarized by the order:

[21] U.S.A.C.E. Sacramento District, *American River, California, Adopted Rain Flood Flow Frequency Analysis*, April 1999, plate 1 and presumably subsequent successor analyses.

> The Corps will proceed to conduct the review of the guidelines and take the actions required by WRRDA § 3013. In accordance with § 3013(g) until the date on which revisions to the guidelines are adopted, the Corps will not require the removal of existing vegetation as a condition or requirement for any approval or funding of a project, or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk (*Friends of the River v. U.S. Army Corps of Engineers,* Case 2:11-cv-01650-JAM-AC (E.D.Cal. Sept. 12, 2014) ¶6).

EE-23
(Cont.)

To date, the review has not been concluded, nor have any revisions to the guidelines contemplated in the court order been adopted. Instead, the representations of how vegetation on and near levees will be treated by the Common Elements projects appear to be consistent with the current Corps Vegetation Engineering Technical Letter (ETL), SWIF, and variance policies, apparently prejudging the results of the review and release from the court order. It is therefore troubling that the Report fails to note that some vegetation-removal actions are not consistent with current federal law or the court order. Nor does the Report note that it has been required by the Congress to review the ETL with the expectation that a revised ETL will then be issued. We appreciate that the project sponsors need to be able to describe the environmental impacts of the successor ETL as the projects in the Common Elements GRR are constructed, but the range of potential of future Corps (and state) levee- and near-levee vegetation policy alternatives are not included in your descriptions.

In fact, it is impossible not to note that the Report and draft EIS/EIR fail to develop any alternatives to implementation of the meat and substance of the current ETL and related vegetation policies. Instead, the GRR apparently assumes that variances will be given. We appreciated that the Sacramento District will seek a variance to the ETL (*Appendix C, Engineering,* 2.4.2) and hope that they receive a variance. However, there could be severe consequences if the existing ETL or similar successor ETL (apparently assumed here) is required to be implemented because variances are not granted. Given the proximity to wild & scenic rivers and the potential to take actions that may violate federal laws meant to protect the environment, this is a deficiency in the project formulation and assurances that needs to be addressed in the Final Report and environmental documents or challenges could arise.[22]

The Central Valley Flood Control Board's adoption resolution for its levee vegetation policy in the Central Valley Flood Protection Plan (CVFPP) also contemplated a state review of the adopted levee-vegetation elements of the CVFPP, which were not consistent with the ETL. Again the possibility of revisions to the state plan elements, particularly the Life Cycle Management Policy (which would gradually result in absence of woody vegetation from most of the levee profile and all of the landside near-levee area) or of the DWR Urban Levee Design Criteria vegetation requirements, are not contemplated in the Report. DWR is also reviewing how their vegetation policy squares

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[22] See NEPA Regulations: 1508.27(b) ("severity" "intensity"); 1508.27(b)(3) ("proximity to. . .wild and scenic rivers"); and 1508.27(b)(10) ("Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.").

with the Draft Conservation Strategy being prepared for adoption before or at the 2017 update to the CVFPP.

EE-23 (Cont.)

A little humility is necessary here. It's O.K. to recognize and report that the federal and state policies are under review but this is how it would work with the existing, but in the federal circumstance, stood-down policy and the state policy that is supposed to be under review. But you have to make it abundantly clear that these policies may change or be refined as a result of future review and discuss the implications of various alternatives.

And speaking of humility, consider the lowly California Poppy *(Eschscholzia californica, E. caespitosa, or E. lobbi)*. The Report assumes that hydroseeding perennial grass seeds on the otherwise barren or mowed or burnt levees envisioned in the Report will be successful in keeping wildflowers and annual grasses of the Sacramento Valley from invading the slopes of the levees in violation of the ETL. It is probably worth some real inquiry on the track record of this technique to achieving mowable perennial grasses that can successfully exclude vegetation inconsistent with the ETL such as forbs and annual grasses. And if the Corps intends to revise the ETL, don't declare war again on California's native wildflowers. They aren't the enemy.

EE-24

GRR p. 4-8: We were pleased to read the following commitment:

> An initial assessment with regards to the method of bank stabilization has been made for this document. During detailed design, the Corps will coordinate closely with the county, state, and federal agencies responsible for managing the resources of the parkway in selecting which method of bank stabilization should be deployed. In carrying out this effort, the Corps will coordinate through the formal and informal processes that have been created to facilitate management of the parkway in application of the above criteria. Where erosion protection is needed to meet established flood risk reduction objectives, the selection of the method of protection will be based on a determination of which method would do the most to protect valuable parkway land, fish and wildlife resources, and recreational facilities considering both the short term impacts of construction and the long term effects of any mitigation measures included in the design of the project.

As you know, one of these groups is the now twenty-two-year-old Lower American River Task Force. This is so important that if necessary the Corps may be well-advised to seek specific authorization to do this if and when an authorization proposal is submitted to the Congress.

EE-25

GRR p. 4-36: It is perhaps premature to specify that the expanded portion of the Sacramento Weir will never be operated "for events up to and including the 1/100 ACE event." By implication, this is either an inflow-into-Folsom Dam or a Folsom Dam outflow statistic (the text is not clear). It should be noted that the current 1/100 ACE inflow into Folsom Reservoir has never been experienced in the period of hydrological record. And no Water Control Manual operation would have required outflows greater than 115,000 cfs in the same period routed through the existing system of dams. It is, thus, not out of the question that the expanded Sacramento Weir would never be used under this policy.

EE-25 (Cont.) The California Department of Water Resources, along with local governments, is also developing a project to expand the Sacramento Weir, which it probably intends to marry with the Corps Common Features tentatively selected alternative. It is premature to judge what project operational criteria they will develop for weir operations. It is certainly possible that DWR et. al. would conclude that opening the weir could be important in circumstances not within the criteria put forward in GRR p. 4-36.

EE-26 GRR p. 4-37–40: Again, the State and National Wild & Scenic Rivers Act §7 standards are not mentioned as avoidance or mitigation objectives. They belong here.

EE-27 GRR p. 7-1–4: In the list of recommendations a number of project-related relevant statutes are referenced for the purposes of a pledge of compliance. There are at least two relevant ones that we do not see: (1) WRRDA §3013 and the conforming District Court order (*Friends of the River v. U.S. Army Corps of Engineers*, Case 2:11-cv-01650-JAM-AC (E.D.Cal. Sept. 12, 2014) as applicable, and (2) the National Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) as set forth herein consists of Public Law 90-542 (October 2, 1968) and amendments thereto.

EE-28 dEIS/EIR p. 56: We suspect that the conclusion, "[i]f a large regional earthquake occurred during a major flood event, these potential [structural degredation] effects would be magnified, and potential for levee breach would be increased," is true, especially for the American River and upstream levees, which rarely experience high stages. But the Sacramento River does experience high stages for weeks and longer during relatively routine rainy periods even in the absence of "a major flood event." Since the GRR project area includes the Sacramento River, the conclusion there that "the potential for failure or significant damage of project structures is low" because, in part, of the "small likelihood of coincidence [of a] flood event and a major earthquake." Given the large populations and ongoing land-use and floodplain-management decisions within the protected reaches of the GRR, more detailed discussion of this issue is in the public interest, even if the project may not change the relative risk of this failure mode in comparison to the without-project condition. Some discussion is also warranted of how sensitive the liquefaction risk is to stage since deeper foundation wetness conditions may not be as sensitive to stage as shallow foundation wetness may be.

EE-29 dEIS/EIR p. 59: The lower American River is not classified as a "Recreation" river within the state and federal wild & scenic river systems. It is classified as a "Recreational" river. "Recreation" is one of two identified extraordinary values of the lower American River wild and scenic river, the other being anadromous fishery.

EE-30 dEIS/EIR p. 60: Thank you for quoting the American River Parkway Plan flood-control policies. As you note on page 59, the parkway plan acts as the management plan for the

EE-30 (Cont.) state and federal wild and scenic rivers acts. It also should be noted that the parkway managers and state and federal agencies need to comply with the statutes in their exercise of discretion when implementing the policies of the management plan.

EE-31 dEIS/EIR p. 63: Although the likely erosion of waterside berms is a basic assumption of the GRR, this hypothesis on a reach-by-reach basis will and should be demonstrated (preferably pre-authorization but failing that, during preconstruction engineering and design). We'll all have to spend more time with GRR Appendix C, Attachments C & E.

EE-32 dEIS/EIR p. 64: The following statement is so important, that we repeat it full:

> The American River Parkway Plan policies address flood risk reduction and levee protection activities with the overall aim of facilitating these activities as necessary to achieve established flood risk reduction objectives in a manner which provides optimum protection to the open space, recreation, and fish and wildlife resources of the Parkway. Consistent with these policies, bank protection improvements and to a lesser extent launchable rock trench improvements have been constructed at various locations in the Parkway over the past 20 years. In selecting which of these methods of protection should be deployed, the Corps will coordinate closely with the Sacramento County Department of Parks and Recreation, the National Park Service, the other Federal and State agencies responsible for managing the resources of the Parkway, and non-governmental stakeholders. In carrying out this effort, the Corps will coordinate through the formal and informal processes that have been created to facilitate management of the Parkway. Where erosion protection is needed to meet established flood risk reduction objectives, the selection of the method of protection will be based on a determination of which method would do the most to protect valuable Parkway land, fish and wildlife resources, and recreational facilities considering both the short term impacts of construction and the long term effects of any mitigation measures included in the design of the project.

We would add that the vegetation and aesthetic resources of the parkway should not be unnecessarily sacrificed, that they contribute to the parkway's extraordinary and outstandingly remarkable values, and that we believe that the above coordination commitment applies here as well.[23] Moreover, we expect that project decisions along the Sacramento River and tributary creeks to the American River will be well coordinated as

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[23] See §10(a) of the National Wild & Scenic Rivers Act. "Each component of the national wild and scenic rivers system shall be administered in such manner as to <u>protect and enhance the values which caused it to be included in said system</u> without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its <u>esthetic</u>, scenic, historic, archaeologic, and scientific features." *(emphasis added)*

EE-32 (Cont.) well, recognizing, of course, that authorities and responsibilities along these waterways may differ.

EE-33 dEIS/EIR p. 69: The "Regulatory Setting" bullet points here and in other portions of the dEIS/EIR should give more careful consideration of whether to include the state and federal wild and scenic river acts. Water resources projects including bank protection projects need to get WSRA §7 sign offs from the National Park Service. Under the California WSRA, each agency makes its own determination of consistency (PRC 5093.61), although the Resources Agency is responsible for coordinating state agency actions and decisions (PRC 5093.60).

EE-34 dEIS/EIR p. 70: The document notes that "[t]he project area is divided into two basins—American River North and American River South." These may be congruent with the pre-leveed natural flood-deposition basins on either side of the American River: the American Basin to the north, and the Sacramento Basin to the south. Since professional and academic use will be made of the GRR, it may be helpful to explain their equivalence or how the terms differ. For example, the portion of the American Basin surrounded by levees in Natomas is often called the Natomas Basin. These three basins are nicely displayed in GRR Appendix E, but the relationships between geomorphic forms could use better discussion.

EE-35 dEIS/EIR p. 75: Table 8 compares pre and post Joint Federal Project (JFP) outflows for modeled year frequency events. We were unaware that the operational rules for the JFP had been completed, presumably a prerequisite for making these predictions. We would be interesting in learning what rule assumptions were made to construct Table 8 and Figure 7 on the following page.

EE-36 dEIS/EIR p. 81: Will the trigger for the use of the expanded Sacramento Weir and Bypass be when a Folsom Release of greater than 115,000 cfs is made or will it be tied to a hydrology analysis of higher inflow into or outflow from Folsom Reservoir than the modeled 1/100 ACE event (as it exists now or in the future)? See our remarks above about the wisdom of making this commitment at this time.

EE-37 dEIS/EIR p. 102, 2nd ¶, 1st sentence: Substitute "effect" for "affect."

EE-38 dEIS/EIR p. 103: Vegetation, both temporary and long-term, are clearly one of the big potential adverse impacts of the Project and revegetation, whether natural or artificial, is a major potential mitigation for the GRR. It is critical, as noted at this page, that [d]uring the design refinement phase, plans will be evaluated to reduce the impacts on vegetation and wildlife to the extent practicable." This is a high-visibility parkway. This commitment needs to be serious and meaningful and that the words "extent practicable" are not misused.

EE-39 dEIS/EIR p. 111: The hypothesis that "high flows in the American River would have a large impact on the American River Parkway as the berms disappear from continued

EE-39 (Cont.)

high flows against erodible material" has yet to be thoroughly and in detail reviewed outside of the GRR team and consultants. As noted earlier, a wider, more public technical reach-by-reach discussion is warranted. We'll all have to spend more time with GRR Appendix C, Attachments C & E.

EE-40

dEIS/EIR p. 116: As noted earlier, there needs to be a review of the Regulatory Setting sections in the dEIS/EIR on whether the state and federal wild and scenic river acts belong in the bulleted list of regulatory statutes. They certainly do here. Anadromous fisheries are listed outstandingly remarkable or extraordinary values.

EE-41

dEIS/EIR p. 148: Please see our earlier remarks regarding the status of the levee ACE vegetation policy. This policy is supposed to be under review.

If the existing ETL is not changed and is still enforced, in addition to the infeasible forb and annual grass prohibition, a variance of more than the lower waterside vegetation would be required. Corps policy is also to prohibit plantings of woody plants that may throw roots into levee critical features, regardless of distance from the levee.

The premise of a SWIF is to eventually comply with the Corps' vegetation policy. This slow deforestation of the landside woody, forb, and annual vegetation (and some levee vegetation?) and the planting prohibition where roots may reach the levee or levee foundation is controversial and not fully accepted by state and federal natural resources agencies. We certainly agree that "collaborative intergovernmental framework[s]" in "complex situations" "will take time," particularly as the Corps and the State of California and federal resource agencies review existing vegetation management policies.

EE-42

dEIS/EIR p. 149: Please list the NPS among the agencies from which to obtain "necessary permits and authorizations." We are pleased that "[t]he Corps would adhere to all applicable…laws…during implementation."

EE-43

dEIS/EIR p. 149: The Bay Delta Conservation Plan with its focus of an HCP and NCCP to recover listed species and co-equal goals appears to have been abandoned, replaced by an effort to construct tunnels under the Delta to deliver Sacramento River water to the export pumps and to mitigate their impact.

EE-44

dEIS/EIR p. 291: We hope that the project, as implemented, will not have significant environmental impacts from loss of vegetation and wildlife habitat and loss of aesthetic and visual resources. In other words, we note that Project proponents have described the environmental documents supporting the potential Corps and Assistant Secretary for Civil Works recommendations for this GRR reauthorization as describing the maximum project adverse impacts. Project proponents hope to avoid some of the described project impacts during preconstruction engineering and design. That is our hope and expectation as well.

Comment Attachments

EE-45 The first two one-page attachments (appended to this PDF) document historic American River floods as measured by flood peaks of hydrographs by estimation method. If you have different estimates and more detailed references, let's discuss this. The second attachment (also appended to this PDF) compares estimated flood peaks and compares them with current and contemplated reservoir design floods. Your assistance in better referencing this document would also be appreciated. EE-46 The last attachment is an outline of the GRR and dEIS/EIR with questions and comments in italics prepared by a consultant with considerable experience on the American River based on a preliminary initial review. It is in an accompanying docx file. Hopefully, these questions can be addressed in the Response to Comments and the "formal and informal processes that have been created to facilitate management of the Parkway" that project sponsors have committed to engage in.

Sincerely,

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AMERICAN RIVER RECORD HIGH FLOWS (Rain Floods) (Top 11) Unregulated Conditions at Fair Oaks (in cubic feet per second)				
Year	Peak Flow	1-Day Mean	3-Day Mean Measure of Design Flow for ARWP Alternatives	Other Mean Flows
February 1986	259,000 cfs Personal Communication w/ ACE, MBK, & USBR	171,000 cfs 1998 ACE (American River Rain Flood Frequency Analysis)	166,000 cfs 1998 ACE	204,000 cfs, 1-Day Mean, 255,000 cfs peak 1987 Folsom Dam Water Control Manual (WCM).
January 1997	298,000 cfs Personal Communication w/, ACE, MBK, & USBR 255,000 cfs FEAT Report	248,921 cfs 1998 ACE	164,252 cfs 1998 ACE	120,106 cfs, 5-Day Mean, 1998 ACE
December, 1964	260,000 cfs 1987 Folsom WCM	183,240 cfs 1998 ACE	140,339 cfs 1998 ACE	106,436 cfs, 5-Day Mean, 1998 ACE
January, 1862 **(flow estimates)**	~320, 000 cfs, unpublished USBR 1998; 265,000 cfs 1941, ACE; ~280,000 cfs COE 1974 USBR 1983		~147,000 cfs 1999 NRC	
December 1955	219,000 cfs 1987 Folsom WCM	189,070 cfs 1998 ACE	127,449 cfs 1998 ACE	89,784 cfs, 5-Day Mean, 1998 ACE
January, 2006	201,000 cfs est. MBK			
November, 1950	180,000 cfs 1987 Folsom WCM	132,000 cfs 1998 ACE	107,500 cfs 1998 ACE	80,940 cfs, 5-Day Mean, 1998 ACE
March, 1928	163,000 cfs 1987 Folsom WCM	119,000 cfs 1998 ACE	98,167 cfs 1998 ACE	73,340 cfs, 5-Day Mean, 1998 ACE
February, 1963	240,000 cfs 1987 Folsom WCM	152,813 cfs 1998 ACE	93,881 cfs 1998 ACE	64,030 cfs, 5-Day Mean, 1998 ACE
March, 1907	156,000 cfs 1987 Folsom WCM	105,000 cfs 1998 ACE	87,833 cfs 1998 ACE	78,500 cfs, 5-Day Mean, 1998 ACE
January, 1909	119,000 cfs 1987 Folsom WCM	98,000 cfs 1998 ACE	87,167 cfs 1998 ACE	70,300 cfs, 5-Day Mean, 1998 ACE

Historic High Flow Table References

American River Project, Rain Flood Flow Frequency Analysis, American River at Fair Oaks, (Unregulated Conditions), ACE, February 3, 1998. (draft)

American River Watershed Project, California, (ARWP), ACE, The Reclamation Board, SAFCA, March, 1996.

Auburn-Folsom South Unit American River Division Central Valley Project, Information Pertaining to Unit Reauthorization Legislation Presently Before the Congress (H.R. 2219), Bureau of Reclamation, July 1983.

Discharge Rating Curves of American River at Fair Oaks and at Folsom, Leslie Bossen, ACE, August, 1941.

Final Report, Governor's Flood Emergency Action Team, (*FEAT Report*) May 10, 1997.

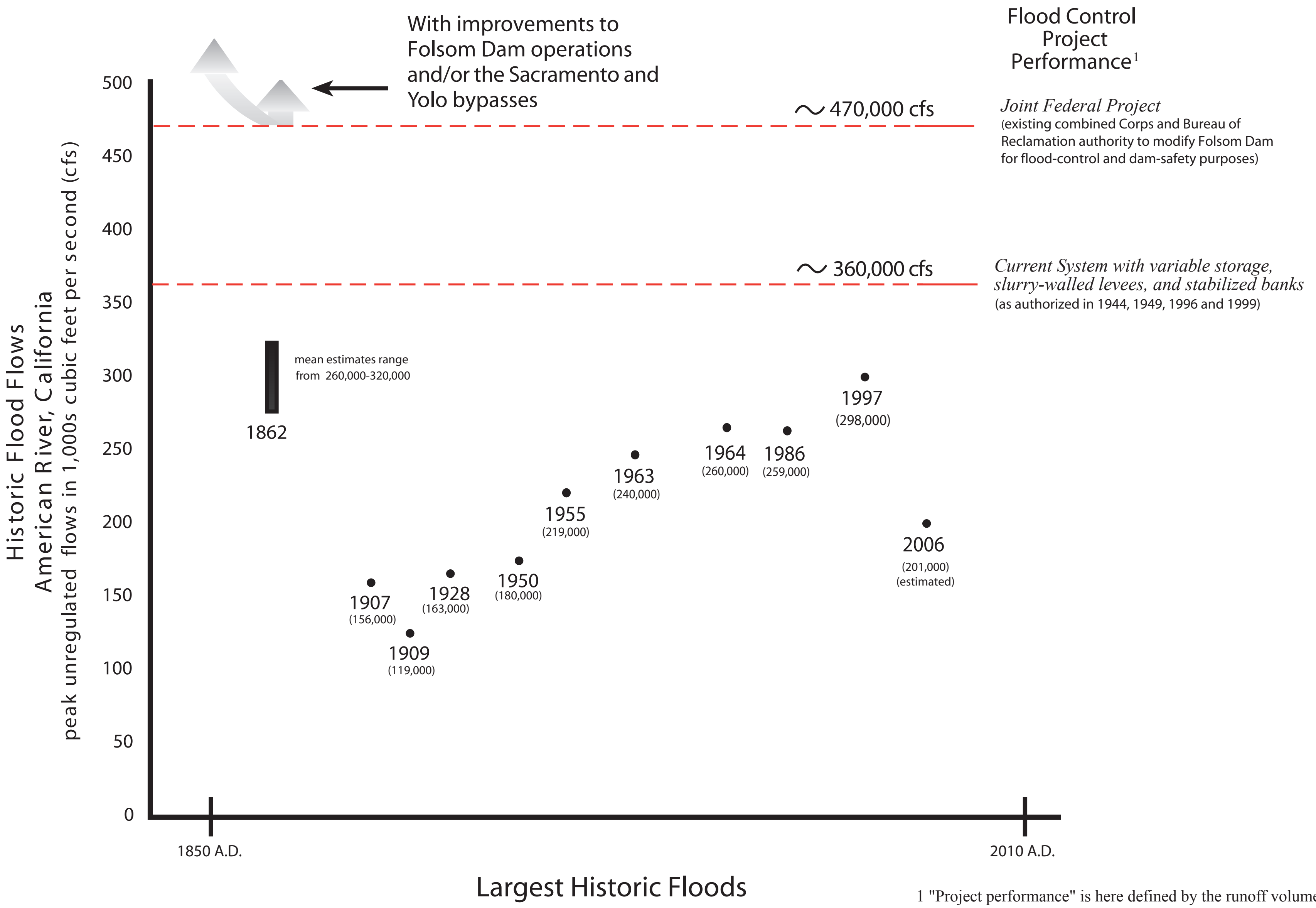
Auburn-Folsom South Unit, Amendment to the Final EIS and Supplement, Vol. 2, ACE comments, Sept., 1974.

Folsom Dam and Lake, American River, California, Water Control Manual, Plate 21, Appendix VII to Master Water Control Manual, Sacramento River Basin, California, ACE Sacramento District, December 1987.

MBK — MBK Consulting Civil Engineers, Sacramento, California.

FOR, August 7, 2006

Record American River Floods, Existing and Authorized Flood Control Project Performance



1 "Project performance" is here defined by the runoff volume (as measured by the flood peak of the unregulated "design flood" hydrograph) that a particular flood-control system can reliably accommodate. In dam-controlled watersheds, use of unregulated (total flow into rivers and storage) runoff-volume hydrographs allows planners to easily compare the performance of past, existing, and planned flood-control projects against historic, modern, and hypothetical storm-runoff events.

June 12, 2006

Draft 5/8/15

DRAFT General Reevaluation Report - EIS/EIR (March 2015).

- **Executive summary:**
  - Introduction (1):
  - Purpose and intended uses of this EIS/EIR (1):
  - Study area (2):
  - Project background (2-4):
  - Need of action (4-5):
  - Alternatives (5-7):
    - No action alternative (5):
    - Alternative 1 – improve levees (5):
    - Alternative 2 – improve levees and widen Sacto. weir and bypass (TSP) (6-7):
  - Environmental effects and mitigation measures (7-8):
    - TABLE ES.2: Environmental impacts and proposed mitigation/compensation for the ARCF GRR: (8)
    - TABLE ES.3: Summary of environmental effects and mitigation measures: (10-16)
  - Cumulative impacts (8):
  - Areas of controversy and unresolved issues (8):
  - Public involvement (9):
  - Tentatively selected plan (TSP) (9

- **1.0 Introduction (1-19):**
  - 1.1 Scope of the environmental analysis (1-3):
  - 1.2 Project location and study area (2):
    - 1.2.1 Location (2):
    - 1.2.2 Study area (2-3):
  - 1.3 Background an history of the Amer. R. Common Features Project (3-7):
  - 1.4 Project purpose and need for action (8-14):
    - 1.4.1 Seepage and underseepage (9):
    - 1.4.2 Levee erosion (910):
    - 1.4.3 Levee stability (10):
    - 1.4.4 Levee overtopping (10-11):
    - 1.4.5 Vegetation and encroachment compliance (11-13):
      - System Wide Improvements Framework (SWIF) (12):
        - An agreement between the Corps and the non-federal sponsor that
          - Allows the local maintenance agency (LMA) to defer compliance with ETL 1110-2-583.
          - Provides that the LMA would address **<u>landside</u>** vegetation and encroachment issues through
            - Implementation of their standard O&M actions over time.
          - Vegetation not impacted by construction would be addressed
            - By the LMA in accordance with
              - State's Levee Vegetation Management Strategy in the CVFPP
                - Over the next 20-40 years.
        - Will be planned and implemented by the non-federal sponsor
          - Will include the flowing criteria.
            - List and short discussion.
      - Vegetation variance (13):
        - Will be sought by the Sacto District to comply with
          - ETL 1110-2-583
            - On the **<u>waterside</u>** of levees.
        - The request required the Corps to show that the
            - Safety
            - Structural integrity
            - Functionality
          - Of the levees would be retained
            - If vegetation were to remain in place.
        - An evaluation of
              - Underseepage
              - Waterside embankment slope stability
            - Was completed by Corps geotechnical engineers.
          - For a Sacto River location (Levee Mile 5.92)
            - As representative of the most critical
                - Channel and levee geometry
                - Underseepage
                - Slope stability
                - Vegetation

- Conditions.
- Results showed that
  - Tree fall and scour did not significantly affect levee performance
  - The levee meets Corps seepage and slope stability criteria
    - Considering that
      - Seepage
      - Slope stability
    - “With-project” improvement measures are in place.
  - It is reasonable to conclude that by
    - Allowing vegetation to remain
      - Safety
      - Structural; integrity
      - Functionality
    - Of Sacto. River levees would be retained.

EE-47

    - *What about American River issues?*
- Vegetation variance request would be developed
  - During design phase
    - To allow for vegetation to remain on the lower portion of waterside levees.
    - Vegetation on the upper waterside slope would be removed as part of project construction.
- If a variance is not approved
  - Recommendations for this portion of the project
    - Will be reformulated
      - Further environmental compliance efforts would be required.

EE-48

      - *If this variance is to apply to the American River, and if it is not approved; what additional vegetation impacts will occur on the LAR?*
- 1.4.6 Releases from Folsom Dam (13-14):
- 1.4.7 Flood management system (14):
- 1.5 Environmental regulatory framework and authority (14-16):
  - 1.5.1 NEPA (14):
  - 1.5.2 CEQA (14-15):
  - 1.5.3 State and local planning (15):
  - 1.5.4 Study authority (15-16):
- 1.6 Intended use of this document (16):
- 1.7 Related documents and resources relied on in preparation of this DEIS/DEIR (16- 17):
- 1.8 Application of NEPA and CEQA principle and terminology (17-18):
- 1.9 Organization of the DEIS/DEIR (18-19):

- **2.0 Alternatives (20-53):**
  - 2.1 Introduction (20-25):
    - 2.2.1 Alternative formulation and screening (20-22):
      - Future without Project condition (21-22):
    - 2.2.2 Measures and alternative considered, but eliminated from future consideration (22-25):
      - Upstream storage on the American River (Auburn Dam) (22):
      - Transitory storage in upstream basins (23):
      - Yolo bypass improvements (23):
      - Reoperation of upstream reservoirs (24):
      - Sacramento River I St. bridge diversion structure (24-25:
      - Non-structural measures (25):
  - 2.2 Non action alternative (25-26):
  - 2.3 Alternative 1 – improved levees (26-42):
    - 2.3.1 American River (30- 31):
        - Levees would require improvements to address erosion.
          - Consisting of waterside armoring to prevent erosion
            - Of banks and levees
              - If unaddressed <u>could potentially</u> undermine levee foundations.

EE-49
              - *What level of uncertainty/certainty does this "could potentially" imply?*
      - Bank protection (30):
        - Consists in placing rock on
          - Banks and in some cases levees
        - <u>When necessary</u> eroded portion of banks would be filled and compacted prior to rock placement.

EE-50
              - *What conditions make this "necessary"?*
        - Sites would be prepared by
            - Clearing and stripping prior to construction
              - <u>Small vegetation</u> and loose material would be removed
          - In most cases
            - <u>Large vegetation</u> would be left in place.

EE-51
              - *What size criteria are to be used for small/large?*

EE-52
              - *If large trees are left in place will the amount be specified by hydraulic modeling of conveyance?*

EE-53
              - *If large trees are left in place, when they die will they be replaced; will natural revegetation be allowed or even possible with the rocked surface?*

EE-54
              - *If these trees are expected to die and not be replaced how should these trees be counted for impact/mitigation purposes?*

EE-55
- *Because of these questions/issues, should the recreation and visual impact assessment be based on no trees at all on these banks?*

- Temporary access ramps would be developed
  - If needed

EE-56
- *In what conditions would access ramps not be needed?*

- Hauled revetment rock will be stored on-site immediately near the construction site.
  - A loader will move rock to the staging area.
- An excavator will place a large rock berm
  - In the water to an elevation slightly above mean summer flow elevation

EE-57
- *A berm using large rock or a large berm using rock?*

EE-58
- *This berm is not indicated on Figure 1.*

  - A planting trench would be established on this rock surface
    - For revegetation.
- The excavator would work to place rock either
  - From the top of bank
  - From the constructed berm
- On levees
  - Rock placement will be from the top of levees.
- On banks
  - The revetment would be placed at slopes of
    - 2V:1H to 3V:1H
      - Depending on site conditions.

EE-59
- *This must be a typo – 2:1 and 3:1 slopes (2H:1V and 3H:1V).*

  - After placing revetment
    - A small planting berm would be constructed in the rock
      - Where feasible
      - To allow some revegetation of the site
      - Outside the vegetation free zone as required by ETL 1110-2-583

EE-60
- *This planting berm is not indicated on Figure 1.*

    - This vegetation will be designed on a site specific basis to
      - Minimize O&M
      - Not impact the channel conveyance.
- Launchable rock trench (31):
  - Designed to deploy revetment once erosion has removed the bank material beneath it.
    - Will be placed outside the channel.
  - Vegetation would be removed from the trench footprint and levee slopes

        - Prior to trench excavation.
    - Trench will be located at the toe of existing levees
        - Will have a
            - River-side slope of 1:1
            - Levee-side slope of 2:1
        - The bottom of the trench would be constructed to an elevation near the summer mean water surface.
            - In order to reduce the;
                - Rock launching distance
                - Amount of rock required
                - *With the design depth and slopes, this configuration seems to maximize the amount of rock required?*

EE-61

    - Trench rock will be covered with a minimum of 3 ft. of stockpiled soil.
    - Rock placed on levee surfaces would be covered with stockpiled soil.
                - *Will soil be placed with the launchable rock in the trench to prevent progressive infiltration of surface soil into rock voids and prevent surface subsidence?*

EE-62

                - *Could the excess excavated soils be used to in-fill mine tailings at restoration sites? This would require the restoration sites to have working plans and to have the cobbles pre-graded.*

EE-63

    - All disturbed areas would be reseeded with
                - Native grasses
                - Small shrubs
                    - Where appropriate.
                - *What conditions make it inappropriate?*

EE-64

        - Some vegetation could be permitted over the trench
                - If planted outside the specified vegetation free zone required by ETL 1110-2-581.
            - This vegetation would likely be limited to
                - Native grasses
                - Shrubs
                - Trees with shallow root systems
                    - To ensure the functionality of the launchable rock trench.
            - This vegetation would only be permitted;
                - If it does not put undue burden on maintaining agencies
                - If it is in locations that do not interfere with channel conveyance capacity.
                - *These limitations seem to prohibit the use of the trench sites for riparian restoration.*

EE-65

- 2.3.2 Sacramento River (31-36):
- 2.3.3 East side tributaries (37-39):
- 2.3.4 O&M (40-42):

- ARFCD (41)
- Maintenance Area #9 (41):
- City of Sacramento (41-42):

- 2.4 Alternative 2 – Sacramento bypass and improve levees (TSP) (41-47):
  - 2.4.1 Sacramento weir and bypass (44):
  - 2.4.2 American River (44):
  - 2.4.3 Sacramento River (45):
  - 2.4.4 East side tributaries (45):
  - 2.4.5 O&M (47):
    - DWR (47):
- 2.5 Comparison of alternatives (47-53):

- **3.0 Affected environment and environmental consequences (54-277):**
  - **3.1 Introduction (54):**
  - **3.2 Geological resources (54-58):**
    - Regulatory setting (54-55):
      - Federal
      - State
    - Existing conditions (55-58):
      - Geology (55-56):
      - Seismicity (56-57):
      - Soils (57):
      - Minerals (57):
  - **3.3 Land use (58-69):**
    - 3.3.1 Environmental setting (58-61):
      - Regulatory setting (58):
        - ARPP
        - Sacto. Co. General plan
        - Sacto. City General Plan
        - Yolo Co, General Plan
        - SAFCA Join Powers Agreement
      - Existing conditions (59-61):
        - General discussion of region
        - ARN (59-61):
          - Includes the ARP
          - ARPP;
            - Defines the ARP land uses
            - Acts as the management plan for the federal and state W&SR Acts.
            - Goal is to
              - Provide
              - Protect
              - Enhance
            - The ARP
              - For public uses.
            - Human developments and facilities
              - Are prohibited in "Open Space Preserve Areas"
                - Except as necessary to protect
                - Public health
                - Safety
                - Welfare
                - Habitat restoration.
            - Flood control-related polices include;
              - Flood control agencies should continue to maintain, and improve, where required, the reliability of the existing public flood control system along the LAR to meet the need to provide a high level of flood protection to the heavily urbanized

floodplain along the LAR consistent with other major urban areas. This effort is expected to include raising and strengthening the levees as necessary to safely contain very high flows (up to 160,000 cfs) for a sustained period.

- Flood control projects, including levee protection projects and vegetation removal for flood control purposes, shall be designed to avoid or minimize adverse impacts on he ARP, including impacts to wildlife and wildlife corridors. To the extent that adverse impacts are unavoidable, appropriate feasible compensatory mitigation shall be part of the project. Such mitigation should be close to the site of the adverse impact, unless such mitigation creates other undesirable impacts.
- Where feasible, multi-use buffers should be created on the landside of levees, including additional access points from public streets that enhance levee O&M activities, improve flood fight capabilities, provide opportunities to relocate or expand levees or supporting stability berms, if required, and support recreational opportunities.
- Vegetation in the ARP should be appropriately managed to maintain the structural integrity and conveyance capacity of the flood control system, consistent with the need to provide a high level of flood protection to the heavily urbanized floodplain along the LAR and in a manner that preserves the environmental, aesthetic, and recreation quality of the ARP.
- Flood control berms, leeves and other facilities should be, to the extent consistent with proper O&M of these facilities, open to the public for approved uses, such as hiking biking and other recreational activities.
- Public facilities and private encroachments that inappropriately constrain the operation and maintenance of the flood-control system should be redesigned or relocated.
- The flood control system should be maintained in a condition that ensures adequate flood fighting capability, consistent with demands of protecting a heavily developed floodplain.

        - Bank scour and erosion shall be proactively managed to protect public levees and infrastructure, such as bridges, piers, power lines, habitat and recreational resources. These erosion control projects, which may include efforts to anchor berms and banks with rock revetment, shall be designed to minimize damage to riparian vegetation and wildlife habitat, and should include a revegetation program that screens the project from public view, provides for a naturalistic appearance to the site, and restores affected wildlife habitat values.
        - Project to address bank stabilization and erosion that are threatening privately-owned structures shall; secure appropriate permits. The engineering of these projects should give preference to biotechnical or non-structural alternative, where feasible, over alternatives involving revetments, bank re-grading, or installation of river training structures. Use of rubble, gunnite, bulkheads, or similar material in these projects is prohibited.
        - It is recognized that flood control agencies have the authority to take actions(s) to prevent or respond to flood emergencies occurring in or adjacent to the ARP. In the event that these actions(s) have an adverse impact on biological resources in excess of the estimated impacts of the projected flood damage to such resources, the agency(ies) undertaking the emergency work will implement feasible compensatory mitigation measures pursuant to Policies. Nothing in the Policy shall be construed to interfere with the existing authority of flood control agencies to prevent or respond to an emergency situation occurring in or adjacent to the ARP.
    - ARS (61):
    - Sacramento bypass (61):
- 3.3.2 Methodology and basis of significance (62):
    - Methodology (62):
        - Determine the effects of the project on land use plans
            - Including;
                - ARPP
                - Sacto. Co. General Plan and zoning code
                - Sacto. City General Plan and zoning code

- Yolo Co, General Plan and zoning code
- Basis of significance (62):
  - Effect are considered significant if any one of the following results;
    - Conflict with any land use plan, policy, regulation.
    - Conflict with approved Habitat Conservation Plans or Natural Community Conservation Plan.
    - Physically divide an established community
    - Displace substantial numbers of people,
      - Necessitating the construction or replacement housing elsewhere.
- 3.3.3 No action alternative (62-63):
  - The waterside berm in the ARP would erode overtime
    - Resulting in the loss of ARP lands.
    - Timing is unknown
      - *Is there a Corps' estimate of potential land, habitat, and recreational facility losses that will be due to the No Action Alt.?*

EE-66

  - The ARPP designated most of the lands within the project area for
    - Natural
    - Recreational
    - Habitat enhanced
    - Uses.
  - Alt. is inconsistent with the ARPP
    - Would be considered a significant effect.
- 3.3.4. Alternative 1 – improved levees (63-67):
  - Barrow sites (63-64):
  - American River (64):
    - Approximately 11 mi of erosion protection needs has been identified.
      - Erosion protection approaches could be
        - Luanchable rock trench
        - Bank protection
  - ARPP policies address flood risk reduction
    - Overall aim of facilitating flood risk reduction activities in a manner that
      - Provide optimum protection to ARP resources;
        - Open space
        - Recreation
        - Fish and wildlife
    - Consistent with these policies
      - Bank protection improvements
      - Some launchable rock trench improvements
      - Have been constructed over the past 20 years
        - At various locations.
  - To select improvement methods (bank protection//launchable rock trench) to be used
    - The Corps will coordinate closely with

- SCRP
- NPS
- Other state and federal agencies
  - Responsible for resource management
- NGO stakeholders

- Will coordinate through
  - Formal processes
  - Informal processes
- That have been created to facilitate ARP management.

- Where erosion protection is needed
  - To meet established flood risk reduction objectives
  - Selection of improvement methods to be used
    - Will be based on
      - Which most protects ARP resource values
        - ARP lands
        - Fish and wildlife
        - Recreational facilities
      - Considering
        - Short-term construction impacts
        - Long-term effects of mitigation measures.
- Launchable rock trench (65):
  - Would minimize land use changes
    - For the 11 mi of erosion protection proposed.
  - Construction activities;
    - Could cause temporary LU changes
        - Within the levee structure
        - Adjacent waterside berm
        - Channel bank
      - Changes include lands for
        - Staging areas
        - Construction footprint
    - As construction progresses along the levee
      - Completed areas will be returned to their prior use.
      - Except;
        - A 15 ft. vegetation free zone on the waterside of the levee.
  - With a maximum trench <u>width of 70 ft</u>.
    - <u>65 ac will be disturbed</u>.
      - *At design trench slopes (2:1 and 1:1) (p31), a 70 ft. wide trench would be 23 ft. deep (70/3=23.3), if it has no bottom width. Design specifications (Figure 1) indicate varying trench bottom widths so*

EE-67

EE-67
(Cont.)

independently estimating trench top-widths is not possible here. However I'm thinking that most of the levee toe elevations are about 20 ft above with lowflow water surface which indicates that, if there is to be any bottom-trench width at all, maximum trench surfaces may be in excess of 70 ft. It is possible that 70 ft. could be the average trench surface width.

EE-68

- *Does this exclude staging areas, temporary ramps and access/construction roads?*

- These areas are presently
  - A 15 ft. wide maintenance road
  - Additional lands containing
    - Riparian habitat
      - Intermixed with
      - Recreation facilities
      - Open space
- Post-construction
  - The maintenance road at the toe of the levee will be replace to original condition
  - Some construction ramps may remain for maintenance access
    - In coordination with
      - SCRP
      - ARFCD
  - Construction roads not needed for maintenance
    - Would be returned to original condition
  - The <u>riparian areas would be replanted with vegetation</u>.
  - Re-establishing <u>riparian habitat would take many years</u>

EE-69

    - *Replanting requirements and limitation (p 31) seem to severely limit the types and amount of revegetation.*

EE-70

    - *Riparian re-establishment on or off-site? If on-site, planting requirements/limitations imply that no deep-rooted trees would be involved so why would on-site re-establishment take so long?*
  - Recreation facilities will be replaced to original condition
    - In coordination with SCRP
- <u>No LU changes</u>,
  - Except;
    - 15 ft. maintenance road
    - Vegetation free zone
- Alt 1. is in compliance with ARPP

        - LU impacts are considered less than significant
            - No mitigation is required.
            - ***In the No Action Alt. the Corps attribute land and resource losses due to ongoing erosion as a significant LU impact that is not consistent with ARPP. The proper functioning of the launchable rock trenches anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of habitat and recreation values. Why are these impacts, which are implicit to the expected proper functioning of the project as designed, not counted as project impacts?***

EE-71

    - Bank protection (65-66):
        - Bank protection may be used
            - Instead of launchable rock trenches
                - To reduce riparian habitat impacts.
        - Construction stage;
            - Access would be
                - From existing maintenance roads and ramps
                - Additional roads and ramps could be required
                    - To the bank for rock placement.
            - Staging areas required to store rock.
            - Construction site locations are presently unknown
                - However new access roads will be designed to
                    - Minimize natural resource impacts.
        - Design would not change existing LU designations
            - Therefore effects to LU are considered less than significant
                - No mitigation would be required.
            - (Riparian habitat loss mitigation is discussed in Veg & Wildlife Section)
  - Sacramento River (66):
  - East side tributaries (66-67):
- 3.3.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (67-68):
- 3.3.6. Avoidance, maintenance, and mitigation measures (68-69):
  - American River (68-69):
    - ARPP Flood Control Polices include;
        - Mitigation is defined as any project-related action taken to minimize or avoid an impact to the physical environment, or

any action designed to replace, repair, or restore a resource that was physically affected by a project.

- Construction projects on the ARP should be designed to first, avoid adverse environmental impacts; second, minimize adverse environmental impacts; and, third replace, repair, or restore adversely impacts resource as close as feasibly in time and place to the impact.
- Impacts are defined as any physical change to the environment, including but not limited to aesthetics, recreational facilities, and access points, water quality, soils, and all biological resources, such as native and non-native vegetation, aquatic habitat, fisheries, and special-status species. Noise, air quality (including fugitive dust), artificial lighting, and other impacts associated with construction activities are also considered to be impacts to avoid, minimize, and mitigate.

- ARPP states in the Flood Control Policy section;
  - Flood control project, including levee protection projects and vegetation removed for flood control purposes, shall be designed to avoids or minimize adverse ARP impacts, including impacts to wildlife and wildlife corridors. To the extent that adverse impacts are unavoidable, appropriate feasible compensatory mitigation shall be part of the project. Such mitigation should be close to the site of the adverse impact, unless such mitigation creates other undesirable impacts.
- Mitigation for lands converted from Parkway lands
  - To flood control uses
    - Will be mitigated
      - With fees to the Sacto. Co. under the Habitat Restoration Program Fees'
        - To be used for natural resource protection or enhancement and for land acquisition.
      - EE-72 *Under either Alternative and for either the bank protection of the launchable rock trench approach, how are these land areas to be computed? Is the Corps talking about land as land area, or land under changing uses and LU designations?*

- Sacramento River (69):
- East site tributaries (69):

- **3.4 Hydrology and hydraulics (69-82):**
  - 3.4.1 Environmental setting (69-76):
    - Regulatory setting (69):
      - Federal:
        - Clean water act 1972
        - Safe drinking act 1974
        - National flood insurance program

- State:
  - Porter-Cologne water quality control act 1970.
- Existing conditions (70-76):
  - Geomorphic conditions (70-71):
    - A short and somewhat strange discussion w/o importance.
  - Sedimentation (71-73):
    - As a result of SN hydraulic mining in the late 1800's
      - The Sacto R. and major tributaries aggraded 10-15 ft.
      - Since then they have gradually incised into residual mining debris.
    - Transport of SN mining debris into and through the Delta
      - probably continued into the mid 1900's
    - Many researchers believe
      - The present sediment loading of the Sacto. R. is approaching pre-gold rush levels.
    - A sediment analysis was not completed for this study
    - A Sacto. basin wide sediment study was conducted under the
      - Sacramento River Bank Protection Project (NHC, 2012).
        - Objectives were to
          - Investigate sediment transport processes in the Sacrto R. and major tributaries/distributaries.
        - HEC-6T sediment transport 1-D model
          - For the Sacto, American, Feather Rivers.
          - Computes streambed profile aggradation and degradation
          - Over the course of a hydrologic event.
    - Long-term simulation of the LAR
      - Most of the 22 mile LAR is actively degrading.
      - RM 22-12
        - 9-10 ft. of degradation
          - For both the 50 and 100 year periods
      - RM 11-12
        - 3-4 ft. of aggradation
        - (Timeframe not specified)
      - RM 0-11
        - Max of 15-16 ft. of degradation
          - 50 year period
        - Max of 19-20 ft. of degradation
          - 100 year period
      - <u>Average LAR degradation</u>
        - 50 year period
          - Thalweg – 5.39 ft.
          - Average channel bed- 4.83 ft.

- 100 year period;
  - Thalweg - 6.42 ft.
  - Average channel bed- 5.84 ft.
- *These modelling results are non-sensible – at least w/o further discussion and explanation.*

EE-73

  - *Were the cemented/indurated clay channel bed nick points considered and what influence would they have on channel degradation upstream of their locations over these timelines? Can very deep channel sections be expected to develop and survive upstream of the several clay-channel bed nick points?*

EE-74

  - *What is the volume of sediment predicted by this modelling to be lost in the LAR over these timelines?*

EE-75

  - *Where does this sediment go?*

EE-76

  - *Have they overlooked that the LAR channel is drowned downstream of RM 5 (due to geologic timescale sea level rise) and that now and in the future (increasing rates of sea level rise), out-fluxing of coarse sediment past this point is not likely. What are the implications of this sea-level rise process on long-term degradation/aggradation in the RM 5-7 reach?*

EE-77

  - *Does the 15-20 ft. of degradation in RM 0-11 reach imply that over these timelines (50-100 yrs.) the SN mining debris sand in the LAR system has become exhausted?*

EE-78

- Irregular channel reaches may not be adequately represented by this model
  - Especially in braided reaches above RM 8.
- *There are no really braided channel plan forms on the LAR upstream of RM 8 except possibly a 0.5 mi section at about RM 14/15 (this is really just a short reach recently experiencing over-loaded sediment influx in conjunction with erodible banks – local widening and the development of multiple channels. This "braided" feature is in the process of change and could develop into a*

EE-79

EE-79
(cont.)

single thread channel with time). The complex channel in the RM 11-12 reach is the result of the breaching of off-channel gravel pits – not channel braiding. The complex channel configuration at RM 9 downstream of the Watt bridge is due to a natural process of sediment deposition and channel re-configuring resulting from late-date gravel bar mining and the resulting over-widened channel – this is not channel braiding. The source of the sediment that is being deposited downstream of the Watt bridge is most likely due to ongoing scour in the 0.5 mi of channel upstream of the Watt bridge. At about RM 6 there is a 0.5 mi braided reach that is due to coarse sediment deposition at the head of the drowned LAR channel reach (RM 0-5) (due to geologic time-scale sea level rise). This is the expected final location of all coarse sediment transported through the LAR.

- Application of generalized results in irregular reaches may be subject to errors.
- Further site-specific analysis could potentially reduce the error.
- In general the mode results conform to records of channel degradation at the Fair Oaks Gage.

- Potential implications of model results;
  - Degraded bed can
    - Increase stress on
    - Levee toes
    - Berm toes
    - Can increase scour in unrevetted reaches.
  - Aggraded bed can
    - Increase floodflow water surface elevations
    - Reduce flood conveyance

- American River channel stability (73-74):
  - "LAR – Erosion Susceptibility Analysis for Infrequent Events (Ayers 2012)
    - 2-D hydraulic model
      - 115.000 cfs
      - 140,000 cfs
      - 160,000 cfs
  - Analyses have been completed;
    - Many more are still underway

        - To understand overall channel stability.
- Additional information in Civil Design and Geotechnical appendices.
- Pending result will not affect the following conclusions:
    - The LAR is degrading under present operational conditions
    - LAR is sediment starved.
        - Bedrock has been reached as far downstream as Guy West Bridge which is slowing further degradation.
        - Without significant bed slope reduction, it will now tend to erode laterally to satisfy need for sediment.

EE-80

    - *This conclusion seems to contradict the predictions of significant channel degradation noted above.*
    - Hydraulic modeling shows areas of bank and levees where allowable velocities for vegetation cover are exceeded
        - These site need to be evaluated in more detail to determine is a levee failure is likely to occur.
    - Field review verified that erosion of the bank is occurring at RM 9.0 RR, even at lowflow of 7,000 cfs.
        - Erosion of the LAR is continually occurring.
        - Leaving the banks sacred and susceptible to future erosion, especially at high flow events.
        - Further reducing the amount of berm separating the channel from the levees
        - Loss of vegetation is leaving the bare soil, which is susceptible to erosion at a lower velocity

EE-81

    - *All of these statements about "erosion" appear to be true when applied only to the field-verified erosion at "RM 9.0 RR."*

EE-82

        - *However this site of erosion is not characteristic of the LAR: It is due to local-scale natural channel adjustments underway in response to channel over-widening that occurred in the 1960-70's when the*

EE-82

(Cont.)

RL attached longitudinal gravel bar was removed for gravel mining purposes. With reduced stream power at this location a medial bar developed which is now morphing into a diagonal bar attached to the RL bank at the bridge. The process has progressively forced more flow and power to the RR bank causing the Corps' "field-verified" erosion. At the location of the original attached bar, the channel is aggrading to a significant degree making the existing boat ramp dysfunctional.

EE-83

- *This condition in not representative of the LAR in general, nor of the critical RM 6-11 reach but is a local phenomenon, with local symptoms and local causal factors.*

EE-84

- *Which could be corrected with proper channel restoration actions.*

EE-85

- *The real long-term erosion issue in this critical reach is the sewer main undercrossing at about RM 7. The line was installed as an inverted syphon with one limb at the edge of the RR active channel bank, with revetment armoring on this bank slope. This constitutes a critical channel impingement and constraint which resulted in severe RR bank erosion upstream of the line due to progressive erosive eddy development during the 1986 flood event. Without that armored nick point on the RR bank (and with the inverted syphon limb set back from the channel bank edge), it is most likely that bank erosion along the RR bank at that location during the 1986 event would have been very modest. The presence of this sewer undercrossing in its present configuration limits intelligent channel reconfigure alternatives for dealing with this critical flood conveyance reach.*

EE-86

- *The Corps' flood conveyance actions in this critical reach should be focused on the modification of the existing inverted syphon such that stream channel, channel bank, and riparian setting reconfiguration and restoration options are maximized not minimized.*

- o Climate (74):
  - Short unimportant discussion.
- o Surface water storage (74-75):
  - Short discussion.
  - For details on hydrologic inputs and storm centering see,
    - Hydrology appendix
- o Existing and future without project condition assumptions (75-76):
  - <u>Existing</u> condition assumptions include;
    - Existing releases from Folsom Dam
    - USBR/SAFCA reservoir operations agreement
      - o Allowing greater flood storage compared to the original operations manual.
  - Future <u>without project</u> condition assumptions include;
    - Construction and operation of all previously authorized on the LAR
      - o WRDA 1996, 1999 Common Features authorizations
      - o Levee repairs as described in the Natoma PACR authorized in WRRDA 1014
      - o The new JFP spillway at Folsom Dam
      - o Future planned raise of Folsom Dam
  - Future <u>with project</u> condition assumptions include;
    - The work proposed as part of the GRR.
  - Implications of the <u>future with project</u> conditions
    - Were developed on the basis of
      - o <u>Future without project</u> conditions
  - TABLE 8: comparison of existing and future w/o project releases from Folsom Dam (75)

Freq (yr).	Existing	Future w/o project (Alt 1)
10	43,000	72,000
25	100,000	115,000
50	115,000	115,000
100	145,000	115,000
200	320,000	160,000
500	520,000	530,000

  - FIGURE 7: Comparison of existing and future w/o project (Alt 1) Folsom Dam releases.

- 3.4.2 Methodology and basis of significance (77-78):

- Methodology (77-78):
- Basis of significance (78):
    - Alternatives were determined to have significant impacts if they result in any of the following;
        - Substantially alter the existing drainage pattern of the site or area, including through the alteration of a stream course in a manner that would result in;
            - Substantial erosion of siltation on- or off-site
            - Substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.
        - Create if contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional source of polluted runoff.
        - Place housing within a 100-year flood hazard area.
        - Place within a 100-year flood hazard area structures which would impede or redirect flood flows.
        - Expose people or structures to a significant risk of loss, injury, or death involving flooding.

- 3.4.3 No action alternative (79):
    - Continued risk of levee failures
        - Continued flood flight regime.
            - Possibly placement of rocks at levee failure site
                - Emergency repair activities
                    - Could result in
                        - <u>Loss of channel capacity</u>
                        - <u>Alteration of present geomorphic processes</u>.

EE-87

                    - *Not sure why these either of these conditions should occur*.

- 3.4.4. Alternative 1 – improved levees (79-80):
    - Levee remediation measures to address deficiencies such as;
        - Seepage
        - Slope instability
        - Overtopping
        - Erosion
        - Lack of vegetation compliance
        - Lack of O&M access
    - Along;
        - American R.
        - Sacto. R.
        - NEMDC
        - Arcade C.
        - Dry C.
        - Robla C.
        - Magpie C.
    - Combines
        - Construction of improvement

- While maintaining present levee alignments.
- Purpose is to,
  - Improve the flood risk management system to
    - Safely convey flows up to a level that
      - Maximizes net benefits.
- Project work primarily includes landside levee fixes,
    - That do not change in-channel geometry or characteristics.
  - Therefore would not:
    - Substantially alter erosion or siltation in the system
    - Increase surface RO in a manner that would result in any flooding.
    - Impact stormwater drainage systems or create additional RO.

EE-88
        - *Can this be said of the proposed 11-12 miles of bank protection and launchable rock trench work in the LAR/ARP?*
- Water surface elevations for
      - Baseline,
      - Alt 1 (which is the "future without-project")
      - Alt 2
    - For the
      - 2-yr event
      - 100-yrevent
  - Is in the Engineering appendix
  - TABLE 12: Comparison or 10, 100 and 200 year events under various conditions (LAR only) (81):

Freq.	Existing (Baseline?)	Future w/o project (Alt 1)	Future w/ project (Alt 2)
10	43,000	72,000	72,000
100	145,000	115,000	115,000
200	320,000	115,000	115,000

  - The 200-yr flows in the LAR
    - Are tied to the changes on Folsom Dam operations
      - Which will be analyzed as part of the ongoing
        - Folsom Dam Water Control Manual Update.
    - Effects of these flows including cumulative effects
      - Will be addressed by
        - The Manual Update EIS/EIR.

EE-89
        - *Does this mean that the 200-yr LAR flows may not be 115,000?*

EE-90
        - *Does this mean that the impacts of changing the floodflow regime on the LAR will be assessed at a later time? That the possible channel implications of the GRR w/o or w/ project conditions do not consider the change in floodflow regime? And that they have not yet been assessed?*

EE-91

- *When will the Manual Update EIS/EIR be undertaken?*

- Alt 1 would not alter flows
  - There would be no significant change or effect on hydrology and hydraulics
    - With the project in place
    - No mitigation would be required.

EE-92

- *If the launchable rock trench method is used, the expected project functionality depends on progress bank erosion/retreat to launch the rocks. Under this post-launched condition, what would be the impacts on the hydraulic conditions of the channel?*

- 3.4.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (80-82):
- 3.4.6. Avoidance, maintenance, and mitigation measures (82):
  - Flows are not increased
    - Effect to hydrology/hydraulics are less than significant
      - No mitigation is required.

EE-93

- *If the launchable rock trench method is used, the expected project functionality depends on progress bank erosion/retreat to launch the rocks. Under this post-launched condition, what would be the impacts on the hydraulic conditions of the channel?*

- **3.5 Water quality and groundwater resources (82-93):**
  - 3.5.1 Environmental setting (82-88):
    - Regulatory setting (82):
    - Existing conditions (83-88):
      - American River (83):
      - Sacramento River (84);
      - East side tributaries (84):
      - Sacramento bypass (84):
      - Surface water quality (84-88):
  - 3.5.2 Methodology and basis of significance (88):
    - Methodology (88):
    - Basis of significance (88):
  - 3.5.3 No action alternative (88-89):
  - 3.5.4. Alternative 1 – improved levees (89-91):
    - American River (90):
    - Sacramento River (90-91):
    - East side tributaries (91):
  - 3.5.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (91):
  - 3.5.6. Avoidance, maintenance, and mitigation measures (92-93):
- **3.6 Vegetation and wildlife (94-106):**
  - 3.6.1 Environmental setting (94-97):
    - Regulatory setting (94):
      - Sacramento County Ordinance, Chapter 19.12, Tree Preservation and Protection (Tree Preservation Ordinance).

        - City of Sacramento Protection of Trees Ordinance (City of Sacramento Municipal Code 12.56.060).
        - City of Sacramento Heritage Tree Ordinance (Code 12.64.020)
- Existing conditions (94-97):
        - Addresses areas within potential construction footprint.
            - These are the areas where potential impacts to vegetation and wildlife could occur.
        - Conducted a survey (2011) of levee trees
                - Within 30 ft. of waterside
                - Within 15 ft. of landside
            - Included;
                - Species
                - Diameter
                - Location
    - American River (94-95):
        - Along the channel vegetation is primarily SRA habitat.
                - *Were the USFS criteria used in this survey/result?*
                - *Is this survey information available?*

EE-94

        - Trees adjacent to the channel are mainly
            - Oaks
            - Cottonwoods
                - With a thick understory of vines, berry bushes, willows.
        - The ARPP details
                - How vegetation should be managed and expanded
                    - Where appropriate
            - Recognizes the primary purpose of the system is for flood control
                - Attempts to manage the natural setting of vegetation and wildlife
                - While meeting the goals of the flood control system.
        - Protected areas contain tracts of naturally occurring vegetation and wildlife
            - Although capable of sustaining <u>light to moderate use</u>
                - With minimal alteration to the natural landscape
            - Would be easily disturbed by <u>heavy use</u>.
                - *Where does this judgment come from?*

EE-95

        - <u>Emphasis is on</u> protection an restoration of large portion of relatively natural areas
            - Which stands a better chance of preservation
                - And provide better sup[port for wildlife
                    - Than smaller pieces.

EE-96
- *Where does this statement/judgement come from?*
- Several areas have been used as
  - Mitigation sites for Corps and other agencies for endangered species
  - Compensation for loss of riparian habitat or oak woodlands from other projects.

EE-97
- *What is the difference between sites used as "mitigation" and "compensation?"*
- Example list of wildlife species in the ARP.
  - Sacramento River (95-96);
  - East side tributaries (96-97):
  - Sacramento weir and bypass (97):
- 3.6.2 Methodology and basis of significance (97-98):
  - Methodology (97-98):
    - Impacts are evaluated based on data collected from
      - Tree surveys
      - Site visits
      - Google Earth
      - ARPP
      - Which provide a comprehensive overview of vegetation conditions
      - Were used to evaluate impacts.
    - ARPP goals and objectives were considered for
      - The impact analysis
      - How construction would impact those goals and objectives.
    - Impacts to wildlife were evaluated based on
      - Construction activities
      - Changes in habitat types after construction.
    - Assumed the Corps would receive a variance to address waterside vegetation
      - Under the requirements of ETL 1110-2-583
    - A System Wide Improvement Framework (SWIF) agreement is being sought by the non-federal sponsor
      - Which would allow the local maintenance agency (LMA) to defer ETL 1110-2-582 compliance of landside vegetation encroachments
        - To be addresses by the LMA at a later time.
        - Details on the SWIF are **presented in 1.4.5**.
    - Effects to vegetation and encroachments are assumed to occur
      - In the footprint of all proposed construction activities.
  - Basis of significance (98):
    - Effect are considered significant if any one of the following results;
      - Substantial loss, degradation, or fragmentation of any natural communities or wildlife habitat.

- <u>Substantial</u> effects of a sensitive natural community, including;
  - Federal protected wetlands
  - Other wetlands of the US
    - As defined in Section 404.
- <u>Substantial</u> reduction in quality or quantity of important habitat
  - Or access to such habitat for wildlife species
- <u>Conflict</u> with
  - ARPP
  - Sacto. Co. Tree Preservation Ordinance
  - City of Sacto. Protection of Trees Ordinance.
- <u>Substantial</u> adverse effects of native wood habitats in the ARP
  - Resulting in the loss of vegetation and wildlife.
    - *What parameters were used to assess "substantial" and "conflict?"*

EE-98

- 3.6.3 No action alternative (98-99):
  - Over time the berms would erode
    - Vegetation would be lost
      - Wildlife would relocate
    - Trails would be lost that provide to access for
      - Wildlife observation
      - Fishing
      - Other recreational activities
  - Does not comply with the ARRP
    - Which states;
      - "Bank scour and erosion shall be proactively managed to protect public levees and infrastructure, such as bridged, piers, power lines, habitat and recreation resource."
        - ***Where is this statement – what context?***

EE-99

  - The loss of
    - Vegetation and wildlife habitat
      - Would be considered a significant impact.
        - *The Corps does not specify or estimate the amount of vegetation and wildlife habitat that would be lost in the ARP.*

EE-100

- 3.6.4. Alternative 1 – improved levees (99-101):
  - A vegetation variance would be obtained to
    - Reduce the impacts to vegetation and wildlife.
    - Allowing most trees on the lower ½ of the waterside slope to remain in place
      - Details on the vegetation variance **<u>are in 1.4.5</u>**.
      - *The discussion of the vegetation variance (p 13) specifies the Sacramento River levees. Will the variance include American River levees?*

EE-101

EE-102

- *What would be the ARP vegetation and wildlife habitat impact implications should the vegetation variance not be approved and/ot not really apply to the LAR?*
- A System Wide Improvement Framework agreement would allow vegetation and encroachment compliance on the landside of the levees to be deferred.
  - Details on SWIF **are in 1.4.5**.
- American River (99-100):
  - Construction of launchable rock trench;
    - Removal of 65 ac of riparian habitat in the ARP
    - Calculated by
      - Overlaying the largest possible footprint onto aerial photos

EE-103

        - *Will this overly be available during the NRMP process?*
      - Calculating the riparian habitat within the footprint.

EE-104

        - ***In Section ____ (p__) the Corps states that 65 ac of land would be disturbed; not 65 ac of riparian habitat. Which is correct?***
    - Is located in areas designated in the ARPP as
      - Protected Areas
      - Nature Study Areas
      - However, the ARPP allows for flood control activities to be conducted
        - In order to pass 160,000 cfs
      - ARPP Section 4.10 states;
        - "Flood control projects, including levee protection projects and vegetation removal for flood control purposes, shall be designed to avoid or minimize adverse impacts on the ARP, including impacts to wildlife and wildlife corridors. To the extent that adverse impacts are unavoidable, appropriate feasible compensatory mitigation shall be part of the project. Such mitigation should be close to the site of adverse impacts, unless such mitigation creates other undesirable impacts."
    - This impact is considered as significant because
      - The temporal loss of trees between the time of removal and their growth to a condition that provides original values.
      - Cannot be mitigated to less than significant.

EE-105

        - *Impacts and determination of significance seems to be based on construction and time delays for construction impacts. This seems to ignore the impacts of properly functions*

EE-105
(Cont.)

designed approach should the launchable rock trench approach be used. The proper functioning of this approach depends of the progressive loss of banks and berms that provide the locations of vegetation and wildlife habitat and the launchable rocks can only be launched once these ARP values are lost. Why shouldn't these proper operational impacts of the launchable rock trench approach be addressed in the same light as the No Action Alternative, that entail the same resource values loses, and over the same timeframe, as the launchable rock trench approach?

- Construction would likely by May-October
  - When birds are likely to be nesting.
- **Once the project is authorized and funded**
  - **Surveys would occur to determine**
    - If nesting birds are present which may be impacted during construction.
  - If nesting birds are located adjacent to the project area
    - Coordination with resource agencies would occur.

- Other additional construction;
  - Would occur on another 135 ac of the ARP
    - Primarily
      - Levees
      - Patrol roads
      - Open lands with no trees.
- 11 miles of intermittent erosion repair
      - Bank protection
      - Launchable rock trench
    - Would occur over a 7 year period.
  - Trees would be removed as the trench is constructed
    - Over multiple years
  - Trees outside the construction footprint
    - Would be covered by the <u>vegetation variance</u>
      - Would therefore remain in place.
      - *Unless the variance is not approved!*
      - *Section 1.4.5 (p 13) specifies that the vegetation variance was for Sacramento River levees. Is this an incorrect interpretation of the text? Would it also apply to LAR levees?*
      - ***Impacts addressed for this alternative are exclusively construction related. What would be the impacts of expected and***

EE-106

EE-107

EE-107

(Cont.)

proper functioning of the launchable rock trench approach?

- Sacramento River (100-101):
- East side tributaries (101):

- 3.6.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (102-103):
  - Sacramento River (102):
  - Sacramento weir and bypass (102-103):
- 3.6.6. Avoidance, maintenance, and mitigation measures (103-106):
  - Estimates of compensation measures are based on
    - The largest potential footprint
    - Worst case scenario
      - For the purposes of NEPA compliance
        - *Does this include the possibility that the vegetation variance will not apply to the LAR or that it will not be approved??*

EE-108

  - If design refinements result in reduced impacts to vegetation
    - Compensation would be coordinated with the appropriate resource agencies and adjust accordingly.
      - *As well as increased impacts??*

EE-109

  - American River (103-104):
    - Design-refinement plans will evaluate reductions to vegetation and wildlife impacts including;
      - Reduced footprint
      - Constructing bank protection rather than launchable rock trench
        - Whenever feasible
          - *This implies that bank protection is the preferred approach unless not feasible.*

EE-110

      - Designing planting berms in areas where significant riparian habitat exists adjacent to the levee toe
        - When no hydraulic impacts would occur.
          - *Could the NRMP be used to assess overall-ARP impacts and implications of mitigation to include greater (short-term) impacts in the construction area with greater long-term mitigation values with restoration/mitigation projects in the Arden/Sacto Bar/Sailor Bar areas??*

EE-111

      - Trees would remain in locations where
        - Bank protection
        - Planting berms
      - Can be constructed
        - Since this area is 15 ft. from levee toes
        - Complies with Corps vegetation policy.
        - *In Section 2.3.1, the Corps said that for bank protection work, large trees may be left in place. However, if these trees live for a while they will die and will leave a bare*

EE-112

EE-112
(Cont.)

rock slope because revegetation success on revetments is very poor. Shouldn't this mean that long-term impacts should count these slopes as unvegetated?

- <u>Trees would be protected</u> in place along the natural channel bank
  - During placement of rock
    - Would anchor trees to reduce risk of falling during high flow events.
    - *In Section 2.3.1, the Corps said that for bank protection work, large trees may be left in place. However, if these trees live for a while they will die and will leave a bare rock slope because revegetation success on revetments is very poor. Shouldn't this mean that long-term impacts should count these slopes as unvegetated?* EE-113
- Additional plantings would be installed on
  - <u>Newly constructed berms</u>
    - To provide habitat for
      - Fish species
      - Avian species
  - Planting berms would be used to <u>minimize impacts</u> to fish and wildlife species,
    - However impact to riparian habitat would still be significant.
    - EE-114 *These planting berms are not discussed specifically in Section 2.3.1 nor are indicated on Figure 1.*
    - EE-115 *Were these "minimized impacts" used to reduce the amount of mitigation obligation?*
    - EE-116 *Would these "newly constructed berms" extend into the channel from the present bank, reducing active channel widths?*

- Compensation for 65 ac of riparian habitat
  - 130 ac of replacement habitat would be created.
- Species selected to compensate for riparian corridor removal
  - Would be consistent with approved native plant species list for the ARP.
- The 130 ac would
  - <u>Create</u>
    - Habitat connectivity
    - Wildlife migratory corridors
      - That provide for the habitat needs of important wildlife species
    - EE-117 *How is this to be assured without a mitigation plan?*
  - <u>Without compromising</u>

- Integrity of the of the flood control facilities
- Flood conveyance capacity
- ARPP management goals
- EE-118 *Where is it demonstrated that this can be done? Has there been an assessment of this possibility?*

- 130 ac of riparian would be planted
  - On top of rock trenches.
- Corps vegetation policy allows
  - Trees to be planted >15 ft. from levee toes.
- To comply with
  - This policy
  - And to reduce maintenance on compensation lands
  - Trees could be planted on top of rock trenches starting 30 ft. from the waterside levee toe.
    - If the rock trench is 70 ft wide, trees plantings for riparian habitat could occur on the outer 40 ft.
  - EE-119 *Will the launchable rock trench surfaces be within the elevation and distance for natural riparian zone sub-irrigation required by trees?*
  - EE-120 *Section 2.3.1 indicates:1) that the trench rock will be covered with a minimum of 3 ft. of stockpiled soil, 2) some vegetation could be permitted over the trench if planted outside the specified vegetation free zone required by ETL 1110-2-581, 3) disturbed areas would be reseeded with native grasses, small shrubs, and trees with shallow root systems (to ensure rock trench functionality) but 4) would only be permitted if it does not burden floodway maintenance agencies and does not interfere with floodway capacity. It sound very much that the "riparian" revegetation in Section 3.3.6 is not compatible with Section 2.3.1. which prohibits deep rooted trees.*
  - EE-121 *This says that there will be at least 130 ac of rock trench surface outside the vegetation free zone (surface areas >30 ft. from the waterside levee toe). What does this say about the total area of (and length of) rock trench surface area on the LAR/ARP?*
  - EE-122 *How was the 130 ac of riparian replanting on rock trenches counted for impact/ mitigation?*

EE-123

- *When and if the launchable rock trenches actually launch the rocks due to erosive bank retreat (that is when the project functions as designed), how will the losses of real riparian vegetation along the banks, and the Corps' "riparian plants" on the rock trench surfaces, be counted as impacts resulting from proper project functioning?*

- The exact location of compensation lands
  - Would be coordinated in the design phase with
    - SCRP
  - And would comply with the ARPP objectives and goals.
- It is assumed that sufficient compensation lands are available in the ARP.
  - If not
    - Other location within Sacto Co. would be identified
    - And public coordination would occur.

- Prior to construction;
  - For several years
    - Survey will be conducted to determine if nesting birds are within 0.5 mi of construction sites.
  - If nests are located in any given year
    - Coordination with appropriate resource agencies would occur
      - To determine what actions should be taken.
    - Trees with active nests would not be removed
      - Until young have fledged.
  - If no nests are found in the vicinity of construction sites for that year
    - Construction may commence without further coordination.
- Sacramento River (104):
- East side tributaries (105)
- Sacramento weir and bypass (105-106):

- **3.7 Fisheries (106-115):**
  - 3.7.1 Environmental setting (106-110):
    - Regulatory setting (106):
    - Existing conditions (106-110):
      - Sacramento River and American River (106-109):
      - East side tributaries (109):
      - Sacramento bypass (109-110):
  - 3.7.2 Methodology and basis of significance (110-111):
    - Methodology (110-111):

    - Basis of significance (111):
  - 3.7.3 No action alternative (111):
  - 3.7.4. Alternative 1 – improved levees (112-114):
    - American River (112):
    - Sacramento River (113):
    - East side tributaries (113-114):
  - 3.7.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (114-115):
    - Sacramento weir and bypass (114-115):
  - 3.7.6. Avoidance, maintenance, and mitigation measures (115):
- **3.8 Special status species (115-150):**
  - 3.8.1 Environmental setting Regulatory setting (116-126):
    - Regulatory setting (116):
      - Federal:
        - ESA
        - Migratory Bird Treaty Act
        - Bald and Golden Eagle Protection Act
      - State:
        - Calif. ESA
        - Calif. Fish and Game Code
        - Calif. Native Plant protection Act
    - Existing conditions (116-110):
        - A list of species status species was compiled from
          - USFWS website
          - CNDDB
        - Those expected to be found in the study area are addressed below.
        - They may occur in any of the project areas so are not broken out to specific areas.
      - <u>VELB (116-117):</u>
        - Federally listed as threatened.
        - Documented along the LAR.
        - Corps conducted a survey of elderberry shrubs along levees in 2012 including
          - Levee structure
          - 15 ft. on either side
            - Where access was available.
        - Survey found the south side of the American River had the greatest amount of clusters.
        - All shrubs are considered to be in <u>the riparian zone</u>
          - Except if located on the landside of levees.
            - EE-124 *How was this "consideration" made? Simply assumed? Or used established criteria?*
            - EE-125 *Just because a particular shrub was "considered" to be in a "riparian zone," for impact/mitigation assessment are these particular plants considered riparian?*
      - <u>Giant garter snake (117)</u>:

        - Federal and state listed as threatened.
        - Inhabits; rice fields, irrigation supply and drainage canals, freshwater marshes, sloughs, ponds, other aquatic habitats
        - Primary cause of decline;
            - Loss or degradation of aquatic habitat caused by agricultural development
            - Compounded by loss of;
                - Upland refugia
                - Bankside vegetation cover
        - Large waterways such as the American River do not provide habitat.
    - <u>Swainson's hawk (120)</u>:
        - Federal listed as species of concern
            - Protected under the Migratory Bird Treaty Act
        - State listed as threatened
        - Occur March-September for breeding
            - Nesting territories established by April
            - Incubation and rearing occurring through June.
        - Found most often in;
            - Grasslands
            - Low shrublands
            - Agricultural areas
        - Nests are found in
            - Riparian woodlands
            - Roadside trees
            - Trees along field borders
            - Isolated trees
        - Majority of nesting sites are in remnant riparian forest corridors along drainages
        - Mostly forage within 1 mile of nest
        - Prey abundance and accessibility are the most important suitability parameters
            - Subject to land use operations (mowing, flood irrigation)
        - American River area is less likely to support nests
            - Urban development
            - Food less abundant than in agricultural areas.
    - <u>Sacramento River winter-run chinook salmon (120-121)</u>:
        - Federally listed as endangered.
        - Sacramento River is considered to be critical habitat.
        - All reaches within the ARCF GRR area are considered EFH.
    - <u>Central Valley spring-run chinook salmon (121-122)</u>:
        - Federally listed as threatened.
        - Critical habitat has been designated
                - Including the American River
            - Includes channel widths to the;
                - Bank-full elevation
                - Or ordinary high-water line elevation

      - All reaches within the ARCF GRR area are considered EFH.
    - Central Valley fall-/late fall-run chinook salmon (122-123):
      - Listed as a species of concern by NMFS
      - Critical habitat is not designated
      - Essential Fish Habitat is designated
        - EFH is defines as those
          - Waters and substrate necessary for
            - Spawning
            - Breeding
            - Feeding
            - Growth to maturity
          - Whether current or historical
        - All reaches within the ARCF GRR area are considered EFH.
    - Central Valley steelhead (123):
      - Federally listed as threatened
      - Critical habitat has been designated
          - For designated reaches
        - Includes channel widths to the;
          - Bank-full elevation
          - Or ordinary high-water line elevation
      - There is no EFH designated.
    - Delta smelt (124):
    - Green sturgeon (124-125):
    - Vernal pool fairy shrimp (125-126):
    - Vernal pool tadpole shrimp (126):
- 3.8.2 Methodology and basis of significance (126-127):
  - Methodology (126):
    - Potential effects were based on
      - Existing documentation
      - 2011 field surveys
        - Conducted on;
          - Levee slopes
          - Landside levee toe – out 15 ft.
          - Waterside levee toe – out 30 ftt.
        - Included;
          - Trees
            - Size
            - Species
            - Health
            - Location
          - Elderberry shrubs
            - Size
            - Location
          - *Does this survey area include all the construction impact zone of the LAR? Was the SCRP GIS database of elderberry shrub locations used? The wording in Section*

EE-126

EE-126

(Cont.)

3.8.6 specifies that the recorded elderberry plants were on and near the levees and not in berm and bank areas where launchable rock trenches and bank protection work would occur. Isn't it very likely that the number of elderberry shrubs along the LAR to be substantially larger?

- Significant impacts occur if
  - The project has substantial adverse effect
    - Directly
    - Through habitat modification
      - On any species identified as
        - Candidate
        - Sensitive
        - Special-status
    - In any local or regional
      - Plans
      - Policies
      - Regulations
    - Or by
      - DFW
      - USFWS
      - NOAA Fisheries.
- Basis of significance (127):
  - Effects are considered significant (substantial?) if project would result in any;
    - Direct or indirect
      - Reduction in
        - Growth
        - Survival
        - Reproductive success
      - Of any species
        - Listed
        - Proposed for listing
      - As
        - Threatened
        - Endangered
      - Under
        - Federal ESA
        - State ESA.
    - Direct
      - Mortality
      - Long-term habitat loss
      - Lowered reproductive success
      - Federal or state species listed as
        - Threatened
        - Endangered
      - Federal species listed as

            - Candidates.
        - Direct or indirect
            - Reduction in
                - Growth
                - Survival
                - Reproductive success of substantial populations
    - Of any
        - Federal species of concern
        - State species listed as
            - Endangered
            - Threatened
        - CNPS listed
            - Plant species
        - Species of special concern
        - Regionally important commercial or game species.
    - Have an adverse effect on species'
        - Designated critical habitat.

- 3.8.3 No action alternative (127-128):
- 3.8.4. Alternative 1 – improved levees (128-136):
    - <u>VELB (128</u>):
        - 250 shrubs were found along the LAR
        - Prior to construction
            - A survey within 100 ft. of construction area will be conducted
                - In accordance with USFWS guidelines
            - Potentially effected shrubs will be
                - Mapped
                - Surveyed
                    - To determine
                        - Size of stems
                        - Location "of shrubs to riparian habitat"
                        - Presence of exit holes.
        - Shrubs that cannot be avoided
            - Would be transplanted
                - Between Nov. and mid-Feb. when plants are dormant.
            - Transplanting procedures will comply with Conservation Guidelines for the VELB (USFWS 1999)
            - Potential impacts due to damage or transplantation include
                - Direct beetle mortality
                - Disruption of lifecycle
        - Temporal loss of habitat
            - May occur due to transplantation
            - Even with compensation measures including
                - Habitat restoration
                - Habitat creation

            - Mitigation plantings would likely require 1 or more years
                - To provide supporting habitat.
        - <u>Associated riparian habitats</u>
            - May take several decades to reach full value.
EE-127
                - *What "associated riparian habitats?" Some that the Corps will plant? Where?*
    - Project is likely to adversely affect VELB.
    - Compensation is discussed in Section 3.8.6
    - Implementation of
        - Avoidance, minimization, compensation measures
            - Impact to VELB would be
                - Less than significant.
- Giant garter snake (129):
- <u>Swainson's hawk (129-130)</u>:
    - <u>134 ac</u>, of riparian habitat (project-wide)
            - Used by Swainson's hawk
                - For;
                    - Roosting
                    - Nesting
            - Will be affected
                - By construction.
EE-128
                - *How is this acreage computed?*
        - Any trees removed
            - Would be mitigated
        - However
            - Temporal losses would be significant due to time delay to recover use values.
    - 2.5 ac of non-native grassland/barren lands (project-wide)
            - Would be removed/disturbed
                - Due to construction at levees
        - Much of it
                - In the Sacto. River and American River area,
            - Where hawks nest and forage.
    - Prior to construction
        - Annual surveys would be conducted
            - Within ½ mi. of anticipated construction areas.
        - If hawks are found
            - Resource agency coordination would occur
                - Appropriate avoidance and minimization measures would be established
                    - Prior to construction.
    - Adverse effect would be significant
        - Due to temporary loss of
            - Nesting habitat
                - Along waterways while new mitigation trees grow.

- Sacramento River winter-run chinook salmon (130):
- Central Valley spring-run chinook salmon (132):
- Central Valley fall-/late fall-run chinook salmon (133):
- Central Valley steelhead (133-134):
- Delta smelt (134-135):
- Green sturgeon (135-136):
- Vernal pool fairy shrimp (136):
- Vernal pool tadpole shrimp (136):

- 3.8.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (137-138):
  - Sacramento bypass and weir (137-138):
- 3.8.6. Avoidance, maintenance, and mitigation measures (138-150):
    - Estimates of compensation measures are based on
        - The largest potential footprint
        - Worst case scenario
      - For the purposes of NEPA compliance

EE-129
          - *Does this include the possibility that the vegetation variance will not apply to the LAR or that it will not be approved??*

EE-130
          - *Based on the 2011 survey area, there could be additional elderberry shrubs impacted. (See comments in Section 3.6.2 above.)*

    - If design refinements result in reduced impacts to vegetation
      - Compensation would be coordinated with the appropriate resource agencies and adjust accordingly.

EE-131
          - *As well as increased impacts??*

  - VELB (138-145):
    - 250 elderberry shrubs were located on the LAR
      - On levee slopes and within
        - 15 ft of the landside toe
        - 30 ft of the waterside toe.
    - In accordance with
          - Conservation Guidelines for VELB (USFWS 1999)
      - Adverse effects would be compensated by;
        - Transplanting shrubs with >1 inch diameter
        - Planting a mix of native riarian/or upland vegetation at a 2:1 And 6:1 ratios
          - Depending on stem diameter
      - Amount of compensation
        - Is based on the 2011 preliminary survey
          - Within the construction footprint

EE-132
          - *Is this the same as the levee slope and 15/30 ft. extension survey above?*

    - On the LAR,
      - Shrubs would be transplanted
      - Additional compensation would be installed
        - On top of rock trenches
          - When possible

- Outside the vegetation free zone
- It is expected that on these trench surfaces
  - Sufficient lands would be available to
    - Plant these shrubs and associated natives.
    - *This implies that there will be at least 89 ac (see note below) of rock trench surface outside the vegetation free zone (surface areas >30 ft from the waterside levee toe (See Section 3.6.6). What does this say about the total area of (and length of) rock trench surface area on the LAR/ARP?*

EE-133

EE-134

    - *What associated natives?*

EE-135

    - *When and if the launchable rock trenches actually launch the rocks due to erosive bank retreat (that is when the project functions as designed), how will the losses of real riparian vegetation along the banks, and the elderberry plants on the rock trench surfaces, be counted as impacts resulting from proper project functioning?*
- If additional lands are required,
  - Off-site plantings could occur
    - At the existing Cal Expo mitigation site
    - Adjacent to the existing mitigation site at River Bend Park

EE-136

    - *More land for mitigation would be needed at River Bend?*
- Based on
  - 2011 survey results
  - Specific shrub stem characteristics assumptions (see text)
  - USFWS compensation requirements
- 66 ac of compensation would be required on the LAR (TABLE 18, p140)

EE-137

    - *Why does the LAR have 83% of the surveyed elderberry shrubs (205 LAR plants /302 total plants = 0.83) ((with many more possible)) but only has 61% of the estimated mitigation area requirements (66 ac LAR/108 ac total = 0.61)?*
- Since the survey was limited to areas within 30 ft. of the waterside of levee toes
  - There are likely many additional shrubs to impacted
    - More compensation will be required.
- PAGE 144: Summary of measures based on
  - *Conservation Guidelines for the VELB (USFWS 1999a)*
- Giant garter snake (145-146):
- Swainson's hawk (145-147):

- To avoid and minimize effects
    - The Corps would implement the following BMP measures;
  - Before ground disturbance
    - All construction personnel would participate in a DFW-approved worker awareness program
      - Present life history
      - Importance of
        - Nest sites
        - Foraging habitat.
  - Breeding season surveys (for Swainson's hawk):
      - For nesting birds
    - Would be conducted
      - For all trees and shrubs that would be removed or disturbed
        - Within 500 ft
        - (0.5 mi. for Swainson's hawk)
      - Of construction activities
    - Completed
      - During at least 2 of the following periods;
        - 1/1 – 3/20
        - 3/20 – 4/5
        - 4/5 – 4/10
        - 6/10 – 7/30
      - With no fewer the 3 surveys completed in at least 2 survey periods
      - With at least 1 of these occurring immediately prior to project initiation
        - (Swainson's Hawk Advisory Committee 2000).
    - Breeding season surveys (for other birds):
      - Migratory bird nest survey could be conducted
        - Concurrent with Swain. hawk surveys
      - With at least 1 survey
        - No more than 48 hr. prior to initiation of project activities
        - To confirm absence of nesting.
    - If area contains no active nests
      - Construction activities could commence
        - Without any further mitigation.
  - If active nests are found;
    - There would be a 0.25 mi buffer
      - Between construction activities and active nests.
    - A qualified biologist would be present on-site
      - To ensure

- That the buffer distance in adequate
- Birds are not showing stress
- If stress could cause nest abandonment
  - Construction activities would cease
  - Until it is determined that fledglings have left the nest.
- If other migratory birds are nesting in or adjacent to the study area the following BMP would be implemented.
  - Tree and shrub removal and other construction activities
    - Would not be conducted during the nesting season (generally 2/15 – 8/31).
      - Depending on species and varying conditions year-to-year.
      - *It is unclear about the buffer distances.*

EE-138

- Implementation of mitigation measure
  - Described below
    - Would avoid, reduce, minimize
      - The significant effect.
  - For Swainson's hawk
    - The Corps will seek a vegetation variance
      - For the lower half of the levee slope
      - Including of LAR levees?
    - <u>Bank protection</u> work site
      - Would be planted with vegetation and trees
        - That over time will provide habitat.
      - *Will this be applied to the LAR?*
      - *This seems to be contrary to the design approach for LAR bank protection work in Section 2.3.1. (See notes above)*

EE-139

EE-140

  - To compensate for 134 ac of riparian habitat supporting
    - Swainson's hawk
    - Other migratory species
    - Approximately 268 ac of replacement habitat will be created
      - As a mitigation area
      - May consider
        - Woodlake
        - Cal Expo
      - *What are the specific riparian habitat types (or structural conditions) that are needed for mitigation? Are there really opportunities for these specific riparian habitat conditions in the Woodlake/Cal Expo areas?*

EE-141

    - **For mitigation in the ARP**
      - Species selected to compensate for riparian corridor removal

- Will be consistent with approved native plant list of the ARP.
- Will prove to be contiguous and create
  - Habitat connectivity
  - Wildlife migratory corridors
  - Support the needs of important wildlife species
- Without compromising;
  - Integrity of flood control facilities
  - Flood conveyance capacity
  - Management goals of the ARPP.
- To comply with the ARPP
  - ARP lands will be evaluated for compensation opportunities
  - For any riparian habitat removed in the ARP.

EE-142
- *Specifically, for impact/mitigation purposes; what type of riparian habitat losses constitutes adverse effects on Swainson's hawk?.*

EE-143
- *What is this acreage of this riparian habitat type in the LAR?*

EE-144
- *How, exactly will this opportunity-evaluation be conducted and by who?*
- Location of ARP compensation lands
  - Will be determined in the design phase
  - Coordinated with SCRP
  - To comply with ARPP objectives and goals

EE-145
- *What level of SCRP coordination is anticipated? What guarantees are in place?*
- It is assumed that sufficient compensation lands are available in the ARP
  - If not other locations in Sacto. Co will be identified
  - And public coordination will occur.
- Additional mitigation may be
  - In the expanded Sacto. bypass
  - Other lands with similar value to those removed.
- Listed fish species (147-149):
- Vernal pool fairy shrimp and tadpole shrimp (149-150):

- **3.9 Cultural resources (150-172):**
  - 3.9.1 Environmental setting (150-162):
    - Regulatory setting (150):
    - Existing conditions (150-162):
      - Prehistoric and ethnographic setting (151-153):
      - Historic setting (153-154):

- Results of the records search (154-155):
- Field survey results (155-156):
- Cultural resource site types (156-159);
- Area of potential effects (159-160):
- Archaeological sensitivity assessment (160):
- Programmatic agreement (160-161)

- 3.9.2 Methodology and basis of significance (163-166):
    - Methodology (163-166):
        - Previous Section 106 compliance of the ARCFD Study (163-165):
        - Application of archaeological sensitivity assessment (165-166):
    - Basis of significance (166):
- 3.9.3 No action alternative (166-167):
- 3.9.4. Alternative 1 – improved levees (167-
    - American River (170):
    - Sacramento River (170):
    - East side tributaries (170-171):
- 3.9.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (171-172):
    - Sacramento bypass (172
- 3.9.6. Avoidance, maintenance, and mitigation measures (172)

- **3.10 Transportation and circulation (173-181):**
    - 3.10.1 Environmental setting (173-177):
        - Regulatory setting (173):
        - Existing conditions (173-177):
            - American River (175-176):
            - Sacramento River (176)
            - East side tributaries (176)
            - Sacramento bypass (177):
    - 3.10.2 Methodology and basis of significance (177):
        - Methodology (177):
        - Basis of significance (177):
    - 3.10.3 No action alternative (178):
        - American River (178-179):
        - Sacramento River (179):
        - East side tributaries (180):
    - 3.10.4. Alternative 1 – improved levees (178-180):
        - American River (178-179):
        - Sacramento River (179):
        - East side tributaries (180):
    - 3.10.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (180):
    - 3.10.6. Avoidance, maintenance, and mitigation measures (180-181):
- **3.11 Air quality (181-203):**
    - 3.11.1 Environmental setting (181-188):
        - Regulatory setting (181-182):
        - Existing conditions (182-188):
    - 3.11.2 Methodology and basis of significance (188-192):
    - 3.11.3 No action alternative (192):
    - 3.11.4. Alternative 1 – improved levees (192-197):
    - 3.11.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (197-200):

- 3.11.6. Avoidance, maintenance, and mitigation measures (200-203):

- **3.12 Climate change (203-215):**
  - 3.12.1 Environmental setting (203-210):
    - Regulatory setting (203-204):
    - Existing conditions (204-210):
      - Global climate trends and associated impacts (205-206):
        Climate change conditions in California (206-208):
      - Greenhouse gas emissions (208-209):
      - Greenhouse gas emissions inventories (209-210):
  - 3.12.2 Methodology and basis of significance (210- 212):
    - Methodology (210-211):
    - Basis of significance (211-212):
  - 3.12.3 No action alternative (212):
  - 3.12.4. Alternative 1 – improved levees (213-214):
  - 3.12.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (214):
  - 3.12.6. Avoidance, maintenance, and mitigation measures (214-215):
- **3.13 Noise (215-229):**
  - 3.13.1 Environmental setting (215-222):
    - Regulatory setting (215):
    - Existing conditions (216-222):
  - 3.13.2 Methodology and basis of significance (223-
    - Methodology (223):
    - Basis of significance (223):
  - 3.13.3 No action alternative (223):
  - 3.13.4. Alternative 1 – improved levees (223-228)
  - 3.13.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (228):
  - 3.13.6. Avoidance, maintenance, and mitigation measures (229-230):
- **3.14 Recreation (230-239):**
  - 3.14.1 Environmental setting (230-234):
    - Regulatory setting (230):
      - ARPP
      - Sections 9 and 10 of the Rivers and Harbors Appropriation Act (1899)
      - S W&SR Act (1972)
      - Sacto. City Parks and Recreation Master Plan
      - Sacto. Co. Bikeway Master Plan
      - Old Sacto. State Historic General Plan.
    - Existing conditions (230-234):
      - American River (230-233):
        - Short discussions of
          - ARP
          - SW&SR//FW&SR
            - Designated
              - Recreation
          - ARPP (addressed in Land use, 3.3)
          - ARPP-allowed recreation
          - Jed Smith Bike trail
          - Recreation boating

- ARP-related parks;
  - Discovery Park
  - Sutter's Landing Regional Park
  - Paradise Beach
  - CC CG
  - Guy West Bridge
  - Howe Ave
  - Waterton // Save the American \River Association (Park)
  - Watt Ave
  - Gristmill Park
  - William Pond Recreation Area
  - River Bend Park
  - Soil Born Farms.
- Sacramento River (233-234):
- East side tributaries (234):
- Sacramento bypass (234):

- 3.14.2 Methodology and basis of significance (235):
  - Methodology (235):
    - Impacts to recreation opportunities
      - Are evaluated based on
        - Temporary changes
        - Permanent changes
    - Taking into consideration;
      - ARRP
      - Other regional plans including
        - Sacto. City General Plan
        - Sacto. City Parks and Recreation Master Plan
      - Sacto. Co. Bikeway Master Plan
      - Rivers and Harbors Appropriation Act
      - W&SR Act.
  - Basis of significance (235):
    - Thresholds of significance were,
      - Based on the environmental checklist in Appendix G of the State CEQA Guidelines..
  - Significant adverse effects are determined if any of the following occur;
    - <u>Eliminate or substantially restric</u>t or reduce the
        - Availability
        - Access
        - Quality
      - Of existing recreational
        - Sites
        - Opportunities.
    - Cause substantial <u>long-term disruption</u> in the use of
      - Existing recreational
        - Facility

- Activity.
    - Result in inconsistences or non-compliance
        - With regional planning documents.
    - Result in inconsistences or non-compliance
        - With ARPP.
    - Result in inconsistences with
        - Rivers and Harbors Act
        - W&SR Act

EE-146
- *Do construction activity impacts differ from "long-term disruption?"*

EE-147
- *How does "long-term disruption" differ from "eliminate or substantially restrict?"*

- 3.14.3 No action alternative (235-236):
    - Without project levee improvements
        - Existing problem would continue
            - Potentially leading to future flood-levee failure.
        - Sustained high flows would erode banks in the ARP
            - Over time
                - The ARP
                - And recreational facilities within it
            - Would be lost.
    - No Action Alt. would,
        - Result in
            - Inconsistences
            - Non-compliance
                - With the ARPP.
        - The <u>ARPP states</u>;
            - "<u>Public facilities and private encroachments</u> that inappropriately constrain the operation and maintenance of the flood-control system should be redesigned or relocated"

EE-148
- *Why does this statement imply that the No Action Alt. is inconsistent with the ARPP?*

- "Bank scour and erosion shall <u>be proactively managed</u> to protect public levees and infrastructure, such as bridges, piers, power lines, habitat and recreational resources. These erosion control projects, which may include efforts to anchor berms and banks with rock revetment, shall be designed to minimize damage to riparian vegetation and wildlife habitat, and should include a revegetation program that screens the project from public view, provides for a naturalistic appearance to the site, and restores affected wildlife habitat values."
    - *Why does this statement imply that the No Action Alt. is inconsistent with the ARPP?*

EE-149
- ***Where are these in the ARPP?***

EE-150
- ***Are there other ARPP goals/objectives that relate to the No Action Alt.?***

- No Action Alt. would cause significant impacts to,
    - Recreational facilities

                - That could not be mitigated
                    - As there are no other similar recreational experience resources in the Sacto. region.
- 3.14.4. Alternative 1 – improved levees (236-238):
    - American River (236-237):
        - Construction closures and disturbances
                - Would result in ARPP non-compliance (See No Action Alt. above).
            - <u>Erosion protection measure construction</u> may take 10 years
                - Occurring at multiple locations at the same time
                    - Considered a significant effect
                    - Due to reduced quality of existing recreation activities.
            - <u>Construction closures</u> include;
                - Portions of the levee-top road
                    - Would be closed to pedestrians during construction.
                - Launchable rock trenches
                    - Would disturb several miles of bike trails
                    - Limit access to public parks and boat launches.

EE-151

                - *Why are these short-term impacts inconsistent with the ARPP?*
        - These same issues make the Alt 1 inconsistent with the federal W&SR Act.
            - Specified resource values "shall be preserve in free-flowing conditions, and that their immediate environment shall be protected for the benefit and enjoyment of present and future generations."
                - Potentially affected (construction) resources include;
                    - Paradise Beach
                    - CC GC
                    - Guy West Bridge
                    - Howe Ave boat ramp
                    - Watt Ave boat ramp
                    - Gristmill Park

EE-152

                - *Why are these short-term impacts inconsistent with the National W&SR Act?*
        - Construction activities would entail various closures and impacts during construction.
            - Mitigation measures would be implemented reduce impacts,
                - Construction impacts would significant.
        - Post-construction;

- Recreation facilities would be returned to pre-construction conditions
  - Long-term effect would be less than significant.
  - ***In the No Action Alt. the Corps attribute land and resource losses due to ongoing erosion as a significant recreation impact that is not consistent with ARPP. The proper functioning of the launchable rock trenches anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of habitat and recreation values and will constitute losses of recreation areas, facilities, and values. Why are these impacts, which are implicit to the expected proper functioning of the project as designed, not counted as project impacts?***

EE-153

- Sacramento River (237):
- East side tributaries (238):

- 3.14.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (238):
  - Sacramento bypass (238):
- 3.14.6. Avoidance, maintenance, and mitigation measures (238-239):
  - **ADD DETAILS here when time allows**

- **3.15 Visual resources (239-258):**
  - 3.15.1 Environmental setting (239-252):
    - Regulatory setting (239):
      - No applicable state or federal regulations
    - Existing conditions (239-252):
      - Visual resources are;
        - Natural features including
          - Land
          - Water
          - Vegetation
          - Geologic
        - Built features including
          - Buildings
          - Roadways
          - Bridges
          - Levees
          - Other structures
      - A common set of criteria (FHWA 1988) for visual quality includes
        - Vividness:
          - The visual

- power
- memorability
- Of landscape components
  - That combine in visual patterns.
- Intactness:
  - The visual integrity of
    - Natural and constructed landscape
    - And its freedom from encroachments
  - This factor can be present in
    - Urban setting
    - Rural landscapes
    - Naturel settings
- Unity:
  - The visual
    - Coherence
    - Compositional harmony
  - Of the landscape resources.
- Existing visual quality is determined based on het relative degree of
    - Vividness
    - Intactness
    - Unity
  - Apparent
    - In views
    - Visual sensitivity
- Sensitivity is based on;
  - Visibility of the landscape
  - Proximity of viewer to the visual resource
  - Elevation of viewers compared to elevation of the resource
  - Frequency and duration of views
  - Number of viewers
  - Type of viewer individuals and groups
  - Viewer expectations.
- American River (240-243):
  - Main viewer groups;
    - Residents living adjacent to the LAR levees
    - Highway travelers
      - Bus. I-80
      - Fair Oaks Blvd/H St.
      - Howe Ave.
      - Watt Ave.
    - ARP recreational uses
    - LAR boaters
  - Visual environment includes;
    - Urban development on the landside of levees
      - ARP views are blocked by levees

        - Second story views are possible
    - Users on the levee tops
        - Have views of ARP riparian forests and open space lands.
    - ARP resourced provide users with
        - A highly-valued
            - Natural setting
            - Feeling of serenity
        - In a developed urban area
    - ARP provides all of the visual quality of
            - Intactness
            - Vividness
            - Unity
        - In a linear park
            - Which can be viewed with limited urban disruption.
    - The ARP aesthetic values
        - Are those unique qualities that define the ARP experience
            - For ARP users
  - The ARPP flood control policies include:
    - "Bank scour and erosion shall be proactively managed to protect public levees and infrastructure, such as bridges, piers, power lines, habitat and recreational resources. These erosion control projects, which may include efforts to anchor berms and banks with rock revetment, shall be designed to minimize damage to riparian vegetation and wildlife habitat, and should include a revegetation program that screens the project from public view, provides for a naturalistic appearance to the site, and restores affected wildlife habitat values."
- Sacramento River (243):
- East side tributaries (245-250):
- Sacramento bypass (250-252):

- 3.15.2 Methodology and basis of significance (252-253):
  - Methodology (252):
    - Potential impacts based on
        - Review of
            - Scenic vistas
            - Landscapes
      - That could be affected
        - By project-related activities.
    - Visual contracts were examined including
        - Changes in
            - Form
            - Size color
            - Project dominance

          - View blockage
          - Duration of impacts
    - Also considered were
      - Natural setting
        - Vegetation
        - Landforms
      - Placement of project components in relation to existing structures
      - Likely viewer groups.
  - Basis of significance (252-253):
    - Thresholds of significance encompass
      - The factors taken into account
        - Under NEPA
          - To determine significance of action un terms of
            - Context
            - Intensity
    - Thresholds used are based on
      - Appendix G of CEQA Guidelines.
    - Significant impacts would occur if the project
      - Have a substantial adverse effect on a scenic vista
          - Are specific vistas identified?
          - What is substantial?
      - Substantially damage scenic resource,
        - Including but not limited to
          - Trees
          - Rock outcrops
          - Historical buildings
      - Substantially degrade
        - The existing visual character or quality of
          - The site
          - Its surroundings
      - Create a new source of substantial
          - Light
          - Or glare
        - That would adversely affect
          - Day or nighttime
            - Views in the area.
- 3.15.3 No action alternative (253):
    - No project construction activities
      - Therefore would not cause additional effects to visual resources.
    - Visual conditions would remain consistent with present conditions
      - Adverse affects
        - Would be caused by
          - Future flood event
          - Levee failure.

EE-154

- *Unlike other resource sections (ie. LU, vegetation etc.) the Corps does not associate the ongoing bank erosion and berm area that would result from the No Action Alt as resulting in visual impacts; Why not?*

- 3.15.4. Alternative 1 – improved levees (253-256):
  - Barrow sites (253-254):
  - American River (254):
    - Launchable rock trench (LRT) approach
      - Construction:
        - On 11 miles of the 26 mi ARP 200 ac of construction area
          - 65 ac of riparian habitat
            - Removed to construct LRT
          - 135 ac are
            - Levees; that will be degraded to install rock trenches
            - Staging areas

EE-155

          - *So is this then launchable rock trench construction on berms/banks along 11 river miles (22 linear miles of project work along 11 miles of channel) on both sides of the LAR, or a total of 11 linear miles of project work along a shorter reach of the LAR?*
        - Construction will last 10 years
          - Short-term construction activity impacts will be significant.
      - Post construction;
        - Loss of riparian vegetation would have
          - Long-term impact
        - LRT would be designed to
          - Include a <u>planting berm</u>
            - Which would be <u>planted with trees</u> outside the 15 ft. vegetation free zone
            - To compensate for some of the 65 ac of lost riparian habitat.

EE-156

          - *This "planting berm" is not mentioned in Section 2.3.1 nor indicated on Figure 1; it is not mentioned in any other resource impact section of the EIS.*

EE-157

          - *In section 2.3.1 the Corps states that LRT would be constructed outside the natural channel; how would the "planting berm" work and where would it be placed?*

EE-158

          - ***The design description of the LRT approach includes a prohibition against planting deep-rooted trees on the trench***

surface which should preclude riparian trees.

- Shrubs would be transplanted
- Additional compensation would be installed
  - On top of rock trenches
    - When possible
  - Outside the vegetation free zone
  - *In Section 3.8.6 for VELB impacts/mitigation; the Corps states that impacted shrubs would be transplanted, that additional compensation would occur thought planting be on top of rock trenches (when possible), outside the vegetation free zone, and that it is expected that on these trench surfaces sufficient lands would be available to plant these shrubs and associated natives.*

EE-159

    - The VELB use-area of the rock trench surfaces seems to conflict with the 65 ac of riparian habitat revegetation.
    - ***Elderberry shrubs are not an exclusively riparian plant nor does it, on its own, constitute riparian habitat.***

EE-160

    - ***Calling elderberry plants riparian does ot make an elderberry replanting area riparian habitat.***

EE-161

    - ***If the launchable rock trenches truly displace riparian habitat, then the 65 ac of riparian habitat replacement on the launchable rock trench surface should use truly riparian species.***

EE-162

    - ***However the vegetation prohibitions in Section 2.3.1 and the most likely finished elevation of the launchable rock trench surfaces (+/- 20 ft above low water surfaces) seems to preclude truly riparian plant species and thus riparian habitat.***

EE-163

  - However these trees would take many years to grow to similar visual values
    - Considered a significant impact
    - That cannot be mitigated.
  - *These impacts/mitigation actions address construction and project footprint considerations only. Unlike other resource*

EE-164

EE-164 (Cont.)

sections (ie. LU, vegetation etc.) the Corps does not associate the ongoing bank erosion and berm area that would result from the No Action Alt as resulting in visual impacts; Not sure why this is the case. The proper functioning of the launchable rock trenches anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of vegetation, habitat, and recreation values and will constitute lost visual resource quality and value. Why are these impacts, which are implicit to the expected proper functioning of the project as designed, not counted as project impacts?

- Bank protection approach:
  - Construction:
    - Footprint would be
      - Adjacent to the bank
      - Varying distances from public access areas.
    - Activities include;
      - Trees would remain in place
        - Anchored with rock to protect them from future erosion
      - Sites planted with vegetation
      - EE-165 *The design specifications (Section2.3.1) state that "large" trees will remain; all other vegetation will be stripped and bank stabilization work will be done, and "planting berms" would be provided where feasible. The berms are not specifically indicated in Figure 1 and there seems to be notable hedging language.*
      - EE-166 *The bank protect that would have to occur on the steep RR bank in the Corps' "critical reach" will not end up looking like the photos of the Sac State project area. Need a realistic description of bank protection project results on steep banks.*
  - Post construction:
    - Visual impacts only seen from
      - The river
      - The ARP
    - Once vegetation is established
      - The rock will not likely be visible from either

        - The river
        - ARP
- Visual values would take time to reach
    - Likely to take 3-5 years to establish vegetation
    - FIGURES 8-10: indicate revegetation progress thru post-construction year 9 (2001-2010)

EE-167

    - *These figures show an apparent improvement in the visual conditions at this (Sac State) project location. However, the pre-project levee and bank conditions at this site are atypical of most of the intended 11 mile project area.*
        - *Except for the RL Fairbairn-Paradise Beach bank which has levee slopes that are adjacent to the LAR bank, and the frontage of Campus Commons golf course (which is an actively eroding bank [largely due to coarse sediment aggradation in the LAR in RM 6]), most of the existing LAR banks are steep and are heavily wooded with riparian trees.*

EE-168

        - *The Corps proposed "bank protection" approach application at these other more natural bank sites will not have a post-construction configuration as at pictured for the Sac State section and will have decidedly different pre- and post-project visual impacts than those represented by Figures 8-10.*
    - The "<u>full natural environment</u>"
        - Preferred by users

EE-169

    - *Even when revegetation has reached its maximum, the rock bank will be clearly seen from the river.*

EE-170

    - *Even when revegetation has reached its maximum, no observant user could mistake the rocked bank and channel margin from a natural bank.*
- Visual effects
    - Are considered to be less than significant
        - Site would quickly revegetate
        - Provide a <u>natural looking</u> environment

EE-171

EE-172

- <u>Similar to or enhances</u> from existing conditions
    - *It is not likely that these sites will ever "look natural" or look "similar to or enhanced" compared to conditions. There are presently essentially no rare eroded banks – almost all of the banks under consideration are heavily wooded with riparian vegetation with natural un-rocked banks and shorelines.*
    - *As noted above, the Corps proposed "bank protection" approach application at these other more natural bank sites will not have a post-construction configuration as at pictured for the Sac State section and will have decidedly different pre- and post-project visual impacts than those represented by Figures 8-10.*
    - Sacramento River (255):
    - East side tributaries (255-256):
- 3.15.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (256-257):
    - Sacramento bypass (256-257):
- 3.15.6. Avoidance, maintenance, and mitigation measures (257-258):
        - Based on construction and project footprints
    - American River (257):
        - Construction:
            - Impacts to visual resource during construction are
                - Unavoidable
                    - Cannot be mitigated
        - Post construction:
            - Trees will be planted along the waterside edge of the LRT
                        - Where there is sufficient space.
                - Will take time to mature to pre-project visual values
                    - Should not take too long
                        - See project figures
            - Additional trees could be planted
                - At other ARP locations
                    - In compliance with the ARPP
                        - To mitigate tree removal
                    - Which provide a natural environment in a urban area.
            - Short-term effect will be significant.
            - Planted trees will reduce effects to less than significant
                - Once they are established
                    - And provide similar views to those removed.
    - Sacramento River (257-258):
    - East side tributaries (258):

- **3.16 Public utilities and services system (258-266):**
  - 3.16.1 Environmental setting (258-260)
    - Regulatory setting (258):
    - Existing conditions (258- 260):
      - Water supply (258-259):
      - Storm water (259):
      - Wastewater (259-260):
      - Solid waste (260):
      - Electrical and natural gas service (260):
      - Telephone and cable (260):
      - Fire and police protections (260):
  - 3.16.2 Methodology and basis of significance (261):
    - Methodology (261):
    - Basis of significance (261):
  - 3.16.3 No action alternative (261-262):
  - 3.16.4. Alternative 1 – improved levees (262-265):
    - Water supply (262-263):
    - Storm water (263):
    - Wastewater (263):
    - Solid waste (264):
    - Electrical and natural gas service (264):
    - Telephone and cable (265):
    - Fire and police protections (265):
  - 3.16.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (265-266):
  - 3.16.6. Avoidance, maintenance, and mitigation measures (266):
- **3.17 Hazardous wastes and materials (266-273):**
  - 3.17.1 Environmental setting (267-270):
    - Regulatory setting (267-268):
    - Existing conditions (268-270):
      - American River (269):
      - Sacramento River (269):
      - East side tributaries (269-270):
      - Sacramento bypass (270):
  - 3.17.2 Methodology and basis of significance (270):
    - Methodology (270):
    - Basis of significance (270):
  - 3.17.3 No action alternative (270);
  - 3.17.4. Alternative 1 – improved levees (270-272):
    - American River (271):
    - Sacramento River (271-272):
    - East side tributaries (272):
    - Barrow sites (272):
  - 3.17.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (272):
    - Sacramento weir and bypass (272):
  - 3.17.6. Avoidance, maintenance, and mitigation measures (272-273):
- **3.18 Socioeconomic, population, and environmental justice (273-277):**
  - 3.18.1 Environmental setting (273-274):
  - 3.18.2 Methodology and basis of significance (275):

- 3.18.3 No action alternative (275):
- 3.18.4. Alternative 1 – improved levees (276-277):
- 3.18.5. Alternative 2 – Sacramento bypass and improve levees (TSP) (277):
- 3.18.6. Avoidance, maintenance, and mitigation measures (277):

- **4.0 Cumulative impacts, growth-inducing impacts, and other requirements (278_):**
    - 4.1 Cumulative effects:
        - 4.1.1 Methodology and geographic scope of analysis
        - 4.1.2 Past, present, and reasonably foreseeable future projects:
    - 4.2 Cumulative impacts analysis
        - 4.2.1 Water quality
        - 4.2.2 Vegetation and wildlife
        - 4.2.3 Fisheries
        - 4.2.4 Special-status species
        - 4.2.5 Cultural resources
        - 4.2.6 Air quality
        - 4.2.7 Climate change
        - 4.2.8 Noise
        - 4.2.9 Recreation
        - 4.2.10 Visual resources
    - 4.3 Growth inducing impacts
    - 4.4 Unavoidable adverse effects
    - 4.5 Relationship of short-term and long-term productivity
    - 4.6 Irreversible and irretrievable commitment of resources

- **5.0 Compliance with applicable laws, policies, and plans (294 -):**
    - 5.1 Federal laws, regulations and polices
    - 5.2 state of California laws, regulations, and polices

- **6.0 Consultation and coordination (308 -):**
  - 6.1 Public involvement under NEPA and CEQA
    - 6.1.1 Notice of Intent, Notice of Preparation, and scoping meetings
    - 6.1.2 Next steps in the environmental review process
    - 6.1.3. Major areas of controversy
  - 6.2 Native American consultation
  - 6/3 Coordination with other federal, state, and local agencies
  - 6.4 List of recipients
    - 6.4.1 elected officials and representatives
    - 6.4.2 Government departments and agencies

Questions and issues:

Page 12 - Issues of Vegetation Variance. EIS (p 13) states that this was for the Sacto River;

- It is stated that the vegetation variance would be developed during the design phase.

EE-173 - *Is there any possibility that the vegetation variance would apply to LAR levees?*

EE-174 - *Do vegetation impact/mitigation assessments for the LAR include the assumption that the vegetation variance is approved?*

EE-175 - *If so, what would be LAR vegetation impacts/mitigation estimates for the LAR?*

Page 30 - The Corps states that Bank Protection project elements: consists in placing rock on banks and in some cases levees, when necessary eroded portion of banks would be filled and compacted prior to rock placement; sites would be prepared by clearing and stripping prior to construction, small vegetation and loose material would be removed; in most cases large vegetation would be left in place.

EE-176 - *What size criteria are to be used for small/large?*

EE-177 - *If large trees are left in place will the amount be specified by hydraulic modeling of conveyance? At this project stage, before site specific design and planning, how can it be determined what portions of project banks would have retained trees and at what density; how can an estimate of the expected vegetation impacts be developed?*

EE-178 - *If large trees are left in place, when they die will they be replaced; will natural revegetation be allowed or even possible with the rocked surface?*

EE-179 - *If these trees are expected to die and not be replaced by natural revegetation, how should these trees be counted for impact/mitigation purposes?*

EE-180 - *Should the recreation and visual impact assessment be based on no trees at all on these banks?*

- The Corps states that the excavator will place a <u>large rock berm</u> in the water to an elevation slightly above mean summer flow elevation; a planting trench would be established on this rock surface for revegetation.

EE-181 - *A <u>berm of large rock</u> or a <u>large berm of rock</u>?*

EE-182 - *This berm is not indicated on Figure 1. What size can be expected?*

EE-183 - *Would not a berm added to the foot of the existing banks further narrow the channel resulting in some measure of greater floodflow velocities?*

- *If so does this not add constraining parameters on vegetation occurrence and added vegetation maintenance activities?*

EE-184 - *What is to be the configuration of the "planting trench" and what plants and plant area widths are to be expected?*

EE-185 - *Long-term, what will be the vegetation configuration of the berm and bank protection project element?*

EE-186 - *Are there other bank protection project element design approaches that could result in satisfactory bank protection and meet project objectives;*

- *with better long-term resource results*
- *but perhaps with greater short-term impacts?*

Page 30, other - The Corps states that Launchable Rock Trench project elements: designed to deploy revetment once erosion has removed the bank material beneath it; will be placed outside the channel, located at the toe of existing levees; the bottom of the trench would be constructed to an elevation near the summer mean water surface (to reduce the rock launching distance and the amount of rock required); will be covered with a minimum of 3 ft. of soil; all disturbed areas would be reseeded with native grasses and small shrubs (where appropriate); some vegetation could be permitted over the trench, if planted outside the specified vegetation free zone, and would likely be limited to native grasses, shrubs, and trees with shallow root systems (to ensure the functionality of the launchable rock trench);. and vegetation would only be permitted if 1) it does not put undue burden on flood protection maintenance agencies, 2) it is in locations that do not interfere with channel conveyance capacity.

- Elsewhere (p 65) the Corps states that the maximum rock trench width would be about 70 ft. - In most of the resource impact/mitigation sections the Corps states that portions of the rock trench surface will be used to replace recreational facilities, and vegetation including elderberry shrubs and riparian habitat.

- Also in most of the resource impact/mitigation sections the Corps' treatment the impacts associated with the launchable rock trench project element is limited to construction activities and the post-construction configuration; the discussions do not address the impacts associated with the ultimate functioning of the protect element as designed, that is when it is achieving its design purpose of levee protection at the expense of channel, riparian, and American River Parkway resource protection.

- In the project reach there are few if any situations where 1) the levee toe is within 70 ft of the present channel margin and/or 2) is lower than about 15-20 ft. above the lowflow water surface elevation.

EE-187 *- Given this; and the vegetation limitation described above, how can the Corps expect the rock trench to support riparian revegetation and provide riparian habitat values? By its very nature, riparian vegetation requires sub-irrigation, which seems to be precluded by the Corps' revegetation criteria. Not to mention the hydraulic parameters.*

EE-188 *- With rock trench slope criteria (2:1 and 1:1), each foot of rock trench depth entails 3 ft. of rock trench surface width; a 70 ft. width results in a 23 ft. deep trench if there is no trench bottom width. With most levee toes in the range of 20 above the lowflow channel elevation, with any rock trench bottom width at all, it seems that a 70 ft. rock trench surface width may be more of a typical condition than a maximum width.*

EE-189 *- In most resource sections the Corps states with the No Action Alt. the waterside berm in the ARP would erode overtime, resulting in the loss of land area and various vegetation, wildlife habitat, recreation, and visual resource values; that these losses constitute signification impacts.*

EE-190 *- The Corps does not state what lands (locations and amounts) that are at risk of loss due to the No Action Alternative so impacts associated with and the loss of land area and various vegetation, wildlife habitat, recreation, and visual resource values for this alternative are not quantifiable..*

EE-191 *- However, the proper functioning of the launchable rock trench approach anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. The bank erosion and bank retreat imply the same resource value losses (land area, and various vegetation, wildlife habitat, recreation, and visual resource values) that the Corps attributes to the No Action Alternative. Why shouldn't these same resource losses be attributed to the launchable rock trench protect elements?*

EE-192 *- When the rocks are launched (as per the project design objectives), there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of habitat and recreation values. Why are these impacts, which are implicit to the proper and expected functioning of the* *project as designed, not counted as project impacts (as was the case for the No Action Alt.)?*

- Elsewhere (p 254) the Corps states that launchable rock trenches: would be designed to include a planting berm; which would be planted with trees outside the 15 ft. vegetation free zone; to compensate for some of the 65 ac of lost riparian habitat.

EE-193

- *However the design specifications in Section 2.3.1 does is not mentioned a "planting berm" and it is not mentioned in any other resource impact/mitigation section.*
  - *In Section 2.3.1 the Corps states that launchable rock trenches would be constructed outside the natural channel; how would the "planting berm" work and where would it be placed?*
  - *The design description of the LRT approach includes a prohibition against planting deep-rooted trees on the trench surface which should preclude riparian trees.*

EE-194

  - *Except possibly on RL between Fairbairn and Paradise Beach, are there any portions of the project reach where levee toes (where the trench is to be located) are set close enough to the present LAR bank such that a planting berm (similar to that described for "bank protection" approach) added to the channel margin would be part of the launchable rock trench approach?*

EE-195

- *How are these statements in the visual impacts/mitigation section compatible with the design specification on Section 2.3.1?*

- Elsewhere (p 254) the Corps states that launchable rock trench construction would occur along 11 of the 26 miles of the ARP involving 200 ac of disturbance. In many locations of the EIS the Corps refers to 11 miles of construction work.

EE-196

- *So is this then launchable rock trench construction on berms/banks along 11 river miles (22 linear miles of project work along 11 miles of channel) on both sides of the LAR, or a total of 11 linear miles of project work along a shorter reach of the LAR?*

Page 63, 65

- The Corps states (p 63) that for the No Action Alt., the waterside berm in the ARP would erode overtime, resulting in the loss of ARP lands. An since the ARPP designated most of the lands within the project area for various uses, the No Action Alt. is inconsistent with the ARPP and would be considered a significant effect.

EE-197

- *The Corps does not provide an estimate of potential land, habitat, and recreational facility losses that will be due to the No Action Alt.*

- The Corps states (p 65) for Alternative 1, that the launchable rock trench protection approach is in compliance with ARPP because no lands would be lost and construction impacts would be mitigated. Further LU impacts are considered less than significant and no additional (non-construction) mitigation is required.

EE-198

- *In the No Action Alt. the Corps' attribute land and resource losses due to ongoing erosion as a significant LU impact that is not consistent with ARPP. However, the proper functioning of the launchable rock trench approach anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched, there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of habitat and recreation values. Why are these impacts, which are implicit to the proper and expected functioning of the project as designed, not counted as project impacts (as was the case for the No Action Alt.)?*

Page 65

- The Corps states that the maximum trench width will be 70 ft., and that a total of 65 ac will be disturbed along 11 miles of treatment.

EE-199

- However with design trench slopes (2:1 and 1:1) (p31), a 70 ft. wide trench-top would be 23 ft. deep (70/3=23.3), if it has no bottom width. Design indicates varying trench bottom widths so independently estimating trench top-widths is not possible here. However I'm thinking that most of the levee toe elevations are about 20 ft. above with lowflow water surface which indicates that, if there is to be any bottom-trench width at all, maximum trench surfaces may be in excess of 70 ft. It is possible that 70 ft. could be the average trench surface width.

EE-200

- Does the 65 ac of disturbance exclude staging areas and access ramps etc.?

Page 71-73 - The Corps' long-term modeling concluded that in 50 years the average LAR bed will degrade 4.8 ft and in 100 years it will degrade 5.8 ft. (with maximum degradation RM 1-11, 12-22 of 16-20 ft. and maximum aggradation RM11-12 of 3-4 ft.

EE-201

- Without further discussion and explanation this appears not sensible.

EE-202

- Were the cemented/indurated clay channel bed nick points considered and over these timelines what influence would they have on channel degradation upstream of their locations?

EE-203

- What is the volume of sediment predicted by this modelling to be lost in the LAR over these timelines?

EE-204

- Where does this sediment go?

EE-205

- Have they overlooked that the LAR channel is drowned downstream of RM 5 (due to geologic timescale sea level rise) and that now and in the future (increasing rates of sea level rise), out-fluxing of coarse sediment past this point is not likely. What are the implications of this sea-level rise process on long-term degradation/aggradation in the RM 5-7 reach?

- The Corps stated that irregular channel reaches may not be adequately represented by this model, especially in braided reaches above RM 8.

EE-206

- There are no really braided channel plan forms on the LAR (above RM 8) except possibly a 0.5 mile section at about RM 14/15 (this is really just a short reach recently experiencing over-loaded sediment influx in conjunction with erodible banks – local widening and the development of multiple channels. This "braided" feature is in the process of change and could develop into a single thread channel with time.).

- The complex channel in the RM 11-12 reach is the result of the breaching of off-channel gravel pits – not channel braiding.

- The complex channel configuration at RM 9 downstream of the Watt bridge is due to a natural process of sediment deposition and channel re-configuring resulting from late-date gravel bar mining and the resulting over-widened channel – this is not channel braiding. The source of the sediment that is being deposited downstream of the Watt bridge is most likely due to ongoing scour in the 0.5 mi of channel upstream of the Watt bridge.

- At about RM 6 there is a 0.5 mi braided reach that is due to coarse sediment deposition at the head of the drowned LAR channel reach (RM 0-5) (due to geologic time-scale sea level rise). This is the expected final location of all coarse sediment transported through the LAR.

Page 73 - The Corps concluded that the LAR is sediment starved; that bedrock (likely the cemented/indurated clay member of the Turlock Lake Frm.) has been reached as far downstream as Guy West Bridge which is slowing further degradation; and that without significant bed slope reduction, it will now tend to erode laterally to satisfy need for sediment.

EE-207 *- This conclusion seems to contradict the long-term (50 and 100 years) predictions of significant channel bed degradation presented on p 72 (see notes in outline above).*

Page 74 - The Corps concluded that field review verified erosion of the bank is occurring at RM 9.0 RR, even at lowflow of 7,000 cfs.; erosion of the LAR is continually occurring; which leaves the banks sacred and susceptible to future erosion, especially at high flow events; further reducing the amount of berm separating the channel from the levees; and that the loss of vegetation is leaving the bare soil, which is susceptible to erosion at a lower velocity.

EE-208 *- All of these statements about "erosion" appear to be true **only when applied** to the field-verified erosion at "RM 9.0 RR."*

- This site of erosion is not generally characteristic of the LAR: It is due to local-scale natural channel adjustments underway in response to channel over-widening that occurred in the 1960-70's when the RL attached longitudinal gravel bar was removed for gravel mining purposes. With reduced stream power at this location a regime of net deposition was induced and a medial bar developed which is now morphing into a diagonal bar attached to the RL bank at the bridge. Since the 1970's the process has progressively forced more flow and power to the RR bank causing the Corps' "field-verified" erosion. At the location of the original attached bar, the channel is aggrading to a significant degree making the existing boat ramp dysfunctional.

- This condition in not representative of the LAR in general, nor of the critical RM 6-11 reach but is a local phenomenon, with local symptoms, and local causal factors.

EE-209 *- This bank erosion problem could be corrected with proper local-scale channel restoration actions.*

EE-210 *- The real long-term erosion issue in this critical reach is the sewer main undercrossing at about RM 7. The line was installed as an inverted syphon with one riser at the edge of the RR active channel bank, with revetment armoring on this bank slope. This constitutes a critical channel impingement and constraint which resulted in severe RR bank erosion upstream of the line due to progressive erosive eddy development during the 1986 flood event. Without that armored nick point on the RR bank (and with the inverted syphon riser set back from the channel bank edge), it is most likely that bank erosion along the RR bank at that location during the 1986 event would have been very modest. The presence of this sewer undercrossing in its present configuration limits intelligent channel reconfigure alternatives for dealing with this critical flood conveyance reach.*

EE-211 *- The Corps' flood conveyance actions in this critical reach should be focused on the modification of the existing inverted syphon (setting back the riser and eliminating the bank revetment at the existing riser which anchors the eddy erosion process/dynamic immediately upstream) such that GRR- project (and possible future-flood management) options for stream channel, channel bank, and riparian setting reconfiguration and restoration are maximized not minimized.*

Page 78-82 - The Corps' criteria for hydrology/hydraulic impact significance (P 78) is limited to floodflow magnitude changes and induced inundation risks to safety and damage.

EE-212 *- Does not concern itself with channel stability issues related to hydraulic effects of bank protection and launchable rock trench design approaches.*

EE-213 *- What may be the hydraulic effects of bank protection and launchable rock trench design approaches, particularly when and if launchable rocks are launched due to bank retreat?*

- The Corps stated that project work primarily includes landside levee fixes; that do not change in-channel geometry or characteristics; and therefore would not substantially alter erosion or siltation in the system.

EE-214

- *Can this be said of the proposed 11 miles of bank protection and launchable rock trench work in the LAR/ARP?*
- *What about the bank erosion that would have to occur to launch the launchable rocks where that approach is used?*
- *What about channel hydraulic conditions when and if the launchable rocks are launched (that is when the project functions as designed), how will the new channel configuration affect hydraulics; what are the consequences of these new channel conditions?*

- The Corps stated that the 200-yr flows in the LAR are tied to the changes in Folsom Dam operations; which will be analyzed as part of the ongoing Folsom Dam Water Control Manual Update; the effects of these flows including cumulative effects will be addressed by the Manual Update EIS/EIR.

EE-215

- *Does this mean that the 200-yr LAR flows may not be 115,000?*
- *Does this mean;*
  - *That the impacts of changing the floodflow regime on the LAR will be assessed at a later time?*
  - *That the possible channel implications of the GRR w/o or w/ project conditions do not consider the change in floodflow regime?*
  - *And that the impacts of these flows (increased floodflow magnitudes at more frequent occurrences, reduced floodflow magnitudes at less frequent occurrences) on the LAR channel etc. have not yet been assessed?*

- The Corps stated that since flows are not increased, project effects on hydrology/hydraulics are less than significant; no mitigation is required.

EE-216

- *This conclusion;*
  - *Is dependent on the narrow conception of the "basis of significance" used for hydrology/hydraulic impacts (p 78).*
  - *Seems to ignore the 11-12 miles of bank protection and launchable rock trench work on the LAR.*
  - *Ignores the hydraulic implications of proper project functioning – that is the consequences of the launching of the launchable rocks;*
    - *Consequences of the bank retreat required to launch the rocks.*
    - *Consequences to channel hydraulics after the rocks have been launched – the new channel configuration.*

EE-217 Page 99-100: - *Will the aerial photo overlay of LAR bank protection and launchable rock trench construction footprint be available to SCRP during the NRMP process?*

EE-218 Page 103: - *Could the NRMP be used to assess overall-ARP impacts and implications of mitigation to include greater (short-term) impacts in the construction area with greater long-term mitigation values with restoration/mitigation projects in the Arden/Sacto Bar/Sailor Bar areas?? That is: accept the short-term impacts of temporal riparian vegetation/habitat losses in the construction areas (but re-planting for on-site mitigation) with restoration of industrial impacted areas to riparian habitat.*

EE-219 Page 103-104 - *The discussion of riparian trees on bank protection surfaces seems to be indicate that large trees (as feasible) will be left in place amid placed revetments. Since these revetment surfaces will have*

EE-219 (Cont.) *very poor revegetation success, when these large trees die it is most likely that no trees will replace them. How are these" large trees left in place" counted as impact/mitigation for habitat, recreation, visual, and W&S River values?*

Page 103-104

EE-220 *- The discussion of riparian plantings on the rock trenches appears to conflict with the design description of launchable rock trench features on page 32. As a result it is unclear how to consider the impacts of the Corps' assertion that 130 ac of riparian will be planted on these trench surfaces.*

EE-221 *- When and if the launchable rock trenches actually launch the rocks due to erosive bank retreat (that is, when the project functions as designed), how will the losses of real riparian vegetation along the banks, and the Corps' "riparian plants" on the rock trench surfaces, be counted as impacts resulting from proper project functioning?*

EE-222 *- Since the proper operational functioning of the launchable rock trench approach is predicated on the progressive loss of banks and berms between the channel and the levee, a natural attribute of this approach entails the same losses of lands, vegetation, and wildlife habitat as is attributed by the Corps to the No Action Alternative. Why should the discussion of vegetation and wildlife impacts associated with the launchable rock trench approach be limited to construction aspects and not include impacts associated with its preforming as designed and achieving its functional purpose?*

Pages 117,

- The Corps considered all elderberry shrubs on the waterside of levees as being in the "riparian zone."

EE-223 *- What criteria were applied to make this riparian zone determination?*
- If a particular shrub is found in a defensibly identified riparian area, could this plant be considered "riparian?" That is, when replanted somewhere else could that new site be defensibly considered "riparian habitat?"

EE-224 *- When talking about planting riparian in portions of rock trench surfaces; is the Corps referring to elderberry?*

EE-225 *- When these plants are newly established on rock trench surfaces, given the likely elevation and distance from water surface, could they be defensibly considered as constituting "riparian habitat?"*

EE-226 *- The Corps states that if there is insufficient space for the 66 ac of VELB mitigation on rock trench surfaces along the LAR, additional mitigation area will be needed. Could be at the Cal Expo and River Bend Park mitigation sites. Are these mitigation sites considered as really "riparian?" Certainly not the River Bend Site!!*

EE-227 *- For the LAR area, it is unclear how the 66 ac of VELB mitigation needs relates to the need for 130 ac of riparian mitigation. Can these acreages be clearly sorted out?*

EE-228 *- When and if the launchable rock trenches actually launch the rocks due to erosive bank retreat (that is, when the project functions as designed), how will the losses of real riparian vegetation along the banks, and the elderberry plants on the rock trench surfaces, be counted as impacts resulting from proper project functioning?*

Page 138-139

- It is indicated that there are 250 elderberry plants on the LAR and mitigation is based on this number.

EE-229 *- However this number was based on a 2011 survey of levee slopes and 15 ft. out from the landside toe and 30 ft. out from the waterside toe. Isn't it most likely that many more elderberry plants would be located along the LAR on berm and bank sites where*

EE-229 (Cont.)

launchable rock trenches and bank protection projects would be constructed? It appears that contrary to the introductory statement in the "measures" paragraph, the impact/mitigation is not based on a worst-case case scenario; more (perhaps much more) mitigation than stated may be required. Does the Corps really have suitable mitigation opportunities?

Page 145-147 - To reduce impact/mitigation for Swainson's hawk the Corps

- Will seek a vegetation variance to maintain vegetation on the lower half of the levee slope.

EE-230

- *But in Section 1.4.5 the variance appears to only apply to Sacto R. levees.*
  - *Will it be extended to Amer. R. levees.*
  - *What will be the impact if the variance is not approved?*

- Corps stated that for bank protection works; revetment slopes will be planted with vegetation and trees that over time will provide habitat.

EE-231

- *This seems to contradict the description of bank protection work in Section 2.3.1.*
  - *"Brush/shrubs/small trees" will be removed*
  - *Rocks will be placed among the "larger" riparian trees*
  - *Where feasible; a planting berm will be established*

EE-232

- *It seems the construction result will be revetment slopes with a few "large trees."*
  - *When these few large trees die, why wouldn't the revetment slopes prevent the reestablishment of "large" trees, or really anything?*

EE-233

  - *Under what conditions would a planting berm be established and how large would they be? If the project work uses tight tolerances (which is normally done), i.e. does not over-build conveyance capacity (to limit costs and project construction impacts/mitigation); realistically, what space will be left for planting berms?*

EE-234

  - *If the planting berms extend into the existing channel area wouldn't that result in reduced floodflow conveyance area, and therefore place more constraints on existing vegetation and mitigation revegetation, leading to net reduction in acceptable vegetation (more vegetation management to maintain floodflow conveyance capacity)?*

EE-235

  - *Practically speaking, what impact reduction could be expected from the proposed bank protection construction approach?*

- The Corps stated that 238 ac of riparian mitigation will be needed.

EE-236

- *How much is needed in the ARP?*

EE-237

- *For Swainson's hawk, specifically what riparian vegetation types or structure is needed?*

EE-238

- *Is the Woodlake/Cal Expo site suited for developing this riparian type/structure?*

EE-239

- *How does this 238 ac relate to the need for 66 ac of elderberry mitigation and the 130 ac of riparian habitat mitigation on the LAR/ARP?*
  - *Are they separate and distinct mitigation needs?*
  - *Is there some overlap?*

Page 235, 236-7 - The Corps' discussion of recreation impacts for Alternative 1 is limited to construction and temporary closures.

- For the No Action Alt. the Corps attribute land and recreation resource losses due to ongoing erosion as a significant recreation impact that is not consistent with ARPP (235).

EE-240

- However, the proper functioning of the launchable rock trenches anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched, as designed, there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of recreation areas, facilities, and values which can only be counted as impacts to the existing, pre-project, conditions. Under this levee protection approach, the impacts associated with its proper functioning and design objectives, would be identical in scope and timing with the No Action Alternative.

- Why are these impacts, which are counted as representing significant impacts for the No Action Alternative, not recognized as impacts at all for the launchable rock trench approach?

- Why is the discussion of impacts limited to the construction phase and to the construction/project footprint area?

Page 254 - The Corps states that for Launchable Rock Trench project elements: construction will occur on 11 miles of the ARP, disturbing 200 ac (65 ac of riparian habitat and 135 ac of existing levees and staging areas), lasting 10 years; resulting in significant short-term visual impacts.

EE-241

- So is this then construction on levees/banks along 11 river miles (22 linear miles of project work along 11 miles of channel) on both side of the LAR, or 11 linear miles of project work along a shorter reach of the LAR?

- The Corps states that for Launchable Rock Trench project elements: post-construction will include, a loss of 65 ac of riparian habitat; would be designed to include a planting berm, which would be planted with trees outside the 15 ft. vegetation free zone, to compensate for some of the 65 ac of lost riparian habitat; but given the time delay in the tree plantings reaching maturity, there will be significant long-term visual impacts that cannot be mitigated.

EE-242

- This "planting berm" is not mentioned in Section 2.3.1 nor indicated on Figure 1; it is not mentioned in any other resource impact section of the EIS.

EE-243

- In Section 2.3.1 the Corps states that launchable rock trench would be constructed outside the natural channel; how would the "planting berm" work and where would it be placed?

EE-244

- The design description of the launchable rock trench approach includes a prohibition against planting deep-rooted trees on the trench surface which should preclude riparian trees.

EE-245

- Except possibly on RL between Fairbairn and Paradise Beach, are there any portions of the project reach where levee toes (where the trench is to be located) are set close enough to the present LAR bank such that a planting berm (similar to that described for "bank protection" approach) added to the channel margin would be part of the launchable rock trench approach?

EE-246

- In Section 3.8.6 for VELB impacts/mitigation; the Corps states that impacted shrubs would be transplanted, that additional compensation would occur thought planting be on top of rock trenches (when possible), outside the vegetation free zone, and that it is expected that on these trench surfaces sufficient lands would be available to plant these shrubs and associated natives.

- The VELB use-area of the rock trench surfaces seems to conflict with the 65 ac of riparian habitat revegetation.

- Elderberry shrubs are not an exclusively riparian plant nor does it, on its own, constitute riparian habitat.

EE-246
(Cont.)

- Calling elderberry plants riparian does not make an elderberry replanting area riparian habitat.

- If the launchable rock trenches truly displace riparian habitat, then the 65 ac of riparian habitat replacement on the launchable rock trench surface should use truly riparian species.

- However the vegetation prohibitions in Section 2.3.1 and the most likely finished elevation of the launchable rock trench surfaces (+/- 20 ft. above low water surfaces) seems to preclude truly riparian tree species and thus riparian habitat.

EE-247

- These impacts/mitigation actions address construction and project footprint considerations. And impacts associated with the time delay in riparian tree reestablishment.. Unlike other resource sections (ie. LU, vegetation, etc.), the Corps does not associate the ongoing bank and berm erosion and the loss of land area that would result from the No Action Alt as resulting in visual impacts; Not sure why this is the case.

- The proper functioning of the launchable rock trenches anticipates (and depends on) ongoing bank erosion and retreat to launch the rocks. When the rocks are launched there will be a continuous revetment slope from the levee toe to the eroded channel margin. This slope will be absent of vegetation, habitat, and recreation values and will constitute lost visual resource quality and value. Why are these impacts, which are implicit to the expected proper functioning of the project as designed, not counted as project impacts?

Page 254 - The Corps states that for Bank Protection project elements: construction footprint would be adjacent to the bank; small trees and brush would be stripped; large trees would remain in place, anchored with rock to protect them from future erosion; and the sites will be planted with vegetation.

EE-248

- The design specifications (Section2.3.1) state that "large" trees will remain; all other vegetation will be stripped and bank stabilization work will be done, and "planting berms" would be provided where feasible. The berms are not specifically indicated in Figure 1 and there seems to be notable hedging language.

- Under what circumstances would this "planting berm be feasible and infeasible?

- Where a planting berm is infeasible, what will the post-construction vegetation look like?

EE-249

- The bank protect that would have to occur on the steep RR banks through most of the Corps' "critical reach" will not end up looking like the photos of the Sac State project area (Figures 8-10). Need a realistic description of the "bank protection" approach post-construction conditions on the steep "natural" banks that are presently pervasive through the project reach.

- The Corps states that for Bank Protection project elements: post-construction; visual impacts only seen from the river and the ARP; once vegetation is established the rock will not likely be visible from either the river or the ARP; likely to take 3-5 years to establish vegetation; Figures 8-10: indicate revegetation progress thru post-construction year 9 (2001-2010); visual effects are considered to be less than significant, sites would quickly revegetate and provide a natural looking environment similar to or enhanced from existing conditions.

EE-250

- These figures show an apparent improvement in the visual conditions at this (Sac State) project location. However, the pre-project levee and bank conditions at this site are atypical of most of the intended 11 mile project area.

- Except for the RL Fairbairn-Paradise Beach bank which has levee slopes that are adjacent to the LAR bank, and the frontage of Campus Commons golf course (which is an actively eroding bank [largely due to coarse sediment aggradation in the LAR in the RM 6 area]), most of the existing LAR banks are steep and are heavily wooded with riparian trees.

EE-251

- The Corps proposed "bank protection" approach application at these other more natural bank sites will not have a post-construction configuration as at pictured for the Sac State section and will have decidedly different pre- and post-project visual impacts than those represented by Figures 8-10.

EE-252

- Even when revegetation has reached its maximum, the rock bank will be clearly seen from the river and no observant user could mistake the rocked bank and channel margin for a natural bank.

- It is not likely that these sites will ever "look natural" or look "similar to or enhanced" compared to conditions. There are presently essentially no rare eroded banks – almost all of the banks under consideration are heavily wooded with riparian vegetation with natural un-rocked banks and shorelines.

- As noted above, the Corps proposed "bank protection" approach application at these other more natural bank sites will not have a post-construction configuration as at pictured for the Sac State section and will have decidedly different pre- and post-project visual impacts than those represented by Figures 8-10.

-- END --

FF

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May 14, 2015

By e-mail and U.S. mail

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Re: Draft American River Watershed Common Features General Reevaluation Report, March 2015

Ms. Baker:

We have reviewed the draft American River Watershed Common Features General Reevaluation Report, March 2015 (dGRR).

First we would like to express our gratitude for extension of the comment period to May 18, 2015. Unfortunately, we did not become aware that there are issues of concern to us with the dGRR until the last public information meeting on April 17, 2015, and, consequently, did not begin review until that time.

We wish to make the following comments on the dGRR.

Our primary concern with the dGRR is the large amount of proposed "erosion protection" on the Lower American River. In addition, we have a couple of more general comments.

Our organization, Save the American River Association (SARA), was instrumental in protecting the lands along the Lower American River from development and in the creation of the American River Parkway. Founded in 1961, we have been protecting and advocating for the River and Parkway for 54 years.

It is our viewpoint that the Lower American River is a Federal and State protected Wild and Scenic River, and the "crown jewel" of Sacramento. Consequently, any proposed actions that would have a significant adverse impact on the River and Parkway must be rigorously and completely justified before adoption by the Corps of Engineers, or State and local flood control agencies. It is clear that the "erosion protection" measures proposed in the dGRR would have an enormous detrimental impact on vegetation, wildlife, recreation, and esthetics of the River and Parkway.

FF-1 However, the justification for the "erosion protection" measures proposed in the dGRR is at best weak, and seems to proceed with a "guilt by association" approach that says if there is clearly concern with erosion risk in one part of the leveed stretch there must be reason for concern with many other areas. This is inappropriate and calls the entire "erosion protection" proposal into question.

FF-2 For example, in Figure 2-7 on p. 2-19 the dGRR presents the American River Velocity Contours from roughly Howe Ave. to Paradise Beach at 115,000, 145,000 and 160,000 cfs. The water velocities in one part of this area are quite high, around 12 feet/second (ft/sec). However, this area is not typical of the rest of the leveed section of the River. The area between roughly Howe Ave. and Paradise Beach has a relatively narrow flood channel between the levees, due to the Corps of Engineers construction of the right bank levee (as part of the Folsom Dam project in the 1950s) close to the left bank levee. However, as shown in Figures 4-4 and 4-5 of the Engineering Appendix Erosion Protection Analysis (Appendix C, Attachment E, pp. 41-2) the narrow section of floodway between roughly Howe Ave. and Paradise Beach is an anomaly. The floodway both upstream and downstream is wider, in many areas much wider, and water velocities are correspondingly lower. Thus, the figure in the dGRR itself is misleading to the reader who does not bore down into the Engineering Appendix.

FF-3 Another figure that is misleading is the dGRR Figure 4-5: TSP Recommended Features along the American River (dGRR p. 4-9). This appears to show selective areas of erosion protection work, with some areas of the left bank and levee impacted and others not impacted. However, when one goes to the Engineering Appendix Erosion Protection Analysis, Figure 6-4, we find that all the sites on the left bank that are not proposed for erosion protection are already sites of "modern revetment repair." Thus, the entire left bank or levee from the confluence of the American with the Sacramento River to the terminus of the levee upstream from the Mayhew Drain would be impacted.

FF-4 One very important feature of the proposed work, bank protection, has inconsistent diagrams between the dGRR itself and the Engineering Appendix. In the dGRR, Figure 4-9, bank protection is shown as rock covering the bank to below the waterline. There is no soil covering the rock. In the Engineering Appendix Erosion Protection Analysis (Appendix C, Attachment E, p. 64) Figures 6-1 and 6-2 show the rock covering the bank and levee covered with soil. Also, figures 6-1 and 6-2 show a trapezoidal soil trench for growth of shielding vegetation that is absent from the dGRR Figure 4-9. We think that it is critically important for any bank protection project to have soil with appropriate vegetation (grasses and small shrubs) covering the rock. We have heard in the past that this makes inspection of the rock more difficult. However, it is fairly obvious that if the soil covering is intact, the rock below must also be in place. We also support the soil trench for growth of shielding vegetation where appropriate.

FF-5 The Engineering Appendix Erosion Protection Analysis (Appendix C, Attachment E, p.7), describing the history of levee construction on the Lower American River, states: "Construction of the south levee of the American River started around 1850 and was completed in the 1910s."

FF-5 (Cont.) There is no further description of south (left bank) levee construction. This description is incomplete and misleading. The levee upstream of the Mayhew Drain (often called the Mayhew Levee) was originally constructed in the mid 1970s, apparently by the company that developed the adjacent Butterfield community. This levee was lower by about three feet than other levees in relation to flood elevation. This levee was raised by about 2.5 feet and widened by the Corps in 2008. The omission of this history in the Erosion Protection Analysis may have contributed to the inappropriate inclusion of this section of river in the proposed erosion protection.

FF-6 Another feature that is worth mentioning is that the dGRR, in Figure 2-6, Problems at Specific Locations in the Study Area (p. 2-15), shows areas of the Lower American River with "Erosion Area(s) of Concern." On the left bank, there is no indication of "erosion concern" upstream from a point about half way between Watt Ave. and the Mayhew Drain. In particular, there is no "erosion concern" on the left bank upstream of the Mayhew Drain, aka the Mayhew Levee area. We find it odd, then, that the proposed plan includes erosion protection work upstream from the point about half way between Watt Ave. and the Mayhew Drain as well as the Mayhew Levee area (dGRR Figure 4-5, p. 4-9).

FF-7 What, from our viewpoint, is the most important about the dGRR and the Erosion Protection Analysis is what is not there. That is, the Erosion Protection Analysis is actually a review of many disparate studies and models, none of which were conducted for the purpose at hand. Perhaps the most useful study is the 2D velocity modeling study by Ayers (2004). But if one asks why the upstream and downstream ends of the right bank are not designated for erosion control and the opposite stretches of the left bank are designated for erosion control, there is no analysis or cogent explanation.

FF-8 We would like to recommend some changes to the erosion protection proposals in the dGRR (Figure 4-5, p. 4-9). First, an additional alternative is desperately needed. This alternative could be called "further study" or "watch and wait." It would involve characterization of the river banks (and levees if appropriate) with sufficient detail that small to moderate erosion events could be documented and quantified. Possibly it could include a comprehensive program of bore holes to characterize the subsurface strata between the river and the levees. This work would be conducted either by the local agencies (Sacramento Area Flood Control Agency, Central Valley Flood Protection Board staff) or by a collaboration between the Corps and the local agencies. Over time, this documentation would allow decisions based on facts to guide further efforts, or to decide that further efforts are not needed. Second, we propose that the left bank from the confluence of the American and Sacramento Rivers to about Paradise Beach should be assigned to this "further study" alternative. So also would the left bank from about Howe Ave. up to the Mayhew Drain (the Mayhew Levee area) be assigned to "further study." Additionally, the right bank upstream from Howe Ave to about half way between Watt Ave. and the Mayhew Drain would be assigned to "further study." Thirdly, the left bank upstream of the Mayhew Drain would be assigned to normal operations and maintenance. The left and right banks between roughly Howe Ave. and Paradise Beach would remain as shown in Figure 4-5. These proposals derive from the flow velocities of the 2D modeling study by Ayers (2004).

The rationale in the foregoing paragraph for placing the left bank upstream of the Mayhew Drain into normal operations and maintenance derives from the following facts. There have been no

FF-8 (Cont.) reports of erosion events along the river bank from either the 1986 or 1997 flood events (Appendix C, Attachment E, pp. 6-7). Also, the 2D modeling studies (Ayers 2004) indicate that the areas of rapid flow are the same in the 115,000 cubic foot/second (cfs) as 160,000 cfs. In addition, overlays of aerial photos from before and after these flood events show no detectable erosion. Finally, there is a quite substantial terrace or bench that is about 200 feet wide between the river and the new levee for most of the length of the levee. The terrace widens to about 500 feet at the upstream end of the levee. Therefore, there is minimal chance of erosion from even large storm events undermining the levee.

In addition, we have some general comments on the dGRR. While many people are familiar with Environmental Impact Statements and Reports and there are ample resources available for becoming more informed, the same is not true of the dGRR. The dGRR would benefit from a description of how the final document is approved, and what uses it may be put to when finished.

FF-9

FF-10 Also, in the dGRR, the acronym "LPP" suddenly appears in the plan description row of the Final Alternative 2 column in table 3-25 (dGRR p. 3-53). We note that this acronym is not in the list of acronyms in the beginning of the dGRR (pp. xi-xiii). We presume that it refers to Locally Preferred Project or Proposal. This raises some important questions that should be addressed. These include who determined what the LPP is and how did they determine it? Also, was this the subject of action by the Board of the Sacramento Area Flood Control Agency or the Central Valley Flood Control Board? Was there public notice, and if so when? This is a particularly important area to elaborate on as the designation of the LPP appears to be the sole justification for the Corps selecting Final Alternative 2 as the "Tentatively Selected Plan" when Final Alternative 1 was the National Economic Development plan.

We thank you, in advance, for your attention to the issues, concerns, and recommendations above.

Sincerely,

James Morgan

Stephen Green

James Morgan
Board Member, SARA

Stephen Green
President, SARA

James Morgan
[redacted]95827
May 17, 2015

by e-mail and U.S. mail

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Re: Draft American River Watershed Common Features General Reevaluation Report, Draft Environmental Impact Statement/Environmental Impact Report, March 2015

Ms. Baker:

First, let me express my gratitude for extension of the comment period to May 18, 2015. Given the size of the subject documents, the extra time is most appreciated.

I have reviewed in part the Draft American River Watershed Common Features General Reevaluation Report (dGRR), Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR), March 2015. These are my comments.

GG-1

Perhaps the most important shortcomings of the dGRR DEIS/DEIR are in what is not there. I may be reading too much into the text, but I get the distinct impression that the Corps (and possibly cooperating agencies) is/are of the opinion that they could go to construction with only the environmental documentation of this DEIS/DEIR (see text on p. ES-1). I would strongly disagree if that is the case. The DEIS/DEIR is so broad-brush and nebulous that it is not really possible for the public, other stakeholders, or relevant government agencies to assess the environmental impacts or make suggestions towards reducing environmental impacts. I would think that at least one additional Environmental Impact Statement/Report would be needed for each of the major elements of the project: the Lower American River work, the Sacramento Levee and Sacramento Weir work, and the small creeks work. Possibly even more project specific environmental documents would be needed. The final version of the DEIS/DEIR would benefit greatly from an explanation, one way or the other, as to what additional environmental impact statements/reports would be anticipated on the way to construction.

GG-2

The second important element that is missing is alternatives for the Lower American River erosion protection work. Both of the action alternatives in the DEIS/DEIR have the same erosion protection proposal for the Lower American River. Thus, for the Lower American River, the only alternatives are no action and the proposed action. This is inadequate. The Lower American River is a State and Federally protected Wild and Scenic River. It has been called the "crown jewel" of Sacramento, and receives a huge amount of recreational use (too

GG-2 (Cont.)

much in some cases). As the proposed action on the Lower American in the DEIS/DEIR is acknowledged to have significant adverse environmental impacts, it is critically important that one or more alternatives that would reduce these impacts be seriously considered.

GG-3

In that regard, allow me to share an experience that I had with you. I regularly attend the meetings of the Lower American River Task Force (LARTF). The GRR has been the topic of presentations at the LARTF. At the meeting on December 9, 2014, a Sacramento Area Flood Control Agency (SAFCA) representative stated that the dGRR was proposing to do erosion protection work in the area from H street to Watt Ave. In a subsequent meeting, on March 10, 2015, a Corps of Engineers representative stated that erosion protection work was to be in the area from Paradise Beach to Watt Ave. Imagine, then, my shock to discover at the last public information meeting on the dGRR on April 17, 2015, that erosion protection work is proposed on the left (south) bank and levee all the way from the confluence of the American and Sacramento Rivers to the end of the leveed stretch upstream from the Mayhew Drain. Additionally, work on the right bank is proposed upstream from Watt Ave. to about half way between Watt Ave. and the Mayhew Drain.

My purpose in relating the above history is to point out that the Corps (and other agencies?) had recently been considering a much smaller erosion protection work footprint than is presented in the dGRR or the DEIS/DEIR.

I propose an alternative that is taken from comments on the dGRR itself to be submitted by the Save the American River Association:

GG-4

"This alternative could be called 'further study' or 'watch and wait.' It would involve characterization of the river banks (and levees if appropriate) with sufficient detail that small to moderate erosion events could be documented and quantified. Possibly it could include a comprehensive program of bore holes to characterize the subsurface strata between the river and the levees. This work would be conducted either by the local agencies (Sacramento Area Flood Control Agency, Central Valley Flood Protection Board staff) or by a collaboration between the Corps and the local agencies. Over time, this documentation would allow decisions based on facts to guide further efforts, or to decide that further efforts are not needed.... We propose that the left bank from the confluence of the American and Sacramento Rivers to about Paradise Beach should be assigned to this 'further study' alternative. So also would the left bank from about Howe Ave. up to the Mayhew Drain (the Mayhew Levee area) be assigned to 'further study.' Additionally, the right bank upstream from Howe Ave to about half way between Watt Ave. and the Mayhew Drain would be assigned to 'further study.'... The left bank upstream of the Mayhew Drain would be assigned to normal operations and maintenance. The left and right banks between roughly Howe Ave. and Paradise Beach would remain as shown in Figure 4-5. These proposals derive from the flow velocities of the 2D modeling study by Ayers (2004)."

Note that Figure 4-5, cited in the above from the dGRR, is the same as Plate 3 and Plate 4 in the DEIR/DEIS in regard to proposed erosion protection work on Lower American River.

It is critically important that one or more alternatives with smaller footprint(s) for Lower American River erosion protection work be considered in the final environmental document. If this is not the case, the document would be inadequate or deficient under applicable statute and regulations.

GG-5

One other point. The “bank protection” alternative as shown in the lower half of Figure 1 of the DEIS/DEIR (p. 32) has bare rock on the river bank. This method of erosion protection would be significantly improved if the rock was covered with moderately cohesive dirt fill and appropriate vegetation (grasses and shrubs). This would greatly reduce the long-term adverse impacts on vegetation, wildlife, recreation, and esthetics. It would help with public acceptance of erosion protection work. I would note that the rock covering the waterside levee surface in the “launchable trench” alternative is covered with dirt fill and hydroseeded in the upper half of Figure 1. Also, in the dGRR Engineering Appendix Erosion Protection Analysis (Appendix C, Attachment E, p. 64), Figure 6-2 shows the rock covering the river bank is covered with soil. Thus, this is a viable and useful change that should be made to the bank protection alternative.

Thank you for your attention to these comments.

Sincerely

James Morgan

James Morgan

HH

From: Gay Jones [redacted]]
Sent: Monday, May 18, 2015 4:14 PM
To: Baker, Anne E SPK
Cc: [redacted]
Subject: [EXTERNAL] Comments on Draft Environment Impact Statement - EIR (March 2015) and Draft General Reevaluation Report (March 2015)

To Anne Baker,

Thank you for extending the comment period on these reports. However, the broad scope of the aforementioned documents begs for more study.

Following are examples of broad policy concerns and specific area concerns.

1. The best outcome will occur if the USACE works with stakeholder groups at the local level. This cannot be emphasized enough. The Lower American River Task Force is an excellent example of a local stakeholder group. It is imperative to work in concert with local representation. HH-1

2. From the public perspective, the scope of the proposal expanded greatly at the end from what had initially been discussed in print. Hence, more study is necessary. HH-2

3. Due to the numerous variances in the topography, a range of multiple alternatives are needed. HH-3

4. Significant flood control projects have already occurred upstream from Watt Avenue to the Gristmill Recreation Area:

Specifically, the entire levee at Gristmill, including modifications to the Mayhew Drain, was recently completed. This USACE and SAFCA project already meets the American River Parkway Plan 160,000 cfs goal as described on page 100 of your report. HH-4

Rip-rap with soil and plant covering is completed at the four areas deemed important. This includes an area just upstream, river left, from the Waterton Access; the area adjacent to the Larchmont Community Park; and two sites at Gristmill where "rills" occurred during levee construction.

A reassessment for the risk of flooding should be done against the backdrop of these newly completed projects. It seems the "fix-in-place" levee improvements have already been accomplished in these areas upstream, river left, from Watt Avenue.

HH-4 (Cont.)

5. Selected quotes from the American River Parkway Plan used in the report are out of context. "Erosion Control Program" section on page 88 (ARPP) discusses the balancing of many goals, "…relying on methods of protection that minimize habitat impacts…each project must consider the nature of the erosion threat and the most effective method for controlling erosion with the least damage to riparian vegetation, wildlife and the aesthetics of the final product."

HH-5

6. On pages 291 and 292 in your report discussing short term and long term impacts, it seems to justify destroying the habitat to build a levee to protect the habitat. It is a circular argument. The proposal would have such devastating impacts on the environment that there would be no environment to protect.

HH-6

Thank you for the opportunity to briefly comment on your proposals.

Gay Jones

[redacted]

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

May 18, 2015

Ms. Erin Brehmer
Department of Water Resources,
3464 El Camino Avenue Room 200
Sacramento, CA 95821

U.S. Army Corps of Engineers,
Sacramento District,
Attn: Ms. Anne Baker
1325 J Street
Sacramento, CA 95814

Dear Ms Brehmer:

State Water Resources Control Board staff comments on the Draft Environmental Impact Statement/Environmental Impact Report for the American River Common Features General Reevaluation Report

The State Water Resources Control Board staff provides these comments on the Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) for the American River Common Features General Reevaluation Report (Project), to be implemented by the Central Valley Flood Protection Board (CVFPB) in cooperation with the U.S. Army Corps of Engineers (Corps) (State Clearinghouse Number 2009012081).

State Water Resources Control Board (State Water Board) staff have reviewed this report, as noticed at http://www.cvfpb.ca.gov/PublicNotices .

The proposed project would construct fix-in-place levee improvement measures to address seepage, slope stability, erosion, and overtopping concerns identified for the American and Sacramento River, Natomas East Main Drainage Canal, Arcade Creek, Dry/Robla Creeks, and Magpie Creek levees. In addition, the Sacramento Weir and Bypass would be widened to divert more flows into the Yolo Bypass during flood events.

Pursuant to CEQA guidelines, California Code of Regulations (CCR), title 14, section 15096, responsible agencies must specify the scope and content of the environmental information germane to their statutory responsibilities. State Water Board staff has reviewed the Draft EIS/EIR to determine if the proposed Project will have significant adverse impacts to water quality and, ultimately, the beneficial use of waters of the state.

We recognize the great importance of flood protection for the communities and farms of the Sacramento River valley and the tributary streams that would benefit by the proposed project. We understand the enormous economic risk and the risk to human life that exists without a safe, functional levee system. However, significant ecological impacts may result from the proposed project.

II-1 In general, we encourage the Corps and the CVFPB to implement alternatives which conserve to the greatest extent the existing riparian vegetation, especially large mature trees that would not likely pose a threat to the integrity of the levee banks. Alternatives that maximize meander zones should be selected. Setback levees should be used when feasible.

State Water Board staff has prepared the attached comments on the Draft EIS/EIR (see Attachment 1, Table 1). Comments which pertain to the entire project and the entire document, or which are broadly applicable throughout the DEIR/EIS, are presented first. Specific comments about specific sections of text follow in the table, to facilitate location of the sections that are the subject of the comments.

State Water Board staff thanks the CVFPB and the Corps for this opportunity to comment on the proposed project. If you have questions regarding any of the comments in this letter or Table 1, please contact:

Cliff Harvey
Environmental Scientist
(916) 558-1709
clifford.harvey@waterboards.ca.gov

Sincerely,

[Clifford Harvey]
(Pdf submitted via email - signed hard copy to follow by mail)

Clifford Harvey
Environmental Scientist
Division of Water Quality

cc: see next page

cc:

Elizabeth Lee
401 Program Manager
Central Valley
Regional Water Quality Control Board
– Sacramento Office
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

	Table 1: State Water Board Staff Comments on Specific Contents of the Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) for the American River Watershed Common Features General Reevaluation Report (SCH No. 2005072046)			
Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	
GENERAL COMMENTS – JURISDICTION AND AUTHORITIES				
1. AUTHORITY T All waters of the state are protected under California law pursuant to the Porter-Cologne Water Quality Control Act (Porter-Cologne). All surface waters and groundwater are considered waters of the state, which include, but are not limited to, aquifers, drainages, streams, washes, ponds, pools, and wetlands. Surface water bodies may be permanent, intermittent, ephemeral or seasonal. Additional protection is provided for waters of the United States (WOUS) under the federal Clean Water Act (CWA). The Regional Water Quality Control Boards (RWQCB); and in this case, the Central Valley RWQCB, have the responsibility for protecting water quality in accordance with their regional water quality control plans (basin plans). The basin plans provide regulations pertaining to the protection of water quality and implementation measures to carry out the Basin Plan provisions in the region. Any discharges of waste that may affect water quality and, ultimately, the beneficial uses of waters of the state may be regulated by the Water Boards. . II-2 Water Board staff request that the final environmental document refer to the basin plans and incorporate mitigation measures that consider all applicable water quality standards, prohibitions, and provisions found there.				
2. FEDERAL AND STATE JURISDICTION Some waters of the state are "isolated" from waters of the U.S., or do not have a "significant nexus" to WOUS. It is important to note that some of these non-federal waters of the state may occur in the project area, and may be subject to impacts by the proposed project. When impacts may occur as a result of project activity to any waters of the state, regardless of federal jurisdiction,, a Report of Waste Discharge (ROWD) must be submitted to the appropriate Regional Water Quality Control Board, and Waste Discharge Requirements (WDRs) must be obtained from that Regional Water Board before the activity commences.				

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II-3 We request that the Project proponent consult with the Corps and the Water Boards when performing the necessary jurisdictional determinations for surface waters within the project area, to ensure that the full extent both state and federal jurisdictional areas are accurately verified, and to ensure that appropriate regulatory pathways are followed.				
3. BENEFICIAL USE ANALYSES II-4 We request that the FEIR/EIS identify and list the beneficial uses of the identified surface waters, as outlined in the basin plans, and evaluate the project's potential impacts to those beneficial uses. All mitigation measures proposed for the protection of surface waters should present evidence that the mitigation avoids, minimizes or compensates for all potentially impacted beneficial uses.				
4. NEED FOR SYSTEM-WIDE PLANNING CONTEXT: II-5 Project planning should be conducted in the context of ecosystem-wide assessments and evaluation of the existing system for long term sustainability.[1] This includes sustainability of the Sacramento Flood Control System from a flood risk reduction perspective and an ecosystem restoration perspective (providing more frequently inundated floodplain habitat and allowing natural river processes to continue). Coordination with SAFCA projects is needed. How the Project compliments the Central Valley Flood Conservation Strategy should be highlighted (http://www.water.ca.gov/conservationstrategy/)				
8. RELIANCE ON ASSUMPTIONS THAT VARIANCES AND A PROPOSED SYSTEM WIDE IMPROVEMENT FRAMEWORK (SWIF) WILL BE DEVELOPED As stated in section 1.1 (p. 1) *"The alternatives being analyzed assume a vegetation variance would be obtained for the lower one half of the waterside levee slope on all waterways. This would allow vegetation to remain in place unless required for construction. Additionally, the No Action alternative assumes that the non-Federal sponsor would prepare a System Wide Implementation Framework (SWIF) to bring the levees into compliance with*				

[1] See, for example, Florsheim, J. et al. 2008. BioScience (2008) 58 (6): 519-529. doi: 10.1641/B580608 http://bioscience.oxfordjournals.org/content/58/6/519.full

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Corps' Engineer Technical Letter (ETL) 1110-2-583 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures over the next 20 to 40 years."

This is reiterated in section 1.4.5 (p. 11) where vegetation and encroachment compliance are discussed. Throughout the EIR-EIS, it is assumed that a variance from the Corps would be obtained to allow for greater retention of existing vegetation than the baseline provided in the Corps ETL 1110-2-583..

Impacts and mitigations described are contingent upon adoption of a System Wide Improvement Framework (SWIF). The SWIF is an agreement between the Corps and the non-Federal sponsor that allows the [local management agency] LMA to defer compliance with [the Corps rules on vegetation management for levees] ETL 1110-2-583. This proposed Framework is not yet adopted, and may take many different forms when it is completed.

II-6

These uncertainties lie at the basis of the entire analysis presented. No alternatives are discussed for cases where the Corps denies variance requests. Discussion of the range of possible forms that future SWIF agreements is not presented.

For these reasons, the alternatives presented do not represent a full range of possibilities. Alternatives that describe impact scenarios in the absence of a Corps variance should be provided. Alternatives that describe a reasonable range of forms that the SWIF may take are also needed.

9. INCLUSION of SAFCA PROJECTS IN THE "FUTURE WITHOUT PROJECT CONDITION"

The Sacramento Area Flood Control Agency (SAFCA) is preparing an *Environmental Impact Report for the North Sacramento Streams, Sacramento River East Levee, Lower American River, and Related Flood Improvements/Levee Accreditation Project*; this document is being prepared simultaneously with the proposed American River Common Features Project. This proposed SAFCA project would affect many miles of levees in the Common Features Project area, and proposes to do so on a schedule that could be in advance of many Common Features Project elements by many years.

II-7 Consideration of these proposed SAFCA projects should be provided in this "Future Without Project Condition" section of the EIR. A discussion of how these SAFCA projects would interact with the proposed Project should also be provided.

	Table 1: State Water Board Staff Comments on Specific Contents of the Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) for the American River Watershed Common Features General Reevaluation Report (SCH No. 2005072046)

Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	
COMMENTS ON SPECIFIC TEXT IN THE DOCUMENT				
10	ES		12	**DREDGE AND FILL IMPACTS TO WATERS OF THE STATE NOT DISCLOSED OR DISCUSSED IN THE EXECUTIVE SUMMARY.** II-8 Table ES.3 summarizes environmental effects and mitigation measures for three project alternatives. No effects are listed for direct impacts to surface waters of the state, including waters of the U.S. Table ES.3 mentions effects to Hydrology, Water Quality, Special Status Species, Vegetation and Wildlife. None of these topics adequately discloses impacts to waters due to the physical manipulation of the channels and levees that are to modified by the proposed Project. The Executive Summary the Final EIR/EIS should address these effects specifically; it should not be assumed that vegetation or habitat impacts are the same as impacts to waters.
		1.4.5	12	**VEGETATION AND ENCROACHMENT VARIANCE** **SWIF = system wide improvement framework** "The ARCF GRR project description (Section 2.0 below) assumes that the variance and SWIF agreements are both in place. The variance is included as a part of the proposed alternatives, while the SWIF would be a part of the future condition, both with or without the project in place" • II-9 What happens if the variance is not approved? • II-10 When is action by the Corps on the variance request expected? II-11 Much of the concern regarding levee improvements focuses on the disposition of vegetation, especially large, old trees, that are within or near the levee footprint. The proposed SWIF criteria cited in the Draft EIR/EIS states that, "Based on the engineering inspection and

		Table 1: State Water Board Staff Comments on Specific Contents of the Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) for the American River Watershed Common Features General Reevaluation Report (SCH No. 2005072046)			
	Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	
II-11 (Cont.)					evaluation, trees and other woody vegetation that do not pose an unacceptable threat need not be removed (bullet 1).” Bullet two continues: “In cases of levee repair or improvement projects, vegetation within the project footprint shall be removed as part of construction activities. “ This statement should be qualified as per the SWIF criteria above to emphasize that vegetation in the project footprint that does not pose an unacceptable threat need not be removed.
II-12		**3**	3.6.1	94	The regulatory setting for vegetation and wildlife impacts lists only local government agencies and ordinances. The Regional Water Quality Control Board, through the Clean Water Act section 401 certification process, should be included. Inclusion of the Department of Fish and Wildlife and the US Fish and Wildlife Service, and the various species and habitat protection laws they enforce, would also be appropriate here.
II-13		**3**	3.6.2	97-98	Chapter 3.6 describes the affected environment and environmental consequences of the alternatives proposed on vegetation and wildlife. In particular, section 3.6.2 describes the methodology and basis of significance used for this analysis. One effect described which could rise to the level of significance is: *“Substantial effects on a sensitive natural community, including Federally protected wetlands and other waters of the U.S., as defined by Section 404 of the Clean Water Act.”* This statement of significance does not recognize the need for protections of wetlands and other waters under state law. Recommended rewording of this statement: *Substantial effects on a sensitive natural community, including all waters of the state as defined by Porter-Cologne, which may also include Federally protected wetlands and other waters of the U.S., as defined by Section 404 of the Clean Water Act.*

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	Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	
II-13 (Cont.)					Note again that protection of vegetation and habitats that occur as wetlands, streams and associated riparian areas does not necessarily provide protection of all beneficial uses of waters of the state. The link between habitat functions, hydrologic functions, and water quality and protections provided under CWA section 404 and 401, and Porter-Cologne should be clearly disclosed as part of the discussion of impacts, significance, and mitigation proposals.
II-14			3.6.6	103	Loss of very large native trees is a significant concern for water quality as well as for fish and wildlife. The discussion of vegetation impacts and mitigations often does not clearly distinguish between loss of smaller trees (which grow back to size sooner) and loss of tall, old riparian and near floodplain overstory trees such cottonwoods. These take many decades to replace. The temporal lag for loss of this riparian forest element is therefore significant, and it may not be possible to fully mitigate for this loss. Analysis of all water quality effects, such as loss of shading on water temperature over time, associated with the loss of very large trees should be provided and should be considered when making mitigation plans.
II-15			3.6.6	103	Compensatory mitigation is proposed as follows: *"To compensate for the removal of 65 acres of riparian habitat, approximately 130 acres of replacement habitat would be created. Species selected to compensate for the riparian corridor removal would be consistent with the approved list of trees, shrubs, and herbaceous plants native to the Parkway."* How and where would this "habitat" be created? While the State Water Boards may not consider some riparian areas to be waters of the state and U.S., impacts to riparian areas often lead to adverse effects on water quality – including, but not limited to, impacts to aquatic plants and wildlife. For this reason, the State Water Board recommends that proposals for riparian mitigation are clearly described in the EIR-EIS. Although riparian mitigation sites may not be permitted under CWA section 404 or as dredge and fill discharges under Porter-Cologne, State Water Board staff would categorize compensatory mitigation sites in a manner that is consistent with the Clean Water Act

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	Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	
II-15 (Cont.)					mitigation rule, the "404(b)(1) guidelines," In these guidelines, we find that *Compensatory mitigation* means "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts." The term "creation" is generally avoided in favor of the term "establishment." If the proposed mitigation sites could appropriately be characterized by this definition, the EIR should acknowledge that the CWA definitions are in use. If some other definition is intended, that definition should be provided as part of the proposal.
II-16			3.6.6	103	What is the source of approval for this "approved list" of plants to be used in this mitigation effort? Recent research is showing that a diverse set of plants is needed for successful revegetation efforts. In addition to the common species, representatives of the uncommon species – which may make up a large proportion of the species list of a site, but only a very small percentage of overall prevalence or dominance – is necessary at the planting stage. These less common species have been shown to not repopulate areas after revegetation with dominant species, even decades after restoration work. Timing of revegetation is also critical in that it should not be assumed that a single episode of planting can be sufficient. Repeated cycles of planting over many years should be considered to help mimic natural patterns of recruitment and succession.
II-17			3.6.6	103	Compensatory mitigation site plans and restoration plans for areas of temporary disturbance should include a long term commitment to monitoring of the performance and condition of the site. All monitoring and assessment should be conducted using methods that are consistent with guidance provided by the California Water Quality Monitoring Council.
II-18			4.2.4,	286	The discussion of cumulative effects on special status species focuses on condition of riparian vegetation, and once again assumes issuance of a variance from the Corps. No discussion or analysis of alternatives where the variance is not obtained is provided.

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Com-ment No.	**Chapter**	**Section/ Sub-section**	**page**	

JJ

Department of
Community Development
Lori A. Moss, Director

Divisions
Administrative Services
Building Permits & Inspection
Code Enforcement
County Engineering
Economic Development & Marketing
Planning & Environmental Review

May 22, 2015 Via Email: Anne.E.Baker@usace.army.mil

U.S. Army Corps of Engineers
Sacramento District, Attn: Ms. Anne Baker
1325 J Street
Sacramento, CA 95814

County of Sacramento Comments on the Draft EIS/EIR for the American River Common Features GRR

Dear Ms. Baker:

Thank you for providing Sacramento County the opportunity to provide comments on the proposed project's Draft EIS/EIR (Document). These comments supplement the comments we provided verbally to the recorder at the April 15th meeting at the Tsakopoulos Library Galleria. The County's concerns are primarily related to impacts to the American River Parkway (Parkway) and secondarily associated with the project's
JJ-1 proposed soil borrow operations. Our concerns with the Parkway analysis include impacts that have not been evaluated and a lack of specificity in the project and alternatives descriptions.

JJ-2 This project may result in loss of use, access, and subsequently, revenue, to the
Sacramento County Department of Regional Parks (Parks Department), through daily
fees, special event fees, annual pass sales, and other park revenues. In particular,
JJ-3 potential impacts to the Campus Commons Golf Course were not disclosed. In
JJ-4 addition, project areas may not have viable detour routes for equestrians on the
Parkway's designated equestrian/hiking trails. Access to angling, wildlife viewing,
JJ-5 rafting and other river-based activities may be limited by construction activities.
Furthermore, special events such as Eppie's Great Race, May is Bike Month activities,
JJ-6 fun runs, and other trail-based events use facilities that could be closed, detoured out of
the Parkway, or otherwise impacted by construction. All of these impacts may result in
loss of Parks revenue, which should be mitigated.

In addition to loss of revenue, the Parks Department may incur additional costs due to
the construction of this project. New ramps and haul roads may increase social trails
JJ-7 (unofficial trails) and visitor use in some areas, leading to additional natural resource
damage, fire risk and suppression costs, social trails management, maintenance, and
ranger patrol to areas not previously utilized by the public. The additional on-going

costs to manage these areas could be mitigated through funding a social trails management plan.

JJ-8 The Document describes the impacts associated with detouring traffic from the paved trails on the American River Parkway. To avoid past USACE contractor difficulties of communicating trail detour information, we recommend that mitigation include funding a public outreach program that is staffed by Parks Department personnel. A Parks Department staffed outreach program would maximize communication with the target audience, minimize confusion, and provide greater overall coordination to better mitigate recreational impacts. Mitigation, of longer term construction detours, on the south side of the Parkway, could also include completion of the planned Two Rivers Trail, to provide alternative detour options that minimize the impacts of detouring traffic onto surface streets.

JJ-9 We would like the project to have the potential to consider borrow sites on the American River Parkway, as there may be areas where park managers desire floodplain lowering. JJ-10 In addition, please be advised, that many of the proposed borrow sites will require County and State permitting, pursuant to the Surface Mining and Reclamation Act (SMARA). The County Department of Community Development is the SMARA lead agency for unincorporated Sacramento County and should be contacted early in the process once a borrow site is known.

In addition to the comments above, we request clarification regarding the clearing and stripping of small vegetation on bank protection sites:

JJ-11
1. What criteria are established to determine which vegetation is large and which is small?

JJ-12
2. If large trees are to be left in place, will these trees be considered in the hydraulic modeling for conveyance? And if modeled, will this information be sufficient to replace these trees (with new plantings) when they die without having to re-model the roughness coefficient and conduct new permitting through the Central Valley Flood Protection Board.

JJ-13
3. What kind of vegetation, both planted and naturally occurring, will be allowed to occur on top of either alternative?

JJ-14
4. Will trees that die during or after the project is completed, due to construction impacts, be mitigated?

JJ-15
5. Figure 1 of the bank protection area does not include a planting berm, but it is indicated in the text: Should a planting berm be indicated in Figure 1 and how would it work?

JJ-16
6. The discussion of the vegetation variance in section 1.4.5 appears to be specific to the Sacramento River: Will this variance also apply to the levees on the American River?

JJ-17
7. Have project impacts been evaluated should the vegetation variance not be applied to the American River levees?

JJ-18

8. As an element of the restoration of disturbed areas, native grasses and small shrubs would be planted "where appropriate." What criteria are used to determine the appropriateness of the replanting?

JJ-19

9. In the "no action" alternative, it is assumed that the land and habitat loss will happen over time: Can this loss, and timing of loss, be estimated with existing modeling?

We also have reservations and concerns about the consequences of choosing launchable rock trench for protection of the Parkway levee. Our specific questions include:

JJ-20

1. The design indicates a maximum width of 70 feet and 23 foot deep trench: Is the 70 foot width measured at the bottom or the top, and what is the total footprint required to terrace a 23 foot deep trench?

JJ-21

2. In the "no action" alternative, the expected bank erosion is listed as a significant impact, while at the same time; the launchable rock trench also would allow significant bank erosion to occur: Why are the impacts of the launchable rock trench, including the loss of habitat and land, not disclosed as significant project impacts?

We understand from participating in the April 15th public comments session that this Document was written at a program level, but this was not apparent in the Document itself. Please clearly state in the Document that there will be additional project level
JJ-22 environmental analysis, with a commitment to additional outreach and cooperative planning. Ongoing coordination of site specific designs on the Parkway should also be
JJ-23 coordinated with recommendations from the Lower American River Task Force.

If you have any questions please contact John Lundgren at (916) 874-8043 or lundgrenj@saccounty.net.

Sincerely,

for - Catherine Hack
Environmental Coordinator

C: Jeff Leatherman, Director
Sacramento County Regional Parks

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Assembly
California Legislature

KEN COOLEY
ASSEMBLYMAN, EIGHTH DISTRICT

COMMITTEES
ACCOUNTABILITY AND ADMINISTRATIVE REVIEW
GOVERNMENTAL ORGANIZATION
INSURANCE
RULES (D-ALT)

SELECT COMMITTEES
CHAIR: COMMUNITY AND NEIGHBORHOOD DEVELOPMENT
COMMUNITY COLLEGES
JOB CREATION FOR THE NEW ECONOMY
GOVERNMENT EFFICIENCY, TECHNOLOGY AND INNOVATION
ASIA/CALIFORNIA TRADE AND INVESTMENT PROMOTION

ALFRED E. ALQUIST SEISMIC SAFETY COMMISSION

June 1, 2015

Ms. Anne Baker
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814

RE: American River Common Features

Dear Ms. Baker,

I am writing to encourage the Army Corps of Engineers, Sacramento District, to continue to work with local districts and agencies as they move forward with the proposed levees along the American River Parkway.

The American River Parkway is of great value to our community. I understand the importance of your work, and appreciate the considerations that are being undertaken during the planning stages of this project. However, I do encourage you to consider the feedback from agencies such as Sacramento Regional Parks and the Butterfield - Rivera East Community Association.

It is my firm belief that by working together, a plan can be made that will balance safety and flood resilience with access to natural habitats and recreation areas. Again, I thank you for your diligent work on this matter. Please do not hesitate to reach out to me should you ever require my assistance.

Sincerely,

Ken Cooley

Ken Cooley
Assemblymember, 8th District

Comment Number	Commenter	Method of Submission	Category	Response
A-1	Sandra Maxwell	Public Meeting Transcript	Flood Insurance	Verano Street is not located immediately adjacent to any of the planned work activity areas. The proposed project would strengthen levee stability and improve flood protection for the Sacramento region. The determination of flood insurance rates does not relate to the environmental analysis contained in the EIS/EIR. Cleanup of trash and other debris is a City and/or County maintenance issue.
B-1	Beverly Nason	Public Meeting Transcript	Construction Impacts	Comment noted. Minimization and mitigation measures are proposed to reduce potential impacts from construction vibration.
B-2	Pamela Bigelow	Public Meeting Transcript	O&M and Construction Impacts	The trees that would be removed as part of the ARCF GRR are limited to the trees that would be directly impacted by construction of the project. The Corps understands the commenter's concerns related to the use of staging areas within existing developed neighborhoods. However, such staging areas are necessary to carry out the proposed project. The Corps will minimize disturbance in the staging areas to the extent feasible. The commenter's concern for this potential fire hazard is appreciated and this issue will be brought to the attention of the appropriate State levee maintenance agency.
B-3	Shirley Short	Public Meeting Transcript	Public Meeting Format	The purpose for the public meeting was to provide interested members of the public and agencies with an opportunity to provide comments on the environmental analysis and to respond to questions regarding the proposed project.
B-4	Craig Carroll	Public Meeting Transcript	Vegetation Removal, Privacy During Construction, and Encroachment removal.	Under the ARCF GRR, the trees proposed for removal are limited to the trees that would be directly impacted by construction of the project. High hazard tree removal is a separate action being conducted by SAFCA. The Corps tagged trees in 2011 as part of preliminary vegetation surveys that were used to establish a baseline condition and effects analysis for this EIS/EIR. The Corps tags do not indicate that a tree is proposed for removal. The Corps appreciates the commenter's concern over privacy during construction; however privacy fences between construction activities and adjacent properties are not proposed as part of the project. Permitted encroachment removal would be coordinated between the non-federal sponsors and the owners, and would be replaced following construction.
C-1	John Lundgren, on behalf of Jeff Leatherman	Public Meeting Transcript	Recreation Impacts	The recreation section of the EIS/EIR has been updated with more detail, including these concerns. The Corps is committed to coordinating with County Parks prior to implementation of construction.
C-2	John Lundgren	Public Meeting Transcript	Borrow Sites	The Corps or its contractor would consult with Sacramento County and ensure receipt of all applicable permits prior to construction. The Corps has not proposed any activities in the Dry Creek Parkway, however SAFCA has proposed a borrow site within the parkway. SAFCA would coordinate with Sacramento County regarding any work in the Dry Creek Parkway if that borrow site is selected for use.
D-1	Pat Hara and Jack Burrows	Public Meeting Transcript	Flood Insurance	This comment does not relate to the environmental analysis contained in the EIS/EIR; the comment is noted.
D-2	Judith Scott	Public Meeting Transcript	Public Meeting	Thank you for your comments.
E	Lissa McKee	Comment Sheet	Various	Thank you for your comments.
F	Carolyn Baker	Comment Sheet	Tree Removal	SAFCA intends to implement the specific levee improvements in the North Sacramento Streams and Sacramento River East Levee areas; other improvements identified in the ARCF GRR would be implemented by the Corps. The Corps Sacramento District will apply for a variance to the vegetation policy and if granted would only remove vegetation within the footprint necessary for construction under the ARCF GRR. The local maintaining agencies are responsible for any further vegetation maintenance activities.

G	Ellen Broms	Comment Sheet	O&M and Construction Impacts	SAFCA understands the commenter's concerns related to the use of staging areas within existing developed neighborhoods. However, such staging areas are necessary to carry out the proposed project. SAFCA will minimize disturbance in the staging areas to the extent feasible. SAFCA's Vegetation Management Decision Key (included as Appendix B of the Levee Accreditation Program DEIR) states that fruit- and nut-bearing trees will be assessed and removed from both landside and waterside levee slopes. Fruit- and nut-bearing trees at these locations were identified as high-hazard trees for removal as part of the proposed project. The locations of trees that would be removed as part of the proposed project are shown on Exhibit 3-17 in Chapter 3, of SAFCA's EIR "Project Description" (page 3-110 of the DEIR).
H	Mary Schwartz	Comment Sheet	Public Meeting Format & Construction Schedule	The Corps will ensure that the commenter's address is added to the final mailing list. Comments regarding meeting format and schedule are noted.
I-1	Dan Kopp	E-mail	Vegetation Removal	The tagged trees by your house may not necessarily be associated with this project, but your description of the locations of the tagged trees sound like they could be from the 2011 tree survey that was conducted by this project. The 2011 tree survey was conducted as preliminary information only and does not necessarily indicate that the trees will be removed. The trees were tagged and logged into a GIS database for data purposes only. No trees have been definitely identified for removal at this time. In the preconstruction engineering and design phase of the project following Congressional authorization, site-specific analysis would be conducted prior to construction to determine specific impacts, including which trees would be need to be removed for construction purposes only.
I-2	Dan Kopp	E-mail	Wildlife Impacts	Tree removal would occur outside of the nesting season and would be monitored by a biologist to ensure that no impacts occur to nesting birds.
I-3	Dan Kopp	E-mail	Typos	Thank you for your comment.
J-1	Stan Jones	E-mail	Public Accessibility During Construction	It is unclear what the purpose would be for providing "viewing areas" for members of the public to see the project-related construction activities. Furthermore, such "viewing areas" would result in a safety hazard for members of the public in proximity to construction equipment, and would not reduce the environmental impacts of the proposed project in any way.
J-2	Stan Jones	E-mail	Public Levee Access	Levee encroachments would be replaced following construction based on existing CVFPB encroachment permits.
J-3	Stan Jones	E-mail	Tree Removal	SAFCA proposes to remove high hazard vegetation as a part of their Levee Accreditation Program. The specific locations of proposed high hazard vegetation can be found in SAFCA's EIR on Exhibits 3-18 (Chapter 3, "Project Description"), and 4.6 3a through 4.6 3d (Section 4.6, "Biological Resources – Terrestrial"). Details regarding the evaluation criteria for trees and other vegetation that would be removed are contained on pages 3 48 through 3 50 of Chapter 3, "Project Description," and in DEIR Appendix B.
K-1	Janet Fullwood	E-mail	Seepage	Both SAFCA and the Corps propose to address seepage concerns through the construction of seepage cutoff walls, including at the location of the commenter's home.
K-2	Janet Fullwood	E-mail	O&M	SAFCA is proposing to construct the seepage and stability improvements in this portion of the ARCF project area. SAFCA will bring this issue to the attention of the appropriate State levee maintenance agency. SAFCA also notes that proposed Conservation Strategy Policy SSP-1 requires that construction vehicles and equipment must be cleaned inside and out at an authorized washing facility before arrival at the project construction areas and must be inspected in an attempt to ensure they are free of soil and debris that could harbor nonnative plant seeds, roots, or rhizomes. If invasive or noxious weeds are already present in portions of the project areas, vehicles must be cleaned before moving from infested areas to areas that are weed free. Exterior cleaning must consist of pressure washing vehicles and equipment, with close attention paid to the tracks, feet, and/or tires and on all elements of the undercarriage. Vehicle cabs must be swept out, and refuse must be disposed at an approved off-site location.
L	James Geary	E-mail	Public Levee Access	Levee encroachments would be replaced following construction based on existing CVFPB encroachment permits.
M	Maggie Beddow	E-mail	Public Levee Access	Levee encroachments would be replaced following construction based on existing CVFPB encroachment permits.

N-1	United Auburn Indian Community of the Auburn Rancheria	E-mail	Alternatives	CEQA Guidelines 15126.6(e)(2) refers to the identification of the No Action Alternative, which was included in accordance with the cited regulations. Identification of the Least Environmentally Damaging Practicable Alternative (LEDPA) is required as a part of the Section 404(b)(1) Analysis and is included in Appendix E of the EIS/EIR. For this project, Alternative 2 is identified as the LEDPA.
N-2	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps attempts to avoid impacts to known cultural resources wherever possible. The consideration of setback levees, stability berms, and seepage berms, is made and incorporated where feasible. The Corps welcomes the opportunity to consider the specific design features the UAIC would like incorporated to reduce the potential for direct cultural impacts. Corps cultural resources staff followed up with UAIC in a letter dated July 7, 2015, in a staff-to-staff consultation meeting on August 6, 2015, and in emails dated August 10 and 17, 2015 requesting this specific information. The Corps has not only consulted during the planning phase, and will continue to consult with UAIC throughout the design and construction phases of the project.
N-3	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps values the role that Native American tribes, including the UAIC, has as a Tribe, government, and partner. UAIC is identified within Section 5.0 (Compliance with Applicable Laws, Policies, and Plans) as a Native American tribe. Within Section 6.0 (Consultation and Coordination) there is extensive description of efforts to consult with tribes, including UAIC. These concerns and a process for addressing them are reflected in the Programmatic Agreement for ARCF as well as the EIS/EIR. As a consulting party, the UAIC, and its comments, are given consideration by the Corps from the initiation of consultation through to the fulfillment of the Section 106 process, and in many cases, beyond. The Corps has not only consulted during the planning phase, and will continue to consult with UAIC throughout the design and construction phases of the project.
N-4	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps appreciates the opportunity to consider tribe/tribal values throughout the document. The Corps has added to section 3.9.1 "Cultural Resources Site Types" descriptions for Traditional Cultural Properties and Traditional Cultural Landscapes which address sites of importance to tribes, and are resource category types directly related to tribal values that tribes have indicated to the Corps are important. Language has been added to ES.9 (Areas of Controversy and Unresolved Issues) to consider effects to cultural resources and resources significant to tribes.
N-5	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The NEPA/CEQA process allows participation through the public comment period. Further, we are currently engaged in government-to-government consultation with the UAIC. The Corps and the CVFPB will provide the updated EIS/EIR to the Tribe at the next public review period (tentatively scheduled for January 2016) and welcome the Tribe's ongoing participation at that time.
N-6	United Auburn Indian Community of the Auburn Rancheria	E-mail	Alternatives	The Corps has considered a reasonable range of alternatives, as required by NEPA. The Corps considered a wide variety of alternatives to reduce flood risk to the city of Sacramento. Further, the Corps provided an extensive explanation for all alternatives considered, but not carried through. Because the levees surrounding the City are in such poor shape, the most effective plan to reduce that risk is to improve the existing levees in place. A setback levee with a seepage berm is recommended for the Sacramento Bypass north levee which would approximately double the floodplain area. The remainder of the levees are adjacent to urban development with little to no available land for a levee setback or seepage berm. These levees would be improved with a slurry cutoff wall through the center of the levee. The top half of the levee would be removed to create a construction platform while the bottom half of the levee on both sides would remain intact.

N-7	United Auburn Indian Community of the Auburn Rancheria	E-mail	Public Review	The Corps and CVFPB would supplement the EIS/EIR in accordance with NEPA/CEQA regulations, if needed. Under CEQA, a lead agency is required to recirculate an EIR when significant new information is added to the EIR after public notice is given of the availability of the draft EIR for public review under Section 15087 but before certification. As used in this section, the term "information" can include changes in the project or environmental setting as well as additional data or other information. New information added to an EIR is not "significant" unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project's proponents have declined to implement (14 CCR Section 15088.5). Under NEPA, the Corps shall prepare supplements to either draft or final environmental impact statements if: (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR 1502.9[c]). Additionally, under NEPA the Corps is required to circulate the Final EIS to the public prior to approval. Currently release of the Final EIS is tentatively scheduled for early 2016.
N-8	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps appreciates UAIC's suggestion to evaluate effects to cultural resources and propose treatment prior to construction beginning. The Programmatic Agreement (PA) (Enclosure 1 of Appendix C of the DEIS/DEIR) includes stipulations (Stipulation III - "The HPMP [which provides the framework by which remaining identification, evaluation of eligibility, findings of effect, and resolution of adverse effect efforts] shall be developed after execution of the Agreement, but before construction commences." and Stipulation IV - "The Corps shall complete any identification and evaluation, and as necessary, any evaluation of effects to Historic Properties prior to proceeding with construction") for the identification and evaluation of cultural resources as construction details become available. Additionally, the PA outlines many potential treatment options for adverse effects to historic properties, not limited to data recovery. These potential treatment options would be developed in consultation with the SHPO and Native American tribes.
N-9	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps has added to section 3.9.1 "Cultural Resources Site Types" descriptions for Traditional Cultural Properties and Traditional Cultural Landscapes which address sites of importance to tribes, and are resource category types directly related to tribal values that tribes have indicated to the Corps are important. The PA includes procedures to consult with tribes on identification, eligibility, and evaluation determinations (Stipulations III, IV, VI, XI) for sites of importance to tribes, throughout its implementation.
N-10	United Auburn Indian Community of the Auburn Rancheria	E-mail	Alternatives/Cultural	Preservation in place is considered as a potential mitigation for cultural resources. Where appropriate, avoidance is the preferred mitigation measure. The Corps has added to section 3.9.1 "Cultural Resources Site Types" descriptions for Traditional Cultural Properties and Traditional Cultural Landscapes which address sites of importance to tribes, and are resource category types directly related to tribal values that tribes have indicated to the Corps are important. The PA includes procedures throughout implementation to consult with tribes on identification, eligibility, and evaluation determinations (Stipulations III, IV, VI, XI) for sites of importance to tribes.
N-11	United Auburn Indian Community of the Auburn Rancheria	E-mail	Utilities/Cultural	Utility relocations, including PG&E lines, are addressed in the EIS/EIR under the Utilities Section (Section 3.16). There is the potential that relocation of underground utility lines could impact cultural resources. During the design phase of the project, site-specific analysis would occur prior to construction, including any impacts associated with utility relocations and associated cultural resources impacts. The Corps will continue to consult with UAIC throughout the design and construction phases of the project.

N-12	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cumulative/Cultural	The cumulative impacts to cultural resources are considered in the EIS/EIR. NEPA and CEQA require the consideration of unavoidable impacts to cultural resources, to include cumulative impacts. The cumulative impact section does not state that "cultural resources are typically not subject to cumulative effects". The document states that "cumulative overall impact to non-renewable cultural resources is likely, as well as significant and unavoidable." The section further states that the project is addressing effects (to include mitigation) through the execution of a PA.
N-13	United Auburn Indian Community of the Auburn Rancheria	E-mail	Borrow/Staging	At this time, no borrow sites and staging areas have been identified for the project. Typical impacts of borrow activities have been analyzed throughout the EIS/EIR, including some updates in the Final EIS/EIR based on project review. If additional impacts occur beyond those described in this EIS/EIR, the Corps would produce a supplemental NEPA/CEQA document, as appropriate.
N-14	United Auburn Indian Community of the Auburn Rancheria	E-mail	Vegetation	For the purposes of this EIS/EIR, the Corps took a conservative approach in analyzing wetlands, and considered all potential wetlands jurisdictional. Wetland delineations will be conducted on a site-specific basis prior to construction. If the delineation determines that there are significant impacts to wetlands beyond those addressed in this document (Sections 3.5, 3.6, and 3.8), then a supplemental NEPA document may be required.
N-15	United Auburn Indian Community of the Auburn Rancheria	E-mail	Construction Details	A Corps project does not take into consideration the requirements for FEMA. Local entities work directly with FEMA to determine if they are in a regulatory floodplain and the implications of any land use restrictions. For bank protection work on the Sacramento River, it is likely that barges will be used.
N-16	United Auburn Indian Community of the Auburn Rancheria	E-mail	NEPA	During the preconstruction engineering and design phase of the project, the Corps will be designing each phase of the project on a site-specific basis. During this site-specific design, an analysis will be conducted to determine whether the impacts are consistent with those described in this EIS/EIR or whether supplemental NEPA analysis would need to occur.
N-17	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	Thank you for your comment regarding the potential need for vibration or compression effects of the project on cultural resources. These types of studies have not been conducted but may be considered appropriate at a later stage of the project once more specific design details are known. Effects to historic properties will be evaluated in accordance with Stipulations III and IV of the PA.
N-18	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	Thank you for your comment regarding the potential need for vegetation impacts of the project on cultural plants, including mounds or cultural landscapes. These types of studies have not been conducted but may be considered appropriate at a later stage of the project once more specific design details are known. During the design phase, site specific analysis would occur and localized effects at each site would be evaluated to determine what additional studies may need to occur.
N-19	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	The Corps appreciates the suggestion and will consider this as future mitigation for the project, which would be determined through the execution of the PA. At present the Corps is not aware of an existing mitigation bank for cultural resources.
N-20	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	Regarding post-approval technical studies for cultural resources, 36 CFR Part 800.14(b)(1)(ii) allows that a PA be used when effects on historic properties cannot be fully determined prior to approval of an undertaking. Specific to the project, the PA will allow for the Corps to follow the Section 106 process to identify historic properties, evaluate their National Register eligibility, assess potential adverse effects, and, if necessary, resolve adverse effects. Regarding other technical studies, the ARCF GRR is a study that evaluates the alternatives and proposes a plan for authorization by Congress. Following Congressional authorization, further studies will occur during the design phase, including site specific engineering and environmental analyses, such as construction plans and specs, wetland delineations, and other more detailed design-level efforts.
N-21	United Auburn Indian Community of the Auburn Rancheria	E-mail	Climate Change	Raising structures was analyzed in the initial array of alternatives in the GRR under "Non-structural Measures" and eliminated from further consideration, and explained why. In the EIS/EIR, this process is summarized in Section 2.1.2 under "Non-Structural Measures".

N-22	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	Under "Cultural Resource Types" there is a section that describes Traditional Cultural Properties (TCPs) that is directly quoted in part from National Parks Service Bulletin 38. A section to describe the Advisory Council on Historic Preservation's definitions of traditional cultural landscapes has also been added to this section. The Corps will continue to consult with the UAIC and other tribes throughout the implementation of the project regarding the importance of place, setting, and landscape to the tribe and will follow up with a request for this information.
N-23	United Auburn Indian Community of the Auburn Rancheria	E-mail	Cultural	NAHC is listed in the EIS/EIR's list of recipients as a State agency that received a copy of the draft report.
O-1	California Department of Transportation	Letter	Bridge Design/H&H	Concur. The Corps will evaluate site-specific conditions, including impacts to critical bridges during site-specific design in the design phase of this study known as Preconstruction, Engineering and Design (PED).
O-2	California Department of Transportation	Letter	Bridge Design	Where project features interface with Caltrans bridges, appropriate steps in PED phase will be taken to coordinate bridge access.
O-3	California Department of Transportation	Letter	Bridge Design/H&H	Concur. The Corps will evaluate site-specific conditions, including impacts to bridge embankments during site-specific design in the design phase of this study known as Preconstruction, Engineering and Design (PED).
O-4	California Department of Transportation	Letter	Bridge Design	Any bridge modifications to incorporate project features will be designed based on current Caltrans design codes and criteria.
O-5	California Department of Transportation	Letter	Bridge Design	Project flood features, including floodwall and levee heights, will be coordinated during PED phase.
O-6	California Department of Transportation	Letter	Transportation	Prior to construction, the Corps and/or its construction contractor will prepare a Traffic Control and Road Maintenance Plan. Hauling by barge is possible for bank protection repairs on the Sacramento River. For this measure, the Corps will consider hauling by barge to reduce truck traffic impacts.
O-7	California Department of Transportation	Letter	Transportation	Detours would be provided during construction for all impacted bike trails. Levee encroachments would be replaced following construction based on existing CVFPB encroachment permits.
O-8	California Department of Transportation	Letter	Transportation	The Corps will continue to provide documents to CalTrans for review, as appropriate.
P-1	California Department of Fish and Wildlife	Letter	Biological Resources	Section 3.6 has been expanded to include analysis of habitat types in the study area, including sensitive habitats. State-listed species have been added to the analysis in Section 3.8.
P-2	California Department of Fish and Wildlife	Letter	Vegetation	Section 3.6 has been expanded to include impact analysis to sensitive species. Habitat maps of the study area have been added as Appendix B of the EIS/EIR.
P-3	California Department of Fish and Wildlife	Letter	Fisheries	The analysis in Section 3.7.5 has been expanded to elaborate on potential impacts to fish species in the Sacramento Bypass, to include fish passage through the bypass and stranding.
P-4	California Department of Fish and Wildlife	Letter	Fisheries	The impact analysis in Section 3.7.4 has been expanded to address predation at bank protection sites.
P-5	California Department of Fish and Wildlife	Letter	Vegetation	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
P-6	California Department of Fish and Wildlife	Letter	Fisheries	The Corps is not proposing to alter the existing Sacramento Bypass under this action. The Corps is proposing to design the newly widened Sacramento Bypass in a manner to ensure positive drainage, which would prevent further stranding of fish in this area.
P-7	California Department of Fish and Wildlife	Letter	Agriculture	Concur. The final EIS/EIR will be updated to reference the current land uses in the proposed widened Bypass area.

P-8	California Department of Fish and Wildlife	Letter	Land Use	After project construction, the CVFPB will evaluate the appropriate course of action regarding the future land use in the Bypass.
P-9	California Department of Fish and Wildlife	Letter	Recreation Impacts	The CVFPB staff coordinated with CDFW to discuss recreation impacts in the Sacramento Bypass, and the recreation section of the EIS/EIR has been updated in response to those discussions to elaborate on impacts to recreation and access. Through these discussions, it was determined that no additional mitigation measures to address recreation impacts needed to be added to the EIS/EIR at this time.
P-10	California Department of Fish and Wildlife	Letter	Recreation Impacts	The CVFPB staff coordinated with CDFW to discuss recreation impacts in the Sacramento Bypass, and Section 3.14.5 of the EIS/EIR has been updated in response to those discussions to include potential restrictions for hunting during some aspects of construction. However, it is anticipated that there would be no conflict for the majority of the construction period, because construction would be occurring outside of the existing bypass with the levee providing a barrier between the wildlife area and the construction area.
P-11	California Department of Fish and Wildlife	Letter	Land Use/GGS	After project construction and turn over, the CVFPB will evaluate the appropriate course of action regarding the future land use in the Bypass. Impacts to GGS associated with removal of canals has been coordinated with USFWS and is included in the Biological Opinion appended to the final EIS/EIR.
P-12	California Department of Fish and Wildlife	Letter	Invasive Species	Section 3.6 was updated to include impact analysis and measures to prevent the spread of invasive species during construction of the project.
P-13	California Department of Fish and Wildlife	Letter	Fisheries	Language was added to the EIS/EIR in both the project description and the Fisheries analysis to reflect that during construction, the expanded bypass would be sloped to the south and graded in a manner consistent with the existing bypass to provide positive drainage.
P-14	California Department of Fish and Wildlife	Letter	Special Status Species	The new north levee of the Sacramento Bypass would be consistent with the existing north levee of the bypass. Impacts to listed species were analyzed with this design considered.
P-15	California Department of Fish and Wildlife	Letter	HTRW	The local sponsors are required to acquire all necessary lands and easements to facilitate the project. Lands acquired for the project must be free of contamination. As a result, they would be required to ensure that the appropriate parties remediate the landfill prior to providing the lands to the Corps for project implementation. As a result, the landfill remediation is not considered to be a part of the proposed action. Any environmental compliance activities associated with the remediation would be the responsibility of the entity conducting the remediation of the site.
P-16	California Department of Fish and Wildlife	Letter	Borrow Sites	Thank you for your comment. We will take this into consideration when selecting final borrow sites during the preconstruction engineering and design phase of the project.
P-17	California Department of Fish and Wildlife	Letter	Borrow Sites	At this time, no borrow sites have been identified for the project. Typical impacts of borrow activities have been analyzed throughout the documents, including some updates in the Final EIS/EIR based on project review. If additional impacts occur beyond those described in this document, the Corps would conduct supplemental NEPA/CEQA compliance analyses, as appropriate. If a borrow site is used as a future mitigation site, the conditions of the site would be improved to provide mitigative habitat beyond the existing condition of a borrow site. Borrow site restoration only includes returning it to pre-project conditions. Mitigation would involve creation of new habitat beyond what was existing prior to borrow activities.
P-18	California Department of Fish and Wildlife	Letter	Borrow Sites	Thank you for your comment. We will take this into consideration when selecting final borrow sites during the preconstruction engineering and design phase of the project.
P-19	California Department of Fish and Wildlife	Letter	Land Use	The EIS/EIR has been updated to describe the existing land use and public access in the Sacramento Bypass, and its operations by both CDFW and DWR.
P-20	California Department of Fish and Wildlife	Letter	Editorial/Land Use	Editorial changes to the EIS/EIR have been made as recommended. After project construction, the CVFPB will evaluate the appropriate future land uses in the Bypass.

P-21	California Department of Fish and Wildlife	Letter	Fisheries	The Corps has not conducted any studies at this time to assess fish passage through the Sacramento Bypass. As a term and condition of the NMFS Biological Opinion, the Corps has committed to conducting monitoring in order to assess these effects. Section 3.8 of the EIS/EIR has been updated to include fish passage measures, measures to prevent stranding, and the other terms and conditions of the Biological Opinion. The final Biological Opinion, with a finding of no jeopardy to listed species, is included as Appendix J of the EIS/EIR.
P-22	California Department of Fish and Wildlife	Letter	Fisheries	Section 3.8 of EIS/EIR has been updated to include further discussion of impacts to listed fish species from stranding and passage concerns. In accordance with the NMFS Biological Opinion, the mitigation section has been updated to reflect the terms and conditions and reasonable and prudent measures, including proposed fish passage measures for the study. Prior to construction, detailed design will occur and these measures will be refined and expanded. At that time, an analysis will occur to determine whether additional NEPA analysis needs to occur. Additional coordination with the resource agencies and other local action agencies would occur during detailed design to ensure that the project is designed to allow for fish migration and passage through the bypasses.
P-23	California Department of Fish and Wildlife	Letter	Fisheries	Concur, the construction window discussion has been updated. A general assumption of August 1 to November 30 was assumed, however this assumption will be reconsidered on a site-specific basis, depending on what species are known to be present and the proposed construction activities at each site.
P-24	California Department of Fish and Wildlife	Letter	Project Design	Concur. Site specific designs would occur during the preconstruction engineering and design phase of the project, to include consideration of fish stranding.
P-25	California Department of Fish and Wildlife	Letter	BA	The compensation times cited in the BA were developed during ongoing consultation with NMFS and USFWS through a variety of Corps programs and are based on the species' life cycles.
P-26	California Department of Fish and Wildlife	Letter	BA/Fisheries	The final BA was transmitted to NMFS and USFWS on 4/3/15 and Biological Opinions have been received from USFWS and NMFS (Appendix J). The Corps acknowledges CDFW's comments and concerns, and should consultation be reinitiated, the Corps will consider incorporating these comments.
P-27	California Department of Fish and Wildlife	Letter	BA/Fisheries	Comment noted.
P-28	California Department of Fish and Wildlife	Letter	BA/Fisheries	Comment noted.
P-29	California Department of Fish and Wildlife	Letter	BA/Fisheries	The life cycles discussion in the EIS/EIR has been updated to focus more on what stages are expected to occur in the study area.
P-30	California Department of Fish and Wildlife	Letter	BA/Fisheries	The Corps' Sacramento River Bank Protection Project has been monitoring bank protection sites to determine optimal designs and effects of these sites on juvenile salmonid species. The results of these studies will be used during site-specific design of the ARCF GRR project to ensure that bank protection sites include features that benefit salmonid species long-term. Additional monitoring of salmonid species is not proposed for this action; however, the Corps intends to initiate a green sturgeon monitoring program under this project to evaluate effects and optimal designs for this species. The details of this program are included in Section 3.8 of the final EIS/EIR and are also discussed in the NMFS Biological Opinion and the Mitigation Monitoring Plan.
P-31	California Department of Fish and Wildlife	Letter	EIS/EIR	CDFW's comments have been addressed as appropriate for this phase of the project and the level of design that currently exists in this Corps SMART Planning study. More detailed design on many aspects of the project will occur following Congressional authorization of the project, and further coordination will occur at that time. During detailed design of the project, an analysis will occur to determine whether further NEPA/CEQA compliance will be required.
Q-1	U.S. Department of the Interior	Letter	Construction Schedule	Tables 4 and 6 of the Draft EIS/EIR show the proposed construction schedule for each alternative, respectively. These tables indicate that construction would take approximately 10 years. For the American River Parkway, Tables 4 and 6 show that construction would occur over 9 of the 10 construction years, sometimes with multiple sites in the Parkway occurring during the same year.

Q-2	U.S. Department of the Interior	Letter	Recreation Impacts	Each construction season would vary depending on the length of the reach being constructed and applicable species work windows. Proposed mitigation for recreation would be implemented, as described in the document, with coordination occurring in advance with Sacramento County and the public. Note that the cumulative effects analysis specifically states that at the time of this analysis, no additional heavy construction projects are expected to occur within the Parkway at the same time as the recommended plan and thus no cumulative effects are assumed. During site-specific design, an analysis will occur to determine whether further NEPA or CEQA documentation would be required.
Q-3	U.S. Department of the Interior	Letter	Vegetation Impacts	The Corps will ensure that the construction contractor adheres to all required BMPs during construction, including ensuring that all appropriate mitigation and restoration is completed.
Q-4	U.S. Department of the Interior	Letter	Recreation	The Corps has added the Wild and Scenic Rivers Act to the Recreation Regulatory Setting.
Q-5	U.S. Department of the Interior	Letter	Coordination	Section 6.3 has been updated to include language regarding coordination with the National Park Service. The Corps will continue coordination with the NPS throughout the design phase of the project.
R-1	Sacramento County Department of Transportation	Letter	Transportation	The Corps will ensure that site-specific traffic studies are completed during the preconstruction engineering and design phase of the project once borrow sites, staging areas, and haul routes are defined for each construction area. If these studies result in impacts beyond those disclosed in this EIS/EIR, then supplemental NEPA documents would address these impacts.
R-2	Sacramento County Department of Transportation	Letter	Transportation	The Corps will ensure that a Traffic Plan is completed by the construction contractors, coordinated with SACDOT, and implemented during construction, to include all required BMPs and mitigation measures discussed in this EIS/EIR.
S-1	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	The Corps has updated the EIS/EIR to reflect that on-road haul trucks will comply with 2010 standards.
S-2	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	Concur. The Corps will update the air quality emission calculations to include the differences between Alternatives 1 and 2.
S-3	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	Concur. This mitigation measure has been removed from the EIS/EIR.
S-4	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	Concur. The Corps has updated the Air Quality section to clarify that the required mitigation for off-road equipment would be the SMAQMD enhanced exhaust controls. However, the Corps will encourage their contractors to use Tier 4 equipment as well to further reduce emissions.
S-5	Sacramento Metropolitan Air Quality Management District	Letter	Climate Change	Concur. The final EIS/EIR will include language acknowledging SMAQMD GHG thresholds for use in supplemental analyses.
S-6	Sacramento Metropolitan Air Quality Management District	Letter	Climate Change	Concur. The Corps revised the referenced GHG mitigation measure and significant threshold discussions in the final EIS/EIR to remove the 7,000 metric ton presumptive threshold.
S-7	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	Tables 1a and 1b have been added to Appendix D for the final EIS/EIR.
S-8	Sacramento Metropolitan Air Quality Management District	Letter	Air Quality	Concur. The Corps will ensure that all applicable SMAQMD rules are identified prior to and during construction.
T-1	State Lands Commission	Letter	Real Estate	The Corps will ensure that appropriate coordination occurs with SLC prior to construction.

T-2	State Lands Commission	Letter	Real Estate	Thank you for your comment and for notifying us up front. We will contact State Lands Commission if we have any questions.
T-3	State Lands Commission	Letter	Real Estate	Construction of the proposed project would not restrict or impede the easement rights of the public. Any in-water construction activities would occur on the bankside and would allow for recreation traffic to continue as normal.
T-4	State Lands Commission	Letter	EIS Revisions	Concur. This paragraph has been revised as requested.
T-5	State Lands Commission	Letter	Turbidity	Section 3.5.6 of the EIS/EIR includes specific mitigation measures to control sediment release during construction. Additional mitigation, as needed, may be coordinated with the CVRWQCB as a part of the Water Quality Certification process during the preconstruction engineering and design phase of the project.
T-6	State Lands Commission	Letter	Turbidity	The Corps proposes BMPs in Section 3.5 to reduce potential water quality effects, including turbidity. The proposed project will ensure that the Basin Plan turbidity standards are not exceeded during construction.
T-7	State Lands Commission	Letter	Cultural	In the event of a cultural resource discovery, the landowner would be notified. Due to the size and scope of the project, this includes many landowners, to include the State Lands Commission. As a result, the general term "landowner" is used throughout the documents. This process is described further in the PA.
T-8	State Lands Commission	Letter	Cultural	The MMRP documents the proposed mitigation associated with this project. The MMRP does not identify specific landowners or parcels, and rather focuses on general mitigation measures to be implemented throughout project construction. At this time, there is no proposed mitigation that the SLC is associated with, and therefore there is not an outlet to add language to the MMRP per this request. The Corps will coordinate with the SLC, as necessary, during the construction phase.
T-9	State Lands Commission	Letter	Cultural	Concur. In the event that cultural resources are discovered on California State Lands Commission lands during construction or any other phase of the project, the commission would be contacted.
T-10	State Lands Commission	Letter	Sea Level Rise	Concur. The Corps addressed Sea Level Rise in the final EIS/EIR in the Climate Change Section.
T-11	State Lands Commission	Letter	Sea Level Rise	Concur. Comment noted.
T-12	State Lands Commission	Letter	Contact	The Corps will ensure that all project related documents are provided to the State Lands Commission, as appropriate.
U-1	Kim Tremaine	Letter	Cultural Resources	Thank you for your comment. The Programmatic Agreement that has been executed for this project will guide future identification of potential historic properties to occur when design details are better known and prior to construction. The Corps is aware of the potential for subsurface sites and will employ a variety of methods, which are to be determined, to identify sites. Consideration of effects to historic properties will be completed through implementation of the PA (Stipulation III and IV). Further, the PA also includes procedures to follow in the event of the discovery of unknown historic properties (Stipulation IX).
V-1	Kim Tremaine	Letter	Geotech	The Corps is required to conduct a Probable Failure Mode Analysis, which is currently in progress through the Corps' Risk Management Center. The RMC is currently conducting the Probable Failure Mode Analysis, which corresponds with the Total Conditional Performance Analysis. This study will be completed prior to authorization of the project.
V-2	Kim Tremaine	Letter	Geotech	There is a significant amount of existing field data that was evaluated for the study. The data will be expanded as needed during PED. Additionally, the Folsom Dam Water Control Manual Update is conducting a channel stability assessment on the American River. In the design phase of the project, the design will be updated as appropriate to reflect the findings of the channel stability assessment. We are unaware of any "fine grained geophysical data" that leads us to a change in our conclusions, however if any data is found, we will incorporate this data during the design phase.

W-1	Delta Stewardship Council	Letter	Systemwide Evaluation/GRR	A wide variety of possible alternatives was considered, including features throughout the watershed, to find ways to reduce the flood risk to the City of Sacramento. USACE has developed a hydraulic model of the Sacramento River which allows us to analyze the effects of modifications to the flood management system. Because the levees surrounding the City are in such poor shape, the analysis showed that most effective plan to reduce the flood risk is to improve the existing levees. A setback levee is recommended for the north levee of the Sacramento Bypass which would approximately double it's floodplain area. The remainder of the levees are adjacent to urban development with little to no available land for a levee setback. The ongoing Central Valley Integrated Flood Management Study (CVIFMS) is a multi-purpose watershed study that is considering the larger, regional scale benefits associated with flood risk management, ecosystem restoration and other water resource related purposes.
W-2	Delta Stewardship Council	Letter	Risk Analysis/GRR	The ARCF GRR identifies the Federal interest in a flood risk management project, and is not constrained by, nor seeks to achieve FEMA levee accreditation standards and local laws such as SB-5. The extent that the recommended plan complies with FEMA and SB-5 standards is a determination required to be made by the non-federal sponsor.
W-3	Delta Stewardship Council	Letter	GRR/Coordination	The Project Delivery team (PDT) for the American River Common Features GRR is made up of staff from USACE as well as staff from the Department of Water Resources (DWR) and the Sacramento Area Flood Control Agency (SAFCA). During the development and evaluation of the alternative plans, weekly team meetings were held to coordinate information and report on the status of analysis. Part of this coordination included reports from the sponsors on activities they are involved in, including the Basin-wide feasibility study. Widening of the Sacramento Bypass was identified by the sponsors as a feature that would be consistent with and supportive of the goals of the Basinwide Feasibility Study.
W-4	Delta Stewardship Council	Letter	GRR/Variance	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
W-5	Delta Stewardship Council	Letter	Variance	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
W-6	Delta Stewardship Council	Letter	CVFIMS	Thank you for your comment. The Central Valley Integrated Flood Management Watershed Study (CVIFMS) will include an assessment of existing and future conditions of the Sacramento River watershed in order to develop recommendations for future actions that integrate co-equal objectives of long-term water supply, flood risk management, and ecosystem sustainability. Assessment of future conditions will include consideration of reasonably foreseeable future actions within the watershed and their effects to watershed resources and function.
W-7	Delta Stewardship Council	Letter	Alternatives	A wide variety of possible alternatives was considered to find ways to reduce the flood risk to the City of Sacramento. Because the levees surrounding the City are in such poor shape, the most effective plan to reduce that risk is to improve the existing levees in place. A setback levee is recommended for the Sacramento Bypass north levee which would approximately double the floodplain area. The remainder of the levees are adjacent to urban development with little to no available land for a levee setback. In areas along the river where bank protection is recommended, riparian vegetation can be maintained and expanded. There is also an opportunity to establish riparian vegetation in the widened portion of the Sacramento Bypass.

X-1	Delta Stewardship Council	Letter	Compliance	The Central Valley Flood Protection Board recognizes its obligations under the Delta Reform Act and the Delta Plan regulations, and the importance of the Delta's co-equal goals. The Board will promote the inclusion of the Delta Stewardship Council's recommendations into future project specific environmental analyses, and the lead agencies intend to initiate additional public involvement and agency coordination prior to project implementation.
X-2	Delta Stewardship Council	Letter	Risk Analysis	Results of the risk analyses are included in the GRR, which is a companion document to the EIS/EIR. The potential for downstream effects is addressed in Section 3.4 of the EIS/EIR and the Hydraulic Appendix to the GRR.
X-3	Delta Stewardship Council	Letter	O&M	The Corps typically updates the O&M Manual during the construction phase of the project. General O&M activities are discussed in the draft EIS/EIR in Section 2.3.4. The Corps reviewed the resource sections to ensure that the effects of these activities are analyzed throughout the document. The existing O&M Manual is available upon request from the Corps.
X-4	Delta Stewardship Council	Letter	Variance	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
X-5	Delta Stewardship Council	Letter	Mitigation	The Corps will mitigate on-site to the maximum extent feasible. Any off-site mitigation is required to be as close to the impact area as possible. The Corps will strive to mitigate on the same waterway when possible, but for some impacts onsite mitigation is not possible and would be compensated through the purchase of mitigation bank credits.
X-6	Delta Stewardship Council	Letter	Variance	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
X-7	Delta Stewardship Council	Letter	Alternatives	The proposed bank protection measure on the American and Sacramento Rivers allow for opportunity to restore and improve SRA habitat in most reaches of the study area. Through ongoing coordination under the Sacramento River Bank Protection Project, the Corps and NMFS have developed a number of options for self-mitigating bank protection sites that include mitigative features that restore SRA habitat. Additionally, mature trees are proposed to remain in place on the lower waterside levees, to protect existing SRA whenever possible. More information about these measures are included in the Mitigation and Monitoring Plan and Biological Opinion, both of which are appended to the EIS/EIR.
X-8	Delta Stewardship Council	Letter	Invasive Species	The Fisheries section has been updated to include analysis of predation at bank protection sites.
X-9	Delta Stewardship Council	Letter	Invasive Species	The Corps has updated the EIS/EIR to include analysis of invasive species and measures to be implemented during construction to manage these species. These measures will be included in the mitigation and monitoring plan, as well as the project's plans and specs prior to construction. No separate invasive species plan has been developed at this time.
X-10	Delta Stewardship Council	Letter	Adaptive Management	An adaptive management plan was developed for the project and included as part of the Mitigation Monitoring Plan, which is appended to the EIS/EIR.
X-11	Delta Stewardship Council	Letter	Delta Plan	The Corps has added language to the environmental setting of the EIS/EIR acknowledging the project's relationship to the Delta Plan and discussing any inconsistencies between the documents.

Y-1	Delta Protection Commission	Letter	Environmental Effects	During the design phase of the project, following Congressional authorization, the Corps and its local partners intend to look at the proposed measures on a site-by-site basis in an attempt to minimize impacts from those described within this effects analysis, as appropriate.
Y-2	Delta Protection Commission	Letter	Recreation	Comment noted. The Corps does not propose to construct new bike trails under the recommended plan.
Z-1	Metropolitan Water District of Southern California	Letter	Project Design/Water Control Manual	Thank you for your comment. Your consideration for habitat restoration opportunities within the Yolo Bypass is noted. The ARCF study used a conservative characterization of future flood management operations at Folsom Dam assuming the Joint Federal Project (JFP) is complete. The Folsom Dam future operations reflected in the ARCF study are based on the operations identified in the Folsom Dam Modification and Folsom Dam Raise Projects PACR (2007). The purpose of the Folsom Dam and Lake Water Control Manual Update (WCM Update) is to carry out a more detailed analysis of how to revise operation rules for Folsom Dam to reduce flood risk based on the capabilities of the JFP, to reflect operation capabilities created by improved weather forecasts, and to potentially reduce the volume of flood control reservation in Folsom Lake at any particular time in comparison to the operations that have been in effect since 1995. Any proposed refinements to operation rules at Folsom identified in the WCM Update are being evaluated on their effectiveness in meeting the flood risk management objectives as well as on their effects to the other project purposes of Folsom Dam. Those other project purposes are: water supply (agricultural and M&I), hydropower, water quality, sustain fish and wildlife resources, and recreation. The WCM Update is evaluating potential effects to these other project purposes on a local and regional basis. Because Folsom Dam and Lake is a key facility in the Central Valley Project, the WCM Update is utilizing the CalSim II model and outputs to measure effects within the larger CVP/SWP system. Along the lower American River and beyond its confluence with the Sacramento River, the WCM Update will be evaluating resource effects to a greater level of detail, utilizing HEC ResSim and RAS models and output to measure changes in flow frequency, duration, rate, and stage, among other variables, on a sub-monthly timestep. The expectation of the WCM Update is that, through an iterative modeling process, operation rules at Folsom Dam will be refined to be able to not only meet the flood risk management objectives of the JFP, but to also minimize, avoid, or possibly provide incidental beneficial effects to the other Folsom Dam project purposes. Results of the WCM Update will be used to better-inform the detailed design of the ARCF selected plan.
AA-1	U.S. Environmental Protection Agency	Letter	HTRW	The local sponsors are required to acquire all necessary lands and easements to facilitate the project. Lands acquired for the project must be free of contamination. As a result, they would be required to ensure that the appropriate parties remediate the landfill prior to providing the lands to the Corps for project implementation. As a result, the landfill remediation is not considered to be a part of the proposed action. Any environmental compliance activities associated with the remediation would be the responsibility of the entity conducting the remediation of the site.
AA-2	U.S. Environmental Protection Agency	Letter	Air Quality	The Air Quality analysis in Section 3.11 has been reevaluated to confirm that currently the proposed project is not exceeding de minimus thresholds.. As a result, a Conformity Analysis is not required at this time. During the design phase of the project, the project will be refined on a site-specific analysis, and if these adjustments result in exceedance of de minimus thresholds, coordination with the EPA will occur, as required.
AA-3	U.S. Environmental Protection Agency	Letter	Air Quality	The measures and assumptions that were factored into the emissions estimates are described in Section 3.11.2 under "Methodology", and are also detailed in the Air Quality Appendix.
AA-4	U.S. Environmental Protection Agency	Letter	Air Quality	The Corps is responsible for ensuring that all commitments in the EIS/EIR are implemented during construction. Additionally, the construction contractor is required to coordinate directly with SMAQMD during construction to ensure that they are meeting required air quality commitments.

AA-5	U.S. Environmental Protection Agency	Letter	Air Quality	Emissions estimates in the final EIS/EIR do not exceed de minimus thresholds. The Corps is including proposed mitigation in order to further reduce these emissions beyond the estimates provided. A draft conformity determination is not required, since estimated emissions do not exceed de minimus thresholds. If at the time of site-specific design prior to construction, further air quality estimates do exceed de minimus thresholds, then the Corps would consult with the EPA, as required, and prepare a draft conformity determination at that time.
AA-6	U.S. Environmental Protection Agency	Letter	Air Quality	Thank you for your comment. The Corps intends to push for reductions through the use of higher tiered equipment during construction.
AA-7	U.S. Environmental Protection Agency	Letter	Air Quality	Thank you for pointing the errors out. We have fixed these as requested for the final EIS/EIR.
AA-8	U.S. Environmental Protection Agency	Letter	SB5	The State has established a standard for urban flood protection in California which applies to cities with populations greater than 10,000 inhabitants. This standard requires levees to withstand flows with a top elevation equal to the mean 200-year water surface profile, plus three feet of freeboard, plus an allowance for wave run-up, plus one foot to account for climate change. USACE does not identify a target level of risk reduction but rather identifies the plan which reasonably maximizes net benefits. The analysis to identify the plan which maximizes net benefits was done with an awareness of the State's goal for urban flood protection for the purpose of informing the State of where the individual plans fall with regards to the State's standards. Neither of the final alternatives is currently able to contain a 1/200 ACE event with 90% assurance. The levee improvements along the Sacramento River will increase the assurance to a level close to 90% but the assurance for the levees along the American River will remain low for the 1/200 ACE. It will be contingent upon the local community to prove to the State that the aggregate flood risk management projects meet the State's standard. The EIS/EIR has been updated to reflect this.
AA-9	U.S. Environmental Protection Agency	Letter	O&M	This reference from the EIS/EIR was in error. Operation of the Sacramento Weir and Bypass would not be deferred until after construction is complete. General assumptions on the future operation of the Sacramento Weir and Bypass are included in Chapter 2 of the final EIS/EIR, however these assumptions will be refined during the preconstruction engineering and design phase of the project. Page 102 of the EIS/EIR has been updated to address this error.
AA-10	U.S. Environmental Protection Agency	Letter	Wetlands	The final EIS will include a mitigation and monitoring plan that will include plans for future mitigation/compensation sites. Wetland delineations will not be completed until the design phase of the project to allow for potentially changing conditions between the study phase and construction of the proposed project.
AA-11	U.S. Environmental Protection Agency	Letter	Climate Change	Section 3.12 has been updated to reflect the CEQ draft guidance and to ensure that it is clearly stated that all GHGs contribute to climate change.
BB-1	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction. A SWPPP would be prepared prior to construction.
BB-2	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction.
BB-3	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction. The Corps would ensure that project construction complies with the regulations contained in the permits.
BB-4	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps does not issue a permit to itself. However, the Corps will ensure that the project complies with the substantive requirements of Section 404 through the preparation of a Section 404(b)(1) analysis, which is included with the EIS/EIR as Appendix E.

BB-6	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps will ensure that prior to initiation of construction, a Section 401 Water Quality Certification is obtained, as necessary, for impacts to waters of the U.S.
BB-7	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction.
BB-8	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction.
BB-9	Central Valley Regional Water Quality Control Board	Letter	Construction Permits	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction.
CC-1	Sacramento Regional County Sanitation District	Letter	Utilities	The Corps will coordinate with SRCSD during the design phase of the project, as appropriate.
DD-1	Joseph O'Connor	Letter	Mayhew Levee Project	The Corps looked at seven alternatives that would have extended the Mayhew levee upstream to high ground. These alternatives were not cost efficient due to the required real estate acquisition costs, and there would be mitigation required for the removal of trees. The local sponsor was not willing to partner in any of these alternatives. Therefore, the Mayhew Plug was the selected alternative, because it provided most of the 200-year level of flood protection for the least cost, and required no mitigation. Additional work in order to complete the last 4-6 inch tie-in would require the removal of a private fence, the removal of a large (heritage) tree and three smaller trees, and approximately 20 cubic yards of soil to be imported and compacted on private property. Due to the rare frequency that a flood event would reach this elevation, the additional effort and expense required for closing this minimal deficit in the levee height is not cost effective. It should be noted that the height of the levee in this location is almost three feet above the 200-year design water surface elevation, even with the reduced levee height at that location. Should a flood event occur that reaches the top of the plug, sandbagging would be required to close this gap.
EE-1	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Additions per the below comments have been incorporated.
EE-2	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The Corps is committed to implementing all proposed mitigation measures as listed at the end of each resource section during the construction phase of the project.
EE-3	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design Phase	During PED, a more substantial site specific design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-4	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Additional clarifying language was added regarding balancing the risk between additional flow being released causing further distress of the levee versus the risk of a dam failure.

EE-5	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	The cited Bureau and DWR reports were cited to provide additional background on the history of Folsom.
EE-6	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	The levees have had an established emergency condition of 152,000 cfs since completion of the north levee on the American River in 1957. The 160,000 cfs condition was added to the Folsom water control manual after 1986. Language to this effect has been added.
EE-7	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Some clarifying language was added. However, the stage in Folsom was in the surcharge pool which mandates emergency operations to avoid dam failure.
EE-8	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Concur that it is a State standard and State defined criteria. The ARCF GRR project documents do not state that performance should be determined through Corps criteria.
EE-9	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Modeling developed for the Sacramento and San Joaquin River Basin Comprehensive Study showed that substantially more flow reached the combination of the Yolo Bypass and Sacramento River just downstream of Fremont Weir these waterways were designed to convey. However, the language was revised to conform with past published accountings of this event.
EE-10	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Language in this section was modified. Geotechnical problems were also cited as leading to the levee failures that occurred.
EE-11	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	An additional statement about the PMF was added to this section. The Corps concurs that the purpose of the project is to pass certain magnitude flood flows downstream without levee failure, but the influence of Folsom and the JFP is important to identify the problems affecting the study area.
EE-12	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	Eyewitness verbal accounts cite that there was less than a foot of freeboard during the 134,000 cfs release in certain reaches of the American River. However, the sentence was rewritten to state that during the 1986 event, the design freeboard was encroached upon risking the potential of overtopping.
EE-13	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Velocities/Erosion	Chapter 2.3.1 of the GRR and Section 3.4 of the EIS/EIR have been updated to show a range of velocity conditions for justification of the erosion protection.
EE-14	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Constraints	The GRR will be compliant with all applicable laws and statues, including the Wild and Scenic Rivers Act, which is discussed throughout the GRR's companion document, the EIS/EIR. Compliance with law and policy is assumed in every study. Planning Constraints are project specific items that are not addressed by either law or policy that would limit planning efforts in some way. At this time, no other planning constraints have been identified beyond the restriction of additional bird habitat near the Sacramento International Airport.

EE-15	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Folsom Dam Operations/ Water Control Manual	The ARCF study used a conservative characterization of future flood management operations at Folsom Dam assuming the Joint Federal Project (JFP) is complete. The Folsom Dam future operations reflected in the ARCF study are based on the operations identified in the Folsom Dam Modification and Folsom Dam Raise Projects PACR (2007). The purpose of the Folsom Dam and Lake Water Control Manual Update (WCM Update) is to carry out a more detailed analysis of how to revise operation rules for Folsom Dam to reduce flood risk based on the capabilities of the JFP, to reflect operation capabilities created by improved weather forecasts, and to potentially reduce the volume of flood control reservation in Folsom Lake at any particular time in comparison to the operations that have been in effect since 1995. Any proposed refinements to operation rules at Folsom identified in the WCM Update are being evaluated on their effectiveness in meeting the flood risk management objectives as well as on their effects to the other project purposes of Folsom Dam. Those other project purposes are: water supply (agricultural and M&I), hydropower, water quality, sustain fish and wildlife resources, and recreation. The WCM Update is evaluating potential effects to these other project purposes on a local and regional basis. Because Folsom Dam and Lake is a key facility in the Central Valley Project, the WCM Update is utilizing the CalSim II model and outputs to measure effects within the larger CVP/SWP system. Along the lower American River and beyond its confluence with the Sacramento River, the WCM Update will be evaluating resource effects to a greater level of detail, utilizing HEC ResSim and RAS models and output to measure changes in flow frequency, duration, rate, and stage, among other variables, on a sub-monthly timestep. The expectation of the WCM Update is that, through an iterative modeling process, operation rules at Folsom Dam will be refined to be able to not only meet the flood risk management objectives of the JFP, but to also minimize, avoid, or possibly provide incidental beneficial effects to the other Folsom Dam project purposes. Results of the WCM Update will be used to better-inform the detailed design of the ARCF selected plan.
EE-16	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Auburn Dam	The assumptions regarding Auburn Dam as discussed in the GRR were based on the Corps' 1996 Supplemental Information Report. Further studies by other agencies have occurred, however, those agencies have analyzed the dam based on other project purposes such as water supply and hydropower. The purpose of the ARCF GRR is Flood Risk Management, and, therefore, the 1996 SIR was adequate for the purposes of this study.
EE-17	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	The two largest floods on record are 1986 and 1997 which are post hydrologic design of all the reservoirs in the system. This is not the main driver on why reoperation of upstream reservoirs was screened out but is part of the story. Location plays a key part and the presence of many unregulated water courses entering the Sac River system. Clarifying text was added to this section.
EE-18	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	A statement was added citing the 1991 study for further information on why the alternative was screened.
EE-19	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project History	The design of the overall Sacramento River Flood Control Project was based on historic floods (1907, 1909, and 1927 for the most part). On many segments of river throughout the Sacramento Valley, flows experienced in 1955, 1964, 1986, and 1997 exceeded the design of those reaches. A clarifying statement was added to section 3-6.
EE-20	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Comment noted.

EE-21	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Alternatives	Concur. Table 3-6 in the GRR has been modified to reflect that the Maximum Plan does not meet the acceptability criteria.
EE-22	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Alternatives	The added uncertainty for large events beyond the 200-Year event are included in the larger range of Folsom Releases described in the Hydrologic Appendix to the GRR.
EE-23	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	WRRDA 2014 Section 3013 requires a review of the levee vegetation policy. The review is still in progress, therefore no new policies have been established at this time and the Corps is making no assumptions about what the policy will consist of. However, WRRDA 2014 Section 3013(g)(1) also requires that vegetation removal not be a condition or requirement for the approval of funding of a project or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk. In line with this provision, under the ARCF GRR a study was conducted to determine the acceptability of the safety risk associated with the vegetation on the levees in the study area. This study is described in Section 1.4.5 of the draft EIS/EIR. The study resulted in a determination that it was an acceptable assumption that a variance to the vegetation policy is appropriate under this study, and therefore waterside vegetation can remain on the levees. Additionally, the sponsor has sent the Corps a Letter of Intent to apply for a SWIF for the levees in the study area. The combination of the SWIF and the variance allows the Corps to leave all vegetation outside of the construction footprint in place. As a result, the project is in compliance with Section 3013(g)(1), because compliance with the vegetation policy is not a factor in funding or approving the ARCF GRR. The presence of wildflowers and native grasses on the levees is not in conflict the ETL. The Corps is supportive of the presence of California's State flower on our levee slopes!
EE-24	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Design	USACE coordinated with the Lower American River Task Force during the previous design and construction of flood risk reduction features in the parkway. This effort resulted in successful implementation of these features and USACE welcomes the opportunity to work together again with the Task Force on this next generation of flood risk reduction features.
EE-25	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Sacramento Weir Operations	The operation of the new Sacramento Weir would be refined during the design and construction phase in conjunction with the project sponsors and the operators of the facility. This refinement would take in consideration other regional efforts to reduce flood risk and optimize the operation of the weir in light of these efforts.
EE-26	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The project will comply with the Wild and Scenic Rivers Act. The EIS/EIR has been updated to include further discussion of this law and potential effects to the values under which the American River is regulated under this Act.
EE-27	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Compliance	The GRR will be compliant with all applicable laws and statues, including the Wild and Scenic Rivers Act and WRRDA 2014.
EE-28	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Geologic Resources	Further discussion of liquefaction potential is included in the Geotechnical Appendix (Appendix C, Attachment C) to the GRR.

EE-29	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Editorial	Concur. Edits have been made to the EIS/EIR accordingly.
EE-30	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Parkway Plan	Citations have been added to the EIS/EIR to quote, reference, and indicate compliance with the American River Parkway Plan.
EE-31	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Design	The ARCF GRR is being planned using principles the Corps' SMART Planning initiative, as required by Section 1001 of WRRDA 2014. As a result, the planning phase relied heavily on existing information to drive the decision making process due to the size of the study area and the scope of the project. Under this process it was not possible to conduct site-specific analysis during the planning phase. These analyses will occur during the preconstruction design phase to confirm the assumptions that drove the planning phase.
EE-32	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps concurs that the vegetation and aesthetic resources of the Parkway should not be unnecessarily sacrificed. The ARCF GRR is a public safety project and all measures proposed are to reduce the risk of life loss and damages from a catastrophic flood event. Additionally, the effects analyzed in the EIS/EIR are a worst-case scenario based on a maximum footprint. In the preconstruction engineering and design phase of the project, the Corps will conduct site-specific analysis to refine the proposed construction footprint and anticipates that there is a strong possibility of minimizing the effects that are disclosed in this study.
EE-33	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Regulatory Setting	The State and Federal Wild and Scenic Rivers Acts were added to the Regulatory Setting. The National Park Service provided comments on the draft EIS/EIR and the Corps is addressing their concerns in this final EIS/EIR. Further coordination with the National Park Service will occur throughout the design phase of the project.
EE-34	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Area	Thank you for your comment. The ARN and ARS basins and the levee reaches described in the study documents are defined based on existing conditions and not historic (pre-leveed) conditions.
EE-35	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The ARCF GRR used a conservative characterization of future flood management operations at Folsom Dam assuming the JFP auxiliary spillway and control structure are complete. The Folsom Dam future operations reflected in the ARCF GRR are based on the operations identified in the Folsom Dam Modification and Folsom Dam Raise Projects Post Authorization Change Report (2007) (JFP PACR).
EE-36	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The operation of the Sacramento Weir is currently based on the gauge at the I Street Bridge. Operations will be refined during the design and construction phase in conjunction with the project sponsors and the operators of the facility. This refinement would take in consideration other regional efforts to reduce flood risk and optimize the operation of the weir in light of these efforts.
EE-37	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Editorial	Thank you for pointing the error out. We have fixed this for the final EIS/EIR.
EE-38	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps is committed to reducing impacts to the maximum extent possible during the design phase. The impacts presented in this EIS/EIR were intended to be a worst-case scenario. When site-specific analysis is conducted during the design phase, we expect to be able to minimize impacts from those presented in this document.

EE-39	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Erosion	Independent External Peer Review was conducted on the feasibility report and its technical appendices including the erosion assumptions. Additionally, a 60-day public review period occurred and allowed for external review of the proposed alternatives. The Corps of Engineers is committed to working with stakeholders during the design and construction process. Previous bank protection constructed working with the Lower American River Task Force is a good example that the Corps is supportive of using as a working model.
EE-40	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Regulatory Setting	The State and Federal Wild and Scenic Rivers Acts were added to the Regulatory Settings.
EE-41	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Under the ARCF GRR a study was conducted to determine the acceptability of the safety risk associated with the vegetation on the levees in the study area. This study is described in Section 1.4.5 of the draft EIS/EIR. The study resulted in a determination that it was an acceptable assumption that a variance to the vegetation policy is appropriate under this study, and therefore waterside vegetation can remain on the levees. Additionally, the sponsor has sent the Corps a Letter of Intent to apply for a SWIF for the levees in the study area. The combination of the SWIF and the variance allows the Corps to leave all vegetation outside of the construction footprint in place. As a result, the project is in compliance with WRRDA 2014 Section 3013(g)(1), because compliance with the vegetation policy is not a factor in funding or approving the ARCF GRR. While the SWIF does assume long-term compliance with the current ETL policies, it also allows for flexibility in adjusting to any change in vegetation policies that may occur.
EE-42	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Compliance	The National Park Service was added to the list of agencies that the Corps is coordinating with on this project.
EE-43	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Cumulative Effects	Concur. Changes in the BDCP were announced after public release of this EIS/EIR. The description of the BDCP has been updated for the final EIS/EIR.
EE-44	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation Impacts	The Corps is committed to reducing impacts to the maximum extent possible during the design phase. The impacts presented in this EIS/EIR were intended to be a worst-case scenario. When site-specific analysis is conducted during the design phase, we expect to be able to minimize impacts from those presented in this document.
EE-45	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	While this comparison may be helpful, the project features are based on a design flow of 160,000 cfs not necessarily a frequency or historical based event. Also, this comparison is best conducted under that Folsom Water Control Manual Update. The Water Control Manual EIS/EIR is tentatively scheduled for release in summer 2016.
EE-46	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Comments	All comments submitted are addressed in this appendix as part of the public review process.
EE-47	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	American River proposed measures would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.

EE-48	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-49	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Editorial	The uncertainty in this statement is primarily related to how much erosion would occur, and how much bank would be lost in a single event. As stated in the No Action Alternative, because we cannot predict when and how large events will occur it would be speculative to assume at which time the berms will erode.
EE-50	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Filling in eroded portions of the bank would be necessary in cases where the bank has eroded away and could potentially undermine the levee foundation. This condition is more typical on the Sacramento River than the American River because there is less berm between the waterway and the levee.
EE-51	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Typically when we are referring to large vegetation vs small vegetation we are referring to trees versus shrubs or grasses.
EE-52	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Site specific designs for erosion protection will be completed in the design phase of this study, including any necessary hydraulic design of the bank protection sites.
EE-53	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps will plant new trees as part of self-mitigating features on bank protection sites. New trees could be planted over time if the sites are not meeting their restoration criteria during the monitoring period, as established in the Mitigation and Monitoring Plan. Once the monitoring period has concluded, natural lifecycle processes are expected to occur.
EE-54	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-55	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The proposed project only impacts vegetation in the construction footprint, and proposes to protect existing trees in place whenever possible. Additionally, all trees removed from the construction footprint would be compensated for, in the case of the Parkway, on-site to the maximum extent practicable. As a result, while there would be a significant short term impact from vegetation removal, long-term vegetation in the parkway is expected to recover. As a result of these proposed measures, the conclusions presented in the draft EIS/EIR are appropriate.
EE-56	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Access ramps may not be needed in cases when there are already existing ramps developed that could be used during construction.
EE-57	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	A large berm made of large rocks. See Engineering Appendix for more details on the size and scope of the bank protection design.

EE-58	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
EE-59	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Editorial	Thank you for pointing the error out. We have fixed this for the final EIS/EIR.
EE-60	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Editorial	Concur. The Corps has updated Figure 1 to ensure that the planting berm is shown.
EE-61	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	A design objective for the launchable rock trench was to reduce the launch distance and increase the reliability of the design. The proposed placement near bottom of the vadose zone does this and helps to reduce the overall rock quantity needed for this design.
EE-62	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The trench design will have soil placed with rock, however, it will not be thoroughly mixed due to the adverse affects to launching capability. Additionally, a geotextile wrap around the trench is proposed to limit the infiltration of soil into rock voids. Aspects to design features such as these will be refined in PED phase.
EE-63	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Excess fill that could not be used for project features would become available for borrow site mitigation or infill purposes at other restoration sites. Future coordination would be performed during PED phase.
EE-64	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Shrubs would be considered appropriate if it does not put undue burden on maintaining agencies, and if it is in locations that do not interfere with channel conveyance capacity.
EE-65	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The trench areas do have limitations as noted, however, they still offer an opportunity to partially/fully mitigate impacts. More specific analysis and coordination with maintenance agencies will be performed during PED phase to determine the mitigation capabilities of these sites.
EE-66	Friends of the River, Habitat 2020, and Save the American River Association	Letter	No Action	Yes, the No Action Alternative is based on past experience and is a forecast of what could transpire with large magnitude flood events.
EE-67	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The trench width is a function of existing topography, trench slopes, depth, and quantity of launchable rock. These aspects of the design will be analyzed in more detail within PED phase. For the purposes of this study and description of impacts, the 70 feet trench width, is considered to be conservative when applied to the extents shown in plates 3 and 4.
EE-68	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The acreage of impact was based on the construction footprint, including some additional areas like ramps and roads in the vegetation and wildlife section. Staging areas have not been determined at this time, because of the potential for changing conditions between this study and the implementation of the project, therefore this acreage was not included in current project estimates. Following authorization when site-specific design occurs, staging areas will be determined and if the impacts associated with those staging areas increase the environmental impacts disclosed in this EIS/EIR, then supplemental NEPA analysis would occur.

EE-69	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	For launchable rock trench, vegetation can not be deep rooted so that it does not interfere with the deployment (launching) of rock, plus, any vegetation other than grass and small shrubs needs to be placed 15 feet or more away from the waterside toe. Within the American River Parkway, this construction area is a very small percentage of the total area. On-site mitigation will be implemented to the maximum extent practicable.
EE-70	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps anticipates restoring riparian vegetation both on and offsite, depending on site conditions and mitigation requirements. Plant establishment takes time. Typically most mitigation sites require up to 10 years of monitoring to ensure establishment that meets the restoration metrics established in the mitigation and monitoring plan. If sites are not meeting those criteria, they could require replanting, which could extend the establishment period. The only option for immediate mitigation/compensation would be purchasing credits at an off-site mitigation bank, which is an option being considered for some of the mitigation associated with the ARCF GRR.
EE-71	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-72	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Land Use	There is no permanent conversion of Parkway lands associated with the ARCF GRR. It is anticipated that all of the proposed erosion protection sites within the Parkway would remain a part of the Parkway, and would continue to be used by the public. This discussion regarding mitigation for permanent loss of Parkway lands has been removed from the final EIS/EIR.
EE-73	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Modeling results are a summarization of a Sacramento Bank Protection Regional Sediment Study. This is a challenging issue. In general, in the absence of bedrock or other erosion resistant materials, the LAR is degradational in nature down to about RM 4. Downstream of this location, the river is slightly aggradational. The erosion resistant layer has only been mapped between river miles 5.5 and 11.5 (approximate RM's). The vertical location of the resistant layer is unknown for the remainder of the river below Nimbus Dam. Despite the general trends, zones of local aggradation and degradation are observed to occur in both the prototype river channel as well as in numerical modeling simulations (e.g., HEC-6T). In the zone where the erosion resistant layer has been identified, it appears that continued wholesale lowering of the channel thalweg is unlikely; however, other portions of the channel cross section (e.g., channel terraces or berms) may continue to degrade over time.
EE-74	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The degradation analysis report did look at nick points developing into full head cuts that would move upstream and jeopardize levee stability. This study found that the only place that this was somewhat probable was in the vicinity of the Guy West bridge. That is the reason that study only recommended grade control in that vicinity. Further site specific design in PED will relook at this, likely in consultation with local stakeholder groups.
EE-75	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Draft results for the long-term simulation indicate that about 263,000 cy would be eroded for the without-project condition during the period simulated. For the without-project conditions, a volume of 304,000 cy would be eroded along the 22-mile study reach of the American River.

EE-76	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	When sediment is mobilized from along the American River or other rivers, it washes downstream. Ultimately, this sediment finds its way to the Suisun, San Pablo, and San Francisco Bay and ultimately to the Pacific Ocean.
EE-77	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Considerable sea level rise would be required to significantly impact the sediment transport ability of the reach of river in question. There are conditions where high stage on the Sacramento River causes backwater effects on the American River in the RM 5-7 stretch, but then there are other conditions where the backwater effect is not present but there are still significant flows coming down the American River causing higher rates of sediment transport including in the RM 5-7 range. Significant sea level rise would need to occur before the sediment transport capability of this reach of river would greatly reduce. However, this will be further studied in PED in consultation with local stakeholder groups.
EE-78	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	It is possible that if these rates of degradation are experienced, that hydraulic mining debris has been exhausted, but it does not have to occur that way. If this amount of degradation occurs, it will likely be because a nick point turns into a full head cut that moves upstream. This will further be analyzed however in PED in consultation with local stakeholder groups.
EE-79	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	We concur that naturally, upstream of RM 8 it is not a braided channel. But, artificially, because of the multiple channels associated with historic gravel mining, upstream of RM 8, sediment transport occurs as if it were a braided channel, which is why it is characterized this way. Further analysis in PED will address this further, likely in consultation with local stakeholder groups.
EE-80	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	In general, in the absence of bedrock or other erosion resistant materials, the American River is degradational in nature down to about River Mile 4. Downstream of this location, the river is slightly aggradational. The conclusions are not contradicting, but are referring to different reaches of the river. The erosion resistant layer has only been mapped between approximately River Miles 5.5 and 11.5. The vertical location of the resistant layer is unknown for the remainder of the river below Nimbus Dam. Despite the general trends, zones of local aggradation and degradation are observed to occur in both the prototype river channel as well as in numerical modeling simulations (e.g., HEC-6T). In the zone where the erosion resistant layer has been identified, it appears that continued wholesale lowering of the channel thalweg is unlikely; however, other portions of the channel cross section (e.g., channel terraces or berms) may continue to degrade over time.
EE-81	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Reference to RM 9.0R was only made as an example of where erosion is actively occurring, even at low discharges such as 7,000 cfs. The concern regarding the erosive trends in the LAR are not predicated on just this one location. A review of the performance of the LAR channel with regards to erosion reveals that multiple locations of the channel have experienced damaging erosion and have required repair following significant discharge event. The GRR and Section 3.4 of the EIS/EIR have been updated to show a comparison of erosion conditions in the channel at both the narrow RM 9 reach, and other lower velocity reaches.
EE-82	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Reference to RM 9.0R was only made as an example of where erosion is actively occurring, even at low discharges such as 7,000 cfs. The concern regarding the erosive trends in the LAR are not predicated on just this one location. A review of the performance of the LAR channel with regards to erosion reveals that multiple locations of the channel have experienced damaging erosion and have required repair following significant discharge event. The GRR and Section 3.4 of the EIS/EIR have been updated to show a comparison of erosion conditions in the channel at both the narrow RM 9 reach, and other lower velocity reaches.
EE-83	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Reference to RM 9.0R was only made as an example of where erosion is actively occurring, even at low discharges such as 7,000 cfs. The concern regarding the erosive trends in the LAR are not predicated on just this one location. A review of the performance of the LAR channel with regards to erosion reveals that multiple locations of the channel have experienced damaging erosion and have required repair following significant discharge event. The GRR and Section 3.4 of the EIS/EIR have been updated to show a comparison of erosion conditions in the channel at both the narrow RM 9 reach, and other lower velocity reaches.

EE-84	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Given the magnitudes of local shear and velocity along portions of the lower American River banks makes bio-engineering or other soft approaches for providing bank protection very challenging. Nonetheless, site specific designs for bank and erosion protection will be developed in the design phase of the study. As part of the Folsom Water Control Manual, additional Channel Stability Analyses are being conducted to further refine the designs.
EE-85	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	It is possible that sewer main undercrossing is contributing to the erosion concerns at RM 7. However, looking at the Ayres' velocity plots - the velocity at this location is high enough to be of concern with or without the sewer main undercrossing. Site specific designs for erosion protection will be completed in the design phase of this study and the sewer main undercrossing will be evaluated.
EE-86	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	It is possible that sewer main undercrossing is contributing to the erosion concerns at RM 7. However, looking at the Ayres' velocity plots - the velocity at this location is high enough to be of concern with or without the sewer main undercrossing. Site specific designs for erosion protection will be completed in the design phase of this study known as Preconstruction, Engineering and Design (PED) and the sewer main undercrossing will be evaluated. Given the magnitudes of local shear and velocity along portions of the lower American River banks makes bio-engineering or other soft approaches for providing bank protection very challenging. Nonetheless, site specific designs for bank and erosion protection will be developed in the next phase of the study (PED Phase). As part of the Folsom Water Control Manual, additional Channel Stability Analyses are being conducted to further refine the designs.
EE-87	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Concur, this text has been removed and the section has been reassessed.
EE-88	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The text has been revised to clarify that the discussion refers to surface runoff conditions, which are not expected to be impacted by implementation of the project. Erosion conditions will be addressed by the proposed measures.
EE-89	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	For the purposes of this study, the project features were designed with a flow of 160,000 cfs which is currently estimated to be a 200-year event.
EE-90	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The ARCF GRR used a conservative characterization of future flood management operations at Folsom Dam assuming the JFP auxiliary spillway and control structure are complete. The Folsom Dam future operations reflected in the ARCF GRR are based on the operations identified in the Folsom Dam Modification and Folsom Dam Raise Projects Post Authorization Change Report (2007) (JFP PACR). Evaluation of how the flow regime has changed to get to the Spillway and Dam raise in place is being done under the Folsom Water Control Manual Update.
EE-91	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Manual Update	The Folsom Dam Water Control Manual Update Draft Supplemental EIS/EIR is tentatively scheduled for release in the summer of 2016.
EE-92	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Use of launchable rock results in a layer of rock which provides erosion protection if/when the rock is launched. The design ensures that sufficient volume of rock is available to provide protection and takes into consideration that the layer is formed, underwater, primarily by gravity. Given the size and depth of the LAR, the layer of "launched" rock would not significantly impact the hydraulic conditions.

EE-93	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Use of launchable rock results in a layer of rock which provides erosion protection if/when the rock is launched. The design ensures that sufficient volume of rock is available to provide protection and takes into consideration that the layer is formed, underwater, primarily by gravity. Given the size and depth of the LAR, the layer of "launched" rock would not significantly impact the hydraulic conditions.
EE-94	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Tree surveys were conducted using the Sacramento County standards for tree measurements. Tree survey data is contained within GIS shape files and is available upon request from the Corps.
EE-95	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Thank you for your comment. The assumption that natural environments can be easily disturbed by heavy use is a standard methodology applied to impact assessment.
EE-96	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Thank you for your comment. Special-status species in the study area, such as the valley elderberry longhorn beetle, benefit from habitat connectivity, which can be achieved through the restoration of larger natural areas. Smaller restoration areas can fragment the habitat and provide less habitat values through most habitat assessment methodologies, than larger stands of natural habitat.
EE-97	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Section 1508.20 of NEPA defines mitigation as a term that encompasses: (1) Avoiding, (2) Minimizing, (3) Rectifying, (4) Reducing, or (5) Compensating for an impact. Compensation would consist of replacing impacted habitat.
EE-98	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Substantial effects are considered to be significant, unmitigatable effects, as described throughout Sections 3.6.4 and 3.6.5. Conflicting with a plan indicates not complying with the relevant goals and policies of that plan.
EE-99	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Citation to this reference from the Parkway Plan was added to the Final EIS/EIR.
EE-100	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Section 3.6 of the EIS/EIR has been updated to clarify habitat impacts under the proposed study.
EE-101	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-102	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.

EE-103	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Footprints were developed for internal use only during the study process, primarily because they are intended to be the largest possible footprint and likely do not represent the refined/reduced footprint that will actually be implemented when the project reaches the construction phase. As site-specific designs are refined post-authorization, these more accurate footprints will be available for coordination and consultation purposes.
EE-104	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	65 acres of riparian habitat are estimated to be impacted by construction of the launchable rock trenches within the American River Parkway.
EE-105	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-106	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-107	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-108	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.

EE-109	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Analysis was intended to address a worst-case scenario, therefore we should not be assuming more impacts than a potential worst-case scenario. If there are greater impacts than what is stated in the NEPA document, then a supplemental NEPA document would be required to address those increased impacts, and further coordination would be required under that supplemental analysis. Therefore, yes, increased impacts would require additional coordination.
EE-110	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The preferred alternative for erosion protection is a combination of both measures, based on site-specific conditions. Site specific designs for erosion protection will be completed in the design phase of this study.
EE-111	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The EIS/EIR assesses impacts and mitigation, including short term and long term impacts. The Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR also includes more information regarding mitigation planning.
EE-112	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-113	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-114	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The planting berm/trench is discussed in the draft EIS/EIR Section 2.3.1 under "Bank Protection" in the 2nd and 4th paragraphs. Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
EE-115	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Mitigation was estimated using a maximized footprint of potential impacts, which would be refined during the design phase of the project. The footprint was not minimized or reduced by any proposed mitigation, such as planting berms.
EE-116	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location.
EE-117	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	A mitigation and monitoring plan was prepared and will be appended to the final EIS/EIR.
EE-118	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps has conducted internal assessments during the planning phase to determine the feasibility of all mitigation commitments. The Corps has confidence that all American River vegetation impacts can be mitigated within the Parkway without compromising the integrity of the flood management system. The proposed alternatives have been designed in accordance with the American River Parkway Plan Flood Control Policies. During the preconstruction engineering and design phase of the project, site-specific designs will be conducted for each segment of the project, and will include the final design of all mitigative features, which would be implemented during project construction. If the Corps determines that proposed onsite mitigation is not feasible, credits may be purchased at a mitigation bank.

EE-119	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trenches would be buried within the existing berm footprint and would not change the elevation of the berm in any way. Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable.
EE-120	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable. If habitat removed is not compatible with the trench, then offsite mitigation in the vicinity of the trench would be sought.
EE-121	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The launchable rock trench size was estimated as a conservative design based on a forecast of the potential for degradation of the channel and bank during a flood event. During the preconstruction engineering and design phase of the project this design will be refined based on site-specific conditions.
EE-122	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	130 acres of riparian mitigation is based on the 65 acre impact, mitigated on a 2:1 basis.
EE-123	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-124	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	An assumption was made for the purposes of mitigation planning that all elderberry shrubs are riparian because the Corps was evaluating effects based on a maximum impact scenario and riparian shrubs have more stringent mitigation requirements than non-riparian shrubs. During site-specific designs, each elderberry shrub will be evaluated on an individual basis and the mitigation will be adjusted, as needed, based on the existing conditions prior to construction.
EE-125	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	An assumption was made for the purposes of mitigation planning that all elderberry shrubs are riparian because the Corps was evaluating effects based on a maximum impact scenario and riparian shrubs have more stringent mitigation requirements than non-riparian shrubs. During site-specific designs, each elderberry shrub will be evaluated on an individual basis and the mitigation will be adjusted, as needed, based on the existing conditions prior to construction.
EE-126	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	The surveys were conducted prior to project design and include only 15 feet from the levee, both landside and waterside. There is the potential that there are more trees impacted by the trench than the survey results showed, which is why the impact associated with the trench is an acreage rather than a tree count. The footprint of the trenches is a maximum of 65 acres.
EE-127	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	The associated natives are based on the requirements established in the USFWS Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS, July 1999). The guidelines list and establish a number of species that are appropriate for VELB mitigation sites, including various species of willows, cottonwoods, oaks, box elder, etc.

EE-128	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Impacts to vegetation and wildlife within the project area are evaluated based on data collected from the tree surveys conducted in 2011, site visits, Google Earth, and the American River Parkway Plan. Engineering provided estimated construction footprints overlayed on aerial photos of the project area. The estimated acreage of impacts shown in the Final EIS/EIR was determined by overlaying the largest possible footprint of the erosion repair work proposed onto aerial photographs of the study area and calculating the habitat within the footprint. Additionally, the habitat maps appended to the Final EIS/EIR were reviewed to determine what other habitat types such as wetlands might be present.
EE-129	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-130	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	The surveys were conducted prior to project design and include only 15 feet from the levee, both landside and waterside. There is the potential that there are more trees impacted by the trench than the survey results showed, which is why the impact associated with the trench is an acreage rather than a tree count. The footprint of the trenches is a maximum of 65 acres.
EE-131	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Effects	Analysis was intended to address a worst-case scenario, therefore we should not be assuming more impacts than a potential worst-case scenario. If there are greater impacts than what is stated in the NEPA document, then a supplemental NEPA document would be required to address those increased impacts, and further coordination would be required under that supplemental analysis. Therefore, yes, increased impacts would require additional coordination.
EE-132	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Yes, the tree surveys were conducted in 2011.
EE-133	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The launchable rock trench size was estimated as a conservative design based on a forecast of the potential for degradation of the channel and bank during a flood event. During the preconstruction engineering and design phase of the project this design will be refined based on site-specific conditions.
EE-134	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	The associated natives are based on the requirements established in the USFWS Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS, July 1999). The guidelines list and establish a number of species that are appropriate for VELB mitigation sites, including various species of willows, cottonwoods, oaks, box elder, etc.
EE-135	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.

EE-136	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Specific mitigation plans, including any lands needed, will be developed during the site-specific design process following Congressional authorization. It is possible that more Parkway lands could be needed for mitigation, however locations haven't been selected yet. Any decisions on locations of mitigation for this project would be developed in coordination with the Sacramento County Department of Parks and Recreation.
EE-137	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	See new impact summary tables in EIS/EIR Section 3.6. Sacramento River has greater impacts. American River effects are double counted in some locations because site-specific design won't occur until PED. Impacts were maximized to account for either erosion protection scenario.
EE-138	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Hawk Mitigation	On page 146 of the draft EIS/EIR, it states that a 0.25-mile buffer would be established between construction activities and active nests.
EE-139	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Proposed vegetation establishment at bank protection sites is applicable to all bank protection sites proposed within the study area, including the American River. The specific details of the vegetation establishment in the planting berm would be designed on a site-specific basis in the design phase of the project.
EE-140	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	On page 30 of the draft EIS/EIR in Section 2.3.1, the planting berm is described as follows: After revetment placement has been completed, a small planting berm would be constructed in the rock where feasible to allow for some revegetation of the site, outside of the vegetation free zone as required by ETL 1110-2-583. This vegetation will be designed on a site specific basis to minimize the O&M responsibility of the LMA and in such a way to not impact the hydraulic conveyance of the channel.
EE-141	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Riparian mitigation would include planting of a variety of species associated with this habitat type, including oaks, cottonwoods, willows, box elder, elderberries, etc. All plantings within the Parkway would be established in coordination with County Parks and per the approved Parkway plant list. Woodlake/Cal Expo could be used for riparian mitigation, however it is not a preferred location for mitigation within the Parkway, due to continued problems with wildfires in this portion of the Parkway. The Corps is not likely to support additional mitigation sites at this location.
EE-142	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	The removal of riparian habitat for construction would likely also include the removal of some trees (as described in Section 3.6.4) that provide nesting habitat for Swainson's Hawk.
EE-143	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Page 147 of the draft EIS/EIS states that 134 acres of riparian habitat supporting Swainson's hawks would be removed.
EE-144	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Coordination would occur between the Corps and County Parks to determine the appropriateness and availability of mitigation opportunities within the Parkway. The Corps and County Parks have a history of collaborating in this way (e.g, the creation of a number of existing restoration sites within the Parkway, including Cal Expo, Sailor Bar, and River Bend Park, among others).
EE-145	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Coordination	Coordination would occur between the Corps and County Parks to determine the appropriateness and availability of mitigation opportunities within the Parkway. The Corps and County Parks have a history of collaborating in this way for the creation of a number of existing restoration sites within the Parkway, including Cal Expo, Sailor Bar, and River Bend Park, among others. Mitigation for Swainson's hawk is guaranteed to occur due to stipulations in the USFWS Biological Opinion, which requires compensation for the removal of riparian trees due to impacts to the Western yellow-billed cuckoo.

EE-146	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Impacts	Typically, impacts from construction are considered to be temporary and short-term, because construction only occurs for a limited amount of time. In this case, since construction is proposed over a number of years, although in different parts of the parkway, the temporary disruption from construction is treated differently than a typical less-than-significant short term impact. This is why the determination resulted in a significant, unmitigatable effect on recreation.
EE-147	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Impacts	"Eliminate" indicates a permanent loss of recreation. "Restrictions" indicate more of a limitation in what recreation activity could occur. "Disruption" is more related to the impacts that occur to present recreationists using the facility, such as noise or dust from construction.
EE-148	Friends of the River, Habitat 2020, and Save the American River Association	Letter	No Action	The Parkway Plan has specifically identified policies for Flood Control project implementation. The Flood Control policies identified in Chapter 4 of the Parkway Plan are the relevant regulations for this action. Implementation of the project is consistent with these policies. Allowing the Parkway to erode away over time, as is assumed in the No Action Alternative, would not be consistent with these policies.
EE-149	Friends of the River, Habitat 2020, and Save the American River Association	Letter	No Action	Citations for the Parkway Plan quotes have been added to the Final EIS/EIR.
EE-150	Friends of the River, Habitat 2020, and Save the American River Association	Letter	No Action	The Parkway Plan has specifically identified policies for Flood Control project implementation. The Flood Control policies identified in Chapter 4 of the Parkway Plan are the relevant regulations for this action. The project is in compliance with these policies, as identified throughout the various sections of this EIS/EIR. This discussion has been expanded for the final report.
EE-151	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Recreation	Section 3.14 evaluates the effects of the project on recreational resources and establishes that significant effects from detours and possible closures of portions of the parkway during construction would conflict with the Parkway Plan.
EE-152	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Recreation	Section 3.14 evaluates the effects of the project on recreational resources and establishes that significant effects from detours and possible closures of portions of the parkway during construction would conflict with the Wild and Scenic Rivers Act.
EE-153	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Recreation	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-154	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Aesthetics	Concur. The Visual Resources No Action alternative has been updated to include full berm loss as a significant impact.

EE-155	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Area	There is a total of 11 miles of erosion protection proposed for the Parkway.
EE-156	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The planting berm/trench is discussed in the draft EIS/EIR Section 2.3.1 under "Bank Protection" in the 2nd and 4th paragraphs. Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
EE-157	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	There would be no planting berm under the launchable rock trench measure. The planting berm is only associated with bank protection measures. Under the trench scenario, on-site plantings would be above the trench.
EE-158	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable. If habitat removed is not compatible with the trench, then offsite mitigation in the vicinity of the trench would be sought.
EE-159	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Elderberry shrubs estimated to be impacted by the project are contained within the acreage of riparian that are estimated to be mitigated. Elderberry mitigation requires the planting of associated riparian native plants. Mitigating for these two habitat types together is an effective and reasonable assumption for the project.
EE-160	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	An assumption was made for the purposes of mitigation planning that all elderberry shrubs are riparian because the Corps was evaluating effects based on a maximum impact scenario and riparian shrubs have more stringent mitigation requirements than non-riparian shrubs. During site-specific designs, each elderberry shrub will be evaluated on an individual basis and the mitigation will be adjusted, as needed, based on the existing conditions prior to construction.
EE-161	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Elderberry shrubs removed from the riparian corridor are considered to be riparian, and on-site mitigation associated with these impacts would be designed to contribute to the riparian corridor.
EE-162	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable. If habitat removed is not compatible with the trench, then offsite mitigation in the vicinity of the trench would be sought.
EE-163	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable. If habitat removed is not compatible with the trench, then offsite mitigation in the vicinity of the trench would be sought.

EE-164	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The Visual Resources No Action alternative has been updated to include full berm loss as a significant impact. Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-165	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
EE-166	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-167	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-168	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-169	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The Corps concurs that rock will be visible, even after revegetation has been established, particularly during low water years. It is anticipated that over time, as new vegetation establishes, the visibility of rock revetment will be greatly reduced. Section 3.15 of the EIS/EIR has been updated to acknowledge that rock will be visible.
EE-170	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The Corps concurs that rock will be visible, even after revegetation has been established, particularly during low water years. It is anticipated that over time, as new vegetation establishes, the visibility of rock revetment will be greatly reduced. Section 3.15 of the EIS/EIR has been updated to acknowledge that rock will be visible.
EE-171	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The Corps concurs that rock will be visible, even after revegetation has been established, particularly during low water years. It is anticipated that over time, as new vegetation establishes, the visibility of rock revetment will be greatly reduced. Section 3.15 of the EIS/EIR has been updated to acknowledge that rock will be visible.

EE-172	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The Sac Bank site shown is a worst case scenario with regards to the amount of bank protection being required and the revegetation that is included in the design. It is anticipated that during site specific design, the quantity of rock needed at most sites will be less than at this site. With this reduction in rock, and the ability to work around most existing vegetation, the extent of environmental impacts is expected to be reduced.
EE-173	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-174	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-175	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Impacts for the American River are as described in the document throughout Section 3.6. As described above, this estimate is based on the impacts to vegetation in the construction footprint and the level of impact would not change under a variance. American River proposed measures would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-176	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Typically when we are referring to large vegetation vs small vegetation we are referring to trees versus shrubs or grasses.
EE-177	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Bank protection will be placed around large trees. If necessary, select trees will need to be removed for construction purposes such as the ability of a hydraulic excavator to place bank protection. Launchable rock protection will require complete removal of vegetation within the footprint of the trench. In all cases, vegetation is being removed for construction purposes and not because of hydraulic analysis.
EE-178	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-179	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-180	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The proposed project only impacts vegetation in the construction footprint, and proposes to protect existing trees in place whenever possible. Additionally, all trees removed from the construction footprint would be compensated for, in the case of the Parkway, on-site to the maximum extent practicable. As a result, while there would be a significant short term impact from vegetation removal, long-term vegetation in the parkway is expected to recover. As a result of these proposed measures, the conclusions presented in the draft EIS/EIR are appropriate.

EE-181	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	A large berm made of large rocks. See Engineering Appendix for more details on the size and scope of the bank protection design.
EE-182	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
EE-183	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location.
EE-184	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Shallow rooted trees could be planted on the trench surface. Trench configuration is described in Chapter 2 of the EIS/EIR.
EE-185	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Vegetation would be removed only from the construction footprint of the project. To the maximum extent practicable, mitigation would be conducted on site with the ultimate goal of returning on-site conditions to as close to pre-project conditions as possible. Further information on proposed mitigation is included in the Mitigation and Monitoring Plan, which is appended to the final EIS/EIR.
EE-186	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Site specific erosion protection analysis to be completed during the design phase could identify locations where better long term resource results and may be able to minimize short term impacts. These additional measures may have less substantial effects that result from site specific design.
EE-187	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Mitigation proposed for the trench surface would compensate for impacts from construction of the trench and would attempt to recreate similar habitat to the maximum extent practicable. If habitat removed is not compatible with the trench, then offsite mitigation in the vicinity of the trench would be sought.
EE-188	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The trench width is a function of existing topography, trench slopes, depth, and quantity of launchable rock. These aspects of the design will be analyzed in more detail within PED phase. For the purposes of this study and description of impacts, the 70 feet trench width, is considered to be conservative when applied to the extents shown in plates 3 and 4.
EE-189	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Concur. Under the No Action Alternative, with erosion not addressed, full berm loss in a major flood event is assumed, and this is considered to be a significant impact.
EE-190	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The Corps has updated the No Action Alternative sections to indicate that full berm loss during a major flood event is considered to be a significant impact.

EE-191	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-192	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-193	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The planting berm/trench is discussed in the draft EIS/EIR Section 2.3.1 under "Bank Protection" in the 2nd and 4th paragraphs. Planting berms are associated with the bank protection design and not the launchable rock trench design. Trenches will be designed on a site-specific basis and would include shallow-rooted tree species.
EE-194	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	There would be no planting berm under the launchable rock trench measure. The planting berm is only associated with bank protection measures. Under the trench scenario, on-site plantings would be above the trench.
EE-195	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Section 2.3.1 includes revegetation through the planting berm at bank protection sites, and through planting shallow-rooted species on the surface of the trenches. This is consistent with the visual mitigation discussion. It should be noted that the conclusion of the visual resources section is that effects are significant and cannot be fully mitigated. This conclusion is primarily due to the temporal loss of vegetation while the new vegetation is establishing.
EE-196	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Area	There is a total of 11 miles of erosion protection proposed for the Parkway.
EE-197	Friends of the River, Habitat 2020, and Save the American River Association	Letter	No Action	The No Action Alternative is based on past experience and is a forecast of what could transpire with large magnitude flood events in the future. It is based on best available information, but does not include specific qualitative estimates.

EE-198	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-199	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The trench width is a function of existing topography, trench slopes, depth, and quantity of launchable rock. These aspects of the design will be analyzed in more detail within PED phase. For the purposes of this study and description of impacts, the 70 feet trench width, is considered to be conservative when applied to the extents shown in plates 3 and 4.
EE-200	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The acreage of impact was based on the construction footprint, including some additional areas like ramps and roads in the vegetation and wildlife section. Staging areas have not been determined at this time, because of the potential for changing conditions between this study and the implementation of the project, therefore this acreage was not included in current project estimates. Following authorization when site-specific design occurs, staging areas will be determined and if the impacts associated with those staging areas increase the environmental impacts disclosed in this EIS/EIR, then supplemental NEPA analysis would occur.
EE-201	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Modeling results are a summarization of a Sacramento Bank Protection Regional Sediment Study. This is a challenging issue. In general, in the absence of bedrock or other erosion resistant materials, the LAR is degradational in nature down to about RM 4. Downstream of this location, the river is slightly aggradational. The erosion resistant layer has only been mapped between river miles 5.5 and 11.5 (approximate RM's). The vertical location of the resistant layer is unknown for the remainder of the river below Nimbus Dam. Despite the general trends, zones of local aggradation and degradation are observed to occur in both the prototype river channel as well as in numerical modeling simulations (e.g., HEC-6T). In the zone where the erosion resistant layer has been identified, it appears that continued wholesale lowering of the channel thalweg is unlikely; however, other portions of the channel cross section (e.g., channel terraces or berms) may continue to degrade over time.
EE-202	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The degradation analysis report did look at nick points developing into full head cuts that would move upstream and jeopardize levee stability. This study found that the only place that this was somewhat probable was in the vicinity of the Guy West bridge. That is the reason that study only recommended grade control in that vicinity. Further site specific design in PED will relook at this, likely in consultation with local stakeholder groups.
EE-203	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Draft results for the long-term simulation indicate that about 263,000 cy would be eroded for the without-project condition during the period simulated. For the without-project conditions, a volume of 304,000 cy would be eroded along the 22-mile study reach of the American River.
EE-204	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	When sediment is mobilized from along the American River or other rivers, it washes downstream. Ultimately, this sediment finds its way to the Suisun, San Pablo, and San Francisco Bay and ultimately to the Pacific Ocean.

EE-205	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Considerable sea level rise would be required to significantly impact the sediment transport ability of the reach of river in question. There are conditions where high stage on the Sacramento River causes backwater effects on the American River in the RM 5-7 stretch, but then there are other conditions where the backwater effect is not present but there are still significant flows coming down the American River causing higher rates of sediment transport including in the RM 5-7 range. Significant sea level rise would need to occur before the sediment transport capability of this reach of river would greatly reduce. However, this will be further studied in PED in consultation with local stakeholder groups.
EE-206	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	We concur that naturally, upstream of RM 8 it is not a braided channel. But, artificially, because of the multiple channels associated with historic gravel mining, upstream of RM 8, sediment transport occurs as if it were a braided channel, which is why it is characterized this way. Further analysis in PED will address this further, likely in consultation with local stakeholder groups.
EE-207	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	This is a challenging issue. In general, in the absence of bedrock or other erosion resistant materials, the LAR is degradational in nature down to about RM 4. Downstream of this location, the river is slightly aggradational. The erosion resistant layer has only been mapped between river miles 5.5 and 11.5 (approximate RM's). The vertical location of the resistant layer is unknown for the remainder of the river below Nimbus Dam. Despite the general trends, zones of local aggradation and degradation are observed to occur in both the prototype river channel as well as in numerical modeling simulations (e.g., HEC-6T). In the zone where the erosion resistant layer has been identified, it appears that continued wholesale lowering of the channel thalweg is unlikely; however, other portions of the channel cross section (e.g., channel terraces or berms) may continue to degrade over time.
EE-208	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Reference to RM 9.0R was only made as an example of where erosion is actively occurring, even at low discharges such as 7,000 cfs. The concern regarding the erosive trends in the LAR are not predicated on just this one location. A review of the performance of the LAR channel with regards to erosion reveals that multiple locations of the channel have experienced damaging erosion and have required repair following significant discharge event.
EE-209	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Reference to RM 9.0R was only made as an example of where erosion is actively occurring, even at low discharges such as 7000 cfs. The concern regarding the erosive trends in the LAR are not predicated on just this one location. A review of the performance of the LAR channel with regards to erosion reveals that multiple locations of the channel have experienced damaging erosion and have required repair following significant discharge event.
EE-210	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	It is possible that sewer main undercrossing is contributing to the erosion concerns at RM 7. However, looking at the Ayres' velocity plots - the velocity at this location is high enough to be of concern with or without the sewer main undercrossing. Site specific designs for erosion protection will be completed in the design phase of this study known as Preconstruction, Engineering and Design (PED) and the sewer main undercrossing will be evaluated. Given the magnitudes of local shear and velocity along portions of the lower American River banks makes bio-engineering or other soft approaches for providing bank protection very challenging. Nonetheless, site specific designs for bank and erosion protection will be developed in the next phase of the study (PED Phase). As part of the Folsom Water Control Manual, additional Channel Stability Analyses are being conducted to further refine the designs.

EE-211	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	It is possible that sewer main undercrossing is contributing to the erosion concerns at RM 7. However, looking at the Ayres' velocity plots - the velocity at this location is high enough to be of concern with or without the sewer main undercrossing. Site specific designs for erosion protection will be completed in the design phase of this study known as Preconstruction, Engineering and Design (PED) and the sewer main undercrossing will be evaluated. Given the magnitudes of local shear and velocity along portions of the lower American River banks makes bio-engineering or other soft approaches for providing bank protection very challenging. Nonetheless, site specific designs for bank and erosion protection will be developed in the next phase of the study (PED Phase). As part of the Folsom Water Control Manual, additional Channel Stability Analyses are being conducted to further refine the designs.
EE-212	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The significance criteria in the Hydrology and Hydraulics section is based on the environmental checklist in Appendix G of the State CEQA Guidelines. Hydraulic effects are discussed throughout the section and the determination is that there would be no significant hydraulic effects associated with the project.
EE-213	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location.
EE-214	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The text has been revised to clarify that the discussion refers to surface runoff conditions, which are not expected to be impacted by implementation of the project. Erosion conditions will be addressed by the proposed measures. If trenches have launched, significant berm has been lost and channel geometry was highly altered by a major flood event. The launched trench would protect the levee. Erosion of the berm is not considered an impact of the project as it is part of the existing condition. Addressing the changed geometry post-flood event would be part of a collaborative effort during the recovery period.
EE-215	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	For the purposes of this study, the project features were designed with a flow of 160,000 cfs which is currently estimated to be a 200-year event. The ARCF GRR used a conservative characterization of future flood management operations at Folsom Dam assuming the JFP auxiliary spillway and control structure are complete. The Folsom Dam future operations reflected in the ARCF GRR are based on the operations identified in the Folsom Dam Modification and Folsom Dam Raise Projects Post Authorization Change Report (2007) (JFP PACR). Evaluation of how the flow regime has changed to get to the Spillway and Dam raise in place is being done under the Folsom Water Control Manual Update.
EE-216	Friends of the River, Habitat 2020, and Save the American River Association	Letter	H&H	The significance criteria in the Hydrology and Hydraulics section is based on the environmental checklist in Appendix G of the State CEQA Guidelines. Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.

EE-217	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The comment is unclear. Site-specific designs will be coordinated with County Parks during the PED phase of the project.
EE-218	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The EIS/EIR assesses impacts and mitigation, including short term and long term impacts. The Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR also includes more information regarding mitigation planning.
EE-219	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
EE-220	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Mitigation plans have been refined since the preparation of the draft EIS/EIR and are evaluated in more detail in the Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR. These plans will be further evaluated in PED during site-specific engineering design and selection of any off-site mitigation sites. Some riparian plantings will occur on the trenches, however, at this time the Corps anticipates that not all required mitigation will occur on-site.
EE-221	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-222	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-223	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	An assumption was made for the purposes of mitigation planning that all elderberry shrubs are riparian because the Corps was evaluating effects based on a maximum impact scenario and riparian shrubs have more stringent mitigation requirements than non-riparian shrubs. During site-specific designs, each elderberry shrub will be evaluated on an individual basis and the mitigation will be adjusted, as needed, based on the existing conditions prior to construction.

EE-224	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Mitigation requirements for VELB are established in the USFWS Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS, July 1999). The guidelines require that elderberries are planted along with a ratio of associated native plants. The Conservation Guidelines list and establish a number of species that are appropriate for VELB mitigation sites, including various species of willows, cottonwoods, oaks, box elder, etc.
EE-225	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Trench footprints are part of the riparian corridor. They primarily consist of riparian forest and oak woodland habitat types. In some cases they would also impact ruderal herbaceous habitat areas. The acreage of impacts will be refined during the design phase and a more accurate assessment of the habitat impacts will be conducted at that time. It is not anticipated that trenches would impact SRA habitat.
EE-226	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Existing mitigation sites within the American River Parkway contribute to the riparian corridor and therefore are generally considered to be riparian. When these sites reach full maturity they are expected to provide riparian habitat.
EE-227	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	The relationship between these mitigation types has not been established at this time. There is some overlap between the riparian mitigation and the required "associated natives " that must be planted for VELB mitigation. The final acreage of mitigation will be determined prior to construction and will be based on the recommendations in the USFWS CAR and the requirements of the Biological Opinion, as well as through coordination with County Parks.
EE-228	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-229	Friends of the River, Habitat 2020, and Save the American River Association	Letter	VELB	Elderberry impacts were based on the 2011 surveys. Because habitat will grow and could change significantly between 2011 and implementation of construction, surveys and counts will be conducted again prior to construction and mitigation implemented would be coordinated with USFWS prior to construction. Mitigation estimates were based on best available information during the planning phase. The project's cost estimate includes contingency costs to allow for potential future increases in mitigation. However, the expectation is that project footprints would decrease during construction and that impacts overall would likely be reduced.
EE-230	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
EE-231	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The draft EIS/EIR does not propose planting levee slopes. Smaller vegetation such as grasses and shrubs must be removed in order to construct bank protection sites, but large trees can be protected in place. Bank protection sites would include the establishment of a planting berm on the waterside toe of the levee. Figures in Chapter 2 will be updated for clarity and will show the planting berms in the Final EIS/EIR.

EE-232	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Smaller vegetation such as grasses and shrubs must be removed in order to construct bank protection sites, but large trees can be protected in place. Bank protection sites would include the establishment of a planting berm on the waterside toe of the levee. Figures in Chapter 2 will be updated for clarity and will show the planting berms in the Final EIS/EIR.
EE-233	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location. Planting berms would include a soil cap to allow for establishment of new vegetation and long-term revegetation (see Figures 8-10 of the EIS/EIR showing vegetative features in bank protection sites near CSU Sacramento).
EE-234	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location.
EE-235	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	The Corps has worked very closely with National Marine Fisheries Service under the Sacramento River Bank Protection Project (SRBPP) over the last 10-15 years to design self-mitigating bank protection sites, which include various types of planting berms to account for impacts to SRA habitat. Under the ARCF GRR, the Corps proposes to evaluate each bank protection site during the design phase to apply the appropriate SRBPP design to minimize and mitigate for effects to habitat.
EE-236	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	An estimate of impacts and mitigation for the American River erosion protection work is included in the EIS/EIR in Sections 3.6 and 3.8 and in the Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR. The final mitigation acreage will be coordinated following authorization once site-specific surveys and designs have been completed. At that time, coordination with County Parks and the resource agencies would occur and the final required mitigation would be established.
EE-237	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	The removal of riparian habitat for construction would likely also include the removal of some trees (as described in Section 3.6.4) that provide nesting habitat for Swainson's Hawk.
EE-238	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Woodlake/Cal Expo could be used for Swainson's/riparian mitigation, however it is not a preferred location for mitigation within the Parkway, due to continued problems with wildfires in this portion of the Parkway. The Corps is not likely to support additional mitigation sites at this location.
EE-239	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Habitat impacts have been clarified in Section 3.6 and 3.8 of the Final EIS/EIR. Additional information is also included in the Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR.
EE-240	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.

EE-241	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Project Area	There is a total of 11 miles of erosion protection proposed for the Parkway.
EE-242	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The planting berm/trench is discussed in the draft EIS/EIR Section 2.3.1 under "Bank Protection" in the 2nd and 4th paragraphs. Concur. The Corps updated Figure 1 to show the planting berm.
EE-243	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	There would be no planting berm under the launchable rock trench measure. The planting berm is only associated with bank protection measures. Under the trench scenario, on-site plantings would be above the trench.
EE-244	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	Deep-rooted trees would not be permitted on the trench, but shallow-rooted trees and shrubs could be planted in these areas.
EE-245	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	There would be no planting berm under the launchable rock trench measure. The planting berm is only associated with bank protection measures. Under the trench scenario, on-site plantings would be above the trench.
EE-246	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Mitigation	Elderberry impacts are included within the riparian impacts estimated. These two habitat types are inter-related and would be mitigated in coordination with one another.
EE-247	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Environmental Effects	The Visual Resources No Action alternative has been updated to include full berm loss as a significant impact. Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
EE-248	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Vegetation	Figures throughout Chapter 2 will be updated to include planting berms. During site-specific design, the Corps will evaluate each site and determine which planting berm designs is appropriate based on existing conditions. The Corps anticipates being able to implement some level of vegetative features at every bank protection site. If a planting berm is infeasible, this could include planting willow poles, or installing IWM for fish habitat.

EE-249	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-250	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-251	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Design	The repair shown is a conceptual design that reflects actual construction on the American River as part of the Sac Bank sites repair. In PED, site specific design will occur that will take into account the hydraulic, geotechnical, topographical, environmental, and cultural aspects of each site. The Corps, in conjunction with stakeholders will address the constraints at individual sites to come up with the best design alternative for each site.
EE-252	Friends of the River, Habitat 2020, and Save the American River Association	Letter	Visual	The Corps concurs that rock will be visible, even after revegetation has been established, particularly during low water years. It is anticipated that over time, as new vegetation establishes, the visibility of rock revetment will be greatly reduced. Section 3.15 of the EIS/EIR has been updated to acknowledge that rock will be visible.
FF-1	Save the American River Association	Letter	Design	It is agreed that the reach of the American River between Howe Ave. and Paradise Beach is the worst stretch of the river with regards to the applied velocity. This reach however is not an anomaly with regards to erosion. Erosion has occurred in this reach and has been repaired (Sac Bank site 4, ARCF site 6.4L, 6.9L, and site 7.0R). Erosion has also occurred downstream and upstream of this reach and has been repaired (Sac Bank sites 1, 2, 3, and 5, ARCF sites 1.8L, 4.0L, 10.0L 10.2R, plus the 1986 emergency repair upstream of the Capital City Freeway). The velocity within the Howe to Paradise Beach reach is 12 to 13 fps for flows ranging from 115,000 cfs to 160,000 cfs. Upstream and downstream of this reach, velocities are often in the 6 to 7 fps range. Bare soil can withstand 1.5 to 2.5 fps and soil with a good turf cover can withstand 3.5 to 8 fps depending on the class of turf. The American River does not offer good turf conditions. This is a reason why we have experienced erosion in reaches downstream and upstream of the Howe to Paradise Beach reach. Text to explain conditions both upstream and downstream of the Howe to Paradise Beach reach has been added to section 2.3.1 of the GRR and Section 3.4 of the EIS/EIR.
FF-2	Save the American River Association	Letter	Design	It is agreed that the reach of the American River between Howe Ave. and Paradise Beach is the worst stretch of the river with regards to the applied velocity. This reach however is not an anomaly with regards to erosion. Erosion has occurred in this reach and has been repaired (Sac Bank site 4, ARCF site 6.4L, 6.9L, and site 7.0R). Erosion has also occurred downstream and upstream of this reach and has been repaired (Sac Bank sites 1, 2, 3, and 5, ARCF sites 1.8L, 4.0L, 10.0L 10.2R, plus the 1986 emergency repair upstream of the Capital City Freeway). The velocity within the Howe to Paradise Beach reach is 12 to 13 fps for flows ranging from 115,000 cfs to 160,000 cfs. Upstream and downstream of this reach, velocities are often in the 6 to 7 fps range. Bare soil can withstand 1.5 to 2.5 fps and soil with a good turf cover can withstand 3.5 to 8 fps depending on the class of turf. The American River does not offer good turf conditions. This is a reason why we have experienced erosion in reaches downstream and upstream of the Howe to Paradise Beach reach. Text to explain conditions both upstream and downstream of the Howe to Paradise Beach reach has been added to section 2.3.1 of the GRR and Section 3.4 of the EIS/EIR.

FF-3	Save the American River Association	Letter	Design	Figure 4-5 has been modified to include the previously installed erosion repair sites.
FF-4	Save the American River Association	Letter	Design	The cross sections shown in all documents are conceptual and do not represent exactly what will occur at any given site. Design will occur at individual sites and will take into account the geotechnical, hydraulic, environmental constraints at the site. Covering rock with soil is now an established practice. To the extent practicable, rock placed above the normal summer water surface will be covered with soil.
FF-5	Save the American River Association	Letter	Engineering Appendix History	Agree that history should be updated in said attachment. However, the Mayhew improvements from 2008 addressed levee height and seepage/stability, and not erosion protection. Our study indicates that Mayhew area is in need of an erosion protection to handle the future without project conditions which the Mayhew seepage/stability and raise project did not account for. However, the necessity of bank protection and the design details of this feature will be further analyzed in PED.
FF-6	Save the American River Association	Letter	Design	Figure 2-6 has been updated to reflect the more current understanding of the potential erosion sites which corresponds with the recommended erosion protection sites.
FF-7	Save the American River Association	Letter	Design	The following text has been added to Chapter 2 of the GRR to describe how areas were identified for erosion protection. Additionally, maps showing the velocity contours of the entire leveed reach of the lower American River have been added to further illustrate this analysis. "Figure 2-7 shows the velocities for a discharge of 115,000 cfs which average about 6 to 8 ft/sec in the channel with maximum velocities ranging up to about 12 ft/sec. Figure 2-8 shows the velocities for a discharge of 160,000 cfs which average about 5 to 9 ft/sec in the channel with maximum velocities ranging up to about 13 ft/sec. Of concern in both of these figures are the proximities of the relatively high velocities to the levees along the Lower American River. Additionally, the range of the computed velocities is of concern since the magnitude of the velocities is great enough to erode many of the relatively fine grained material present in the channel lining. The results of the analysis indicate that the large discharge events are capable of eroding the material typically found lining the Lower American River channel." Additionally, the following language has been added to Chapter 4: "The rationale used to determine where erosion protection was required involved consideration of several factors. The most important factors included: 1) the velocity computed by the hydraulic modeling (Ayres 2004) for a discharge of 160,000 cfs, 2) the erodibility of the material near the levee prism, and 3) the past performance of the levee segment with respect to erosion."
FF-8	Save the American River Association	Letter	Alternatives	The recommended plan in the GRR has identified areas along the American River where potential high flow velocities are within a proximity to the levee which would cause concern for potential levee failure. This footprint of erosion work represents the largest area that the initial studies have identified. These sites will be further investigated during the design phase and the extent of levee work would possibly be reduced as a result of the future analysis. Additionally, the recommendations in the GRR would be constructed in a worst-first sequence, meaning that the areas considered to be the highest risk would be constructed first. Since the GRR would need to wait for both authorization and then annual appropriations from Congress, it could be many years until the funding is in place for construction for those areas considered to be lower risk.

FF-9	Save the American River Association	Letter	General	A description of the final report approval process has been added to Chapter 4 of the GRR. That approval process is as follows: The Project Delivery Team (PDT) has responded to the comments on the Draft GRR & EIS/EIR and Appendices received during concurrent Public Review, Agency Technical Review (ATR), Independent External Peer Review (IEPR) and HQUSACE Policy Review and revised the documents as appropriate. The Final GRR &EIS/EIR and Appendices are transmitted to the South Pacific Division (SPD) for endorsement and then forwarded to HQUSACE. Once the documents are received at HQUSACE, a Civil Works Review Board (CWRB) is convened. The purpose of the CWRB is to determine if the final GRR &EIS/EIR and appendices, along with the proposed Report of the Chief of Engineers, are ready to be released for State and Agency review, as required by the Flood Control Act of 1944, as amended (33U.S.C. 701-1). Upon a successful conclusion of the CWRB meeting, the Deputy Commanding General for Civil and Emergency Operations (DCG-CEO) will approve release of the documents for State and Agency review and final NEPA review. After State and Agency review, comments are incorporated in to the documents as appropriate and a Final Chief's Report will be signed by the Chief of Engineers. The Chief's Report will then be sent to the chairpersons of the Senate Committee in Environment and Public Works and the House of Representative Committee on Transportation and Infrastructure. The Chief's Report, along with the GRR, EIS/EIR and appendices will then be sent to the Assistant Secretary of the Army for Civil Works (ASA(CW)) for review and approval. After approval by the ASA(CW), the documents will be sent to the Office of Management and Budget (OMB) for review.
FF-10	Save the American River Association	Letter	LPP	The acronym "LPP" has been added to the list of acronyms at the front of the report. The LPP was developed by the project delivery team which consists of USACE and sponsor staff. It has been endorsed by USACE Headquarters, the Assistant Secretary of the Army for Civil Works (ASA(CW)), the Central Valley Flood Protection Board and the SAFCA Board of Directors.
GG-1	James Morgan	Letter	NEPA	During the preconstruction engineering and design phase of the project, the Corps will be designing each phase of the project on a site-specific basis. During this site-specific design, an analysis will be conducted to determine whether the impacts are consistent with those described in this EIS/EIR or whether supplemental NEPA analysis would need to occur.
GG-2	James Morgan	Letter	Alternatives	A lot of levee improvement work has already taken place along the American River. The remaining problem is the potential for erosion to cause a levee failure. Sites have been identified along the American River where high velocity flows could cause potential levee erosion. Several different construction techniques have been identified to address the erosion potential. These techniques will be refined on a site specific basis during the design phase.
GG-3	James Morgan	Letter	Communication	The information presented at the Lower American River Task Force was meant to highlight the risk of erosion in the length of river between Paradise Beach and Watt Ave. We regret any misunderstanding this might have caused.
GG-4	James Morgan	Letter	Alternatives	The recommended plan in the GRR has identified areas along the American River where potential high flow velocities are within a proximity to the levee which would cause concern for potential levee failure. This footprint of erosion work represents the largest area that the initial studies have identified. These sites will be further investigated during the design phase and the extent of levee work would possibly be reduced as a result of the future analysis. Additionally, the recommendations in the GRR would be constructed in a worst-first sequence, meaning that the areas considered to be the highest risk would be constructed first. Since the GRR would need to wait for both authorization and then annual appropriations from Congress, it could be many years until the funding is in place for construction for those areas considered to be lower risk.
GG-5	James Morgan	Letter	Design	Concur, the bank protection graphic on page 32 should have soil cover for the rocks areas which are above the summer mean water surface elevation.

HH-1	Gay Jones	E-mail	Coordination	The Corps of Engineers is committed to working with stakeholders during the design and construction process. Previous bank protection constructed working with the LARTF is a good example that the Corps is supportive of using as a working model.
HH-2	Gay Jones	E-mail	Scope	As part of the ongoing effort to reduce the flood risk for the City of Sacramento, many studies have been conducted to gain a better understanding of the nature of the risk and possible ways to reduce the risk. These efforts have greatly expanded the understanding of the extent of the risk, including the potential for erosion of not only the banks of the American River, but the levees as well.
HH-3	Gay Jones	E-mail	Alternatives	The recommendations included in the GRR will be refined during the design phase of the project, at which time, site specific surveys and details would be taken into account.
HH-4	Gay Jones	E-mail	Alternatives	The levees along the American and Sacramento River could fail during a flood event due to four main factors. These factors include 1) flood water seeping through and under the levee, 2) levee instability, 3) flood waters overtopping a levee during a flood event, and 4) erosion of the levee. The first three factors have been addressed by prior work along the American River, however, the risk of significant levee erosion still remains as a possible cause of levee failure. Several erosion sites have been repaired and this work, along with all the other previous work, was accounted for during the development of the recommended plan for the GRR. The analysis conducted as part of the GRR identified additional areas where there is a high likelihood of erosion during large flood events.
HH-5	Gay Jones	E-mail	Parkway Plan	The majority of the Parkway Plan quotes in the document are directly out of Chapter 4 of the Parkway Plan, which identifies the goals and regulations for flood control actions in the Parkway. The EIS/EIR has been updated with citations to Chapter 4 of the Parkway Plan.
HH-6	Gay Jones	E-mail	Vegetation	The Corps does not propose to construct any new levees under the ARCF GRR. The project proposes to improve known problems in the existing levee system that could lead to a failure, damages, and loss of life. In order to complete this important public safety project, there would be significant impacts on the environment. The mitigation proposed in the EIS/EIR is expected to provide a similar habitat value long-term, however the short-term effects would be significant and unavoidable. The Corps intends to do what it can in site-specific design to minimize these significant effects, however, protecting habitat is not the purpose of the project.
II-1	State Water Resources Control Board	Letter	Alternatives	A wide variety of possible alternatives was analyzed as part of the study. Because the levees surrounding the City are in such poor condition, the study concluded that the most effective way to reduce the flood risk for the City of Sacramento is to improve the levees. A setback levee with a seepage berm is recommended for the Sacramento Bypass north levee which would approximately double the width of the floodplain area in the Sacramento Bypass. The remainder of the levees are adjacent to urban development with little to no available land for a levee setback.
II-2	State Water Resources Control Board	Letter	Water Quality	The CVRWQCB Basin Plan for the Sacramento and San Joaquin River Basins is referred to throughout Section 3.5, and the thresholds identified within the Basin Plan are cited throughout as the regulatory level applicable to the project for various water quality issues such as dissolved oxygen, water temperature, pH, and turbidity. Mitigation is proposed to comply with these thresholds, and monitoring would be conducted during in-water work to ensure that these thresholds are not exceeded. Further coordination with the CVRWQCB would occur during the design phase prior to construction to ensure that all appropriate permits (i.e., Section 401 Water Quality Certification) is met and any additional mitigation required will be coordinated with the board through that process.
II-3	State Water Resources Control Board	Letter	Water Quality	The Corps will ensure that prior to initiation of construction, a Section 401 Water Quality Certification is obtained, as necessary, for impacts to waters of the U.S. Through the Water Quality Certification process, the Corps will consult with the Water Boards, as required.
II-4	State Water Resources Control Board	Letter	Water Quality	Section 3.5 of the EIS/EIR has been updated to identify beneficial uses of surface waters and to analyze the impacts that could occur to these water uses.

II-5	State Water Resources Control Board	Letter	Alternatives	A wide variety of possible alternatives was considered, including features throughout the watershed, to find ways to reduce the flood risk to the City of Sacramento. USACE has developed a hydraulic model of the Sacramento River which allows us to analyze the effects of modifications to the flood management system. Because the levees surrounding the City are in such poor shape, the analysis showed that most effective plan to reduce the flood risk is to improve the existing levees. A setback levee is recommended for the north levee of the Sacramento Bypass which would approximately double it's floodplain area. The remainder of the levees are adjacent to urban development with little to no available land for a levee setback. The ongoing Central Valley Integrated Flood Management Study (CVIFMS) is a multi-purpose watershed study that is considering the larger, regional scale benefits associated with flood risk management, ecosystem restoration and other water resource related purposes. SAFCA is a local cost sharing partner on the study and has been in close coordination with USACE on the development of the GRR and the proposed work along the Sacramento River and the North Area Streams. The recommendations of the GRR are considered integral to the Lower Sacramento River Feasibility Study that is being developed as part of the Central Valley Flood Protection Plan (CVFPP).
II-6	State Water Resources Control Board	Letter	Vegetation	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
II-7	State Water Resources Control Board	Letter	SAFCA projects	SAFCA has informed the Corps that they will be seeking both permission to alter the Federal Flood Management Project (Section 408) and Credit Consideration (Section 221) for levee improvement work they intend on constructing prior to implementation of the ARCF GRR recommended project. Section 221 of the Flood Control Act of 1970 as amended by Section 2003 of the Water Resources Development Act (WRDA) of 2007 (42 U.S.C. 1962d-5b) allows the sponsor to seek credit for the study, design and construction of Federally authorized water resources development projects that are carried out after the execution of an agreement with the ASA(CW). Where there is a cost sharing agreement, the sponsor may provide in-kind contributions in accordance with the terms of the applicable agreement. The sponsor has indicated that they intend to construct portions of the levee improvements recommended by the GRR that are considered the highest risk areas and seek credit for those improvements. These actions will not be considered part of the without project condition however, in order that the sponsor may receive credit consideration in the future.
II-8	State Water Resources Control Board	Letter	Water Quality	Section 3.5 of the EIS/EIR has been updated to identify beneficial uses of surface waters and to analyze the impacts that could occur to these water uses.
II-9	State Water Resources Control Board	Letter	Vegetation	If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583.
II-10	State Water Resources Control Board	Letter	Vegetation	The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
II-11	State Water Resources Control Board	Letter	Vegetation	The SWIF Plan will be prepared by the local sponsors. It is anticipated that this will be acknowledged within the SWIF plan, as it is a key assumption associated with the vegetation variance and SAFCA's ongoing vegetation management efforts under the Levee Accreditation Program.
II-12	State Water Resources Control Board	Letter	Vegetation	The regulatory setting sections refer to the laws and regulations that are applicable to the proposed projects. These laws are further described in Chapter 5, including details on which agencies must be consulted with and what actions the Corps must take in order to achieve full compliance.

II-13	State Water Resources Control Board	Letter	Wetlands	The second bullet in the Significance Criteria for Section 3.6 states: "Substantial effects on a sensitive natural community, including Federally protected wetlands and other waters of the U.S., as defined by Section 404 of the Clean Water Act.".
II-14	State Water Resources Control Board	Letter	Water Quality	In Section 3.6, the EIS/EIR acknowledges the significant impacts that result from the temporal loss of vegetation, including riparian trees. Additionally, in Section 1.4.5 the EIS/EIR describes the project's approach to vegetation removal and protection under the Corps' levee safety policies. Section 1.4.5 describes the vegetation variance, which will allow the Corps to leave mature vegetation in place along the waterways, preserving the SRA habitat in the study area. Additionally, the Corps proposes to plant additional waterside habitat through the construction of planting berms at bank protection sites. Through these measures, the project would not result in a significant impact on water temperature. The Water Quality section will be updated for the final EIS/EIR to include this analysis.
II-15	State Water Resources Control Board	Letter	Mitigation	Mitigation planning efforts are ongoing and are discussed in greater detail in the Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR.
II-16	State Water Resources Control Board	Letter	Mitigation	Mitigation planning efforts are ongoing and are discussed in greater detail in the Mitigation and Monitoring Plan, which is appended to the Final EIS/EIR.
II-17	State Water Resources Control Board	Letter	Mitigation	The Corps will comply with all applicable State and Federal regulations. Further coordination with the CVRWQCB will occur following project authorization to ensure that the Corps is conducting all mitigation and monitoring in accordance with the applicable guidance.
II-18	State Water Resources Control Board	Letter	Vegetation	As detailed in Section 1.4.5 of the EIS/EIR, the Corps has conducted an analysis to determine the feasibility of acquiring a vegetation variance. The analysis determined that receipt of a variance is a reasonable assumption for the project and therefore all effects analyses assumed the variance is in place. If a variance is not granted by USACE HQ, then the Corps will conduct further NEPA/CEQA analysis at that time to analyze the effects of compliance with ETL 1110-2-583. The variance application process will be conducted following Congressional authorization during the preconstruction engineering and design phase of the project.
JJ-1	Sacramento County	Letter	Environmental Effects	The Final EIS/EIR has been updated with an effort to be more specific about habitat impacts.
JJ-2	Sacramento County	Letter	Recreation	Recreational access points, boat launches, parks, and recreation sites such as the Campus Commons Golf Course would remain open to the greatest extent practicable. If construction equipment and material delivery requires full closure of revenue generating facilities, compensation would be discussed during PED phase when such closures are determined to be required.
JJ-3	Sacramento County	Letter	Recreation	Impacts to the Golf Course will be included in the Final EIS/EIR.
JJ-4	Sacramento County	Letter	Recreation	Construction of the project would not take place in all areas of the Parkway at one time, and there may be viable detours for equestrians during construction. However, communication about where the construction would take place would enable equestrian riders to determine the best route to take in order to avoid equestrian startlement and confusion. These efforts would be further discussed during PED phase.
JJ-5	Sacramento County	Letter	Recreation	Construction of the project would not take place in all areas of the Parkway at one time. There is the potential for bank-side access points near construction sites to be closed or limited during construction, but construction would not substantially limit the ability for recreationists to do water-based activities.
JJ-6	Sacramento County	Letter	Recreation	Closures and detours of the recreational trail could impact multiple events such as Eppie's Great Race, the American River Parkway Half Marathon, the Jed Smith Ultra Classic, and multiple other fun runs and events. Coordination during PED phase would reduce impacts to these events to the greatest extent practicable. Recreational access points, boat launches, parks, and recreation sites such as the Campus Commons Golf Course would remain open to the greatest extent practicable. If any construction would require full closure, compensation of lost revenue would be considered during the design phase.

JJ-7	Sacramento County	Letter	Recreation	Construction contractors are required to restore the area to pre-construction conditions. If unofficial public trails are created due to project impacts, the eroded areas would be included in project impacts and restored to pre-construction conditions.
JJ-8	Sacramento County	Letter	Recreation	Coordination with Park staff would be conducted during design phase in order to reduce impacts to recreation to the greatest extent practicable. If detours, closures, and other disturbances to recreation are determined to be necessary in order to complete the project, public outreach would be conducted in conjunction with State and local outreach efforts.
JJ-9	Sacramento County	Letter	Borrow	Thank you, we will consider in PED phase.
JJ-10	Sacramento County	Letter	Borrow	The Corps or its contractor would acquire all appropriate permits prior to the initiation of project construction.
JJ-11	Sacramento County	Letter	Vegetation	Typically when we are referring to large vegetation vs small vegetation we are referring to trees versus shrubs or grasses.
JJ-12	Sacramento County	Letter	Vegetation	Design based on site-specific hydraulic and environmental conditions would occur during the design phase of the project to determine which erosion protection measure is appropriate at each location.
JJ-13	Sacramento County	Letter	Vegetation	More information about vegetation habitats has been included in the Final EIS/EIR and the Mitigation and Monitoring Plan.
JJ-14	Sacramento County	Letter	Vegetation	Trees left in place are not expected to die. The Corps has been protecting trees in place as part of bank protection construction under the Sacramento River Bank Protection Project and the trees at these sites have had successful survival rates over the last decade.
JJ-15	Sacramento County	Letter	Design	Concur. The Corps will update figure 1 to ensure that the planting berm is shown.
JJ-16	Sacramento County	Letter	Vegetation	Proposed measures on the American River would only impact vegetation within the construction footprint. For the launchable rock trench measure, the construction footprint includes the lower waterside slope. Since the vegetation variance only applies to the lower waterside slope, it cannot be applied to this measure. The bank protection measure on the American River does not involve the levee slope, and therefore, a vegetation variance is not necessary. The Corps will minimize impacts to vegetation in the Parkway to the maximum extent possible during construction.
JJ-17	Sacramento County	Letter	Vegetation	Impacts for the American River are as described in the document throughout Section 3.6. As described above, this estimate is based on the impacts to vegetation in the construction footprint and the level of impact would not change under a variance. No ETL compliance is necessary for the measures proposed under this project on the American River. It remains the responsibility of the local maintaining agency.
JJ-18	Sacramento County	Letter	Vegetation	The appropriateness of where replantings occur would be determined on a site-specific basis during the preconstruction engineering and design phase of the project. For example, following construction on the Sacramento River levees, new trees would not be installed in the levee prism, as it would conflict with State and Federal vegetation policies, but they would be installed in planting berms, while levees would be reseeded with native grasses.
JJ-19	Sacramento County	Letter	No Action	As part of the Folsom Water Control Manual update, additional Channel Stability Analyses are being conducted to further refine channel widening and deepening.
JJ-20	Sacramento County	Letter	Design	The trench width (top) is a function of existing topography, trench slopes, depth, and quantity of launchable rock. These aspects of the design will be analyzed in more detail within PED phase. For the purposes of this study and description of impacts, the 70 feet trench width is considered to be conservative when applied to the extents shown in plates 3 and 4.

JJ-21	Sacramento County	Letter	Design	Berm erosion is part of the existing condition and is not an impact of project implementation or operation. Additionally, since a combination of bank protection and trench is proposed, the project does prevent the full berm loss that is considered significant under the No Action alternative. Erosion of the bank/berm is a natural process that is continually occurring, but is exacerbated when extreme precipitation results in high releases from Folsom Dam. The decision to construct launchable rock trench as opposed to bank protection does not change these erosion conditions, but rather prevents the erosion from causing a levee failure. The construction of a trench rather than bank protection in some locations also allows for some natural sediment transport processes to continue. The balance of these two measures reduces the potential significant impacts that would occur if either one was implemented on its own. During PED, a more substantial design analysis will be conducted, working with stakeholders. This more substantial design analysis will look at site specific conditions to better inform the decision on bank protection versus launchable rock.
JJ-22	Sacramento County	Letter	NEPA	Section 1.1 of the EIS/EIR describes the process for evaluating site-specific conditions in the design phase of the project and determining whether any supplemental NEPA/CEQA analysis will need to be conducted prior to construction.
JJ-23	Sacramento County	Letter	Coordination	As part of the ongoing coordination for the ARCF GRR, site-specific designs would be shared when they are developed during the Design Phase.

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Notice of Intent To Prepare an Environmental Impact Statement for 408 Permission and 404 Permit to Three Rivers Levee Improvement Authority for the Feather River Levee Repair Project, California, Segment 2

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of intent.

SUMMARY: The action being taken is the preparation of an Environmental Impact Statement (EIS) for the issuance of both the 408 permission to the Central Valley Flood Protection Board and 404 Permit to Three Rivers Levee Improvement Authority (TRLIA) for their work on the Feather River Levee Repair Project (FRLRP). Under 33 U.S.C. 408, the Chief of Engineers grants permission to alter an existing flood control structure if it is not injurious to the public interest and does not impair the usefulness of such work. Under section 404 of the Clean Water Act, the District Engineer permits the discharge of dredged or fill material into waters of the United States if the discharge meets the requirements of the Environmental Protection Agency's 404(b)(1) guidelines and is not contrary to the public interest. The FRLRP is located in Yuba County, CA. TRLIA is requesting this permission and permit in order to complete construction along the east levee of the Feather River.

DATES: A public scoping meeting will be held March 10, 2008, 6:30 to 8:30 at the Yuba County Government Center, 915 8th Street, Marysville, CA. Send written comments by April 9, 2008 to the address below.

ADDRESSES: Send written comments and suggestions concerning this study to Mr. John Suazo, U.S. Army Corps of Engineers, Sacramento District, Attn: Planning Division (CESPK–PD–R), 1325 J Street, Sacramento, CA 95814. Requests to be placed on the mailing list should also be sent to this address.

FOR FURTHER INFORMATION CONTACT: Questions about the proposed action and EIS should be addressed to John Suazo at (916) 557–6719, e-mail: *john.suazo@usace.army.mil* or by mail to (see **ADDRESSES**).

SUPPLEMENTARY INFORMATION:

1. *Proposed Action.* The U.S. Army Corps of Engineers is preparing an EIS to analyze the impacts of the work proposed by TRLIA from the implementation of the FRLRP, Segment 2. The FRLRP, Segment 2 is being constructed by TRLIA to improve flood protection to portions of Yuba County and Reclamation District (RD) 784.

2. *Alternatives.* The EIS will address an array of flood control improvement alternatives along Segment 2. Alternatives analyzed during the investigation will include a combination of one or more flood protection measures. These measures include seepage berms, stability berms, setback levees, seepage cutoff walls, and relocation of a pump station.

3. *Scoping Process.* a. The Corps has initiated a process to involve concerned individuals, and local, State, and Federal agencies. A public scoping meeting will be held on March 10, 2008 to present information to the public and to receive comments from the public.

b. Significant issues to be analyzed in depth in the EIS include effects on hydraulic, wetlands and other waters of the U.S., vegetation and wildlife resources, special-status species, cultural resources, land use, fisheries, water quality, air quality, transportation, and socioeconomics; and cumulative effects of related projects in the study area.

c. The Corps is consulting with the State Historic Preservation Officer to comply with the National Historic Preservation Act, and the National Marine Fisheries Service and the U.S. Fish and Wildlife Service to comply with the Endangered Species Act. Coordination with the National Marine Fisheries Service has been completed; coordination with U.S. Fish and Wildlife Service is still ongoing.

d. A 45-day public review period will be provided for individuals and agencies to review and comment on the draft EIS. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS circulation.

4. *Availability.* The draft EIS is scheduled to be available for public review and comment in early 2008.

Dated: February 22, 2008.

Thomas C. Chapman,

COL, EN, Commanding.

[FR Doc. E8–3919 Filed 2–28–08; 8:45 am]

BILLING CODE 3710–EZ–P

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Notice of Intent To Prepare an Environmental Impact Statement for the American River Common Features General Reevaluation Report, Sacramento, CA

AGENCY: Department of the Army, U.S. Army Corps of Engineers; DOD.

ACTION: Notice of intent.

SUMMARY: The action being taken is the preparation of an environmental impact statement (EIS) for the American River Common Features General Reevaluation Report (GRR). The Common Features Project GRR will re-evaluate the currently authorized plan as well as develop and evaluate other viable alternatives, including a locally-preferred plan, with the goal of identifying a comprehensive plan that will lower the risk of flooding in and around the City of Sacramento. The Common Features Project GRR is located in Sacramento, Sutter and Yolo Counties, CA.

DATES: A series of public scoping meetings will be held as follows:

1. March 5, 2008, 5 to 7 p.m. at The Elk's Lodge.
2. March 6, 2008, 5 to 7 p.m. at Arden Park Community Center, Room A.
3. March 10, 2008, 3 to 6 p.m. at The Library Galleria East Meeting Room.
4. March 13, 2008, 5 to 7 p.m. at The Sierra Health Foundation.

Send written comments by April 11, 2008 to the address below.

ADDRESSES: Written comments and suggestions concerning this study may be submitted to Ms. Elizabeth Holland, U.S. Army Corps of Engineers, Sacramento District, Attn: Planning Division (CESPK–PD–R), 1325 J Street, Sacramento, CA 95814. Requests to be placed on the mailing list should also be sent to this address. The location of the public meetings is as follows; The Elks Lodge, 6446 Riverside Blvd., Sacramento, CA; Arden Park Community Center, 1000 La Sierra Drive, Sacramento, CA; Library Galleria, 828 ''I'' Street, Sacramento, CA; and Sierra Health Foundation, 1321 Garden Highway, Sacramento, CA.

FOR FURTHER INFORMATION CONTACT: Questions about the proposed action and EIS should be addressed to Liz Holland at (916) 557–6763, e-mail *Elizabeth.g.holland@usace.army.mil* or by mail to (see **ADDRESSES**).

SUPPLEMENTARY INFORMATION:

1. *Proposed Action.* The U.S. Army Corps of Engineers is preparing an EIS

to analyze the impacts of a range of alternatives that would lessen the risk of flooding in and around the City of Sacramento.

2. *Alternatives.* The EIS will address an array of flood control improvement alternatives that are intended to reduce flood risk within the project area. Alternatives analyzed during the investigation will include a combination of one or more flood protection measures. These measures include levee improvements (e.g., seepage berms, adjacent setback levees, seepage wells, seepage cutoff walls), revisions to system hydraulics through setbacks, levee raises, and/or more diversion of flow into the bypass system, and possible use of upstream lands for detention.

3. *Scoping Process.* a. A series of public scoping meeting will be held in early March, 2008 to present information to the public and to receive comments from the public. These meetings are intended to initiate the process to involve concerned individuals, and local, State, and Federal agencies.

b. Significant issues to be analyzed in depth in the EIS include effects on hydraulics, wetlands and other waters of the U.S., vegetation and wildlife resources, special-status species, esthetics, cultural resources, recreation, land use, fisheries, water quality, air quality, transportation, and socioeconomics; and cumulative effects of related projects in the study area.

c. The Corps is consulting with the State Historic Preservation Officer to comply with the National Historic Preservation Act and the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act. The Corps is also coordinating with the U.S. Fish and Wildlife Service to comply with the Fish and Wildlife Coordination Act.

d. A 45-day public review period will be provided for individuals and agencies to review and comment on the draft EIS. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS circulation.

4. *Availability.* The draft EIS is scheduled to be available for public review and comment in spring 2010.

Dated: February 15, 2008.

Thomas C. Chapman,

COL, EN, Commanding.

[FR Doc. E8–3922 Filed 2–28–08; 8:45 am]

BILLING CODE 3710–EZ–P

DEPARTMENT OF DEFENSE

Department of the Navy

Meeting of the Ocean Research and Resources Advisory Panel

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Ocean Research and Resources Advisory Panel (ORRAP) will meet to discuss National Ocean Research Leadership Council (NORLC) and Interagency Committee on Ocean Science and Resource Management Integration (ICOSRMI) activities. All sessions of the meeting will be open to the public.

DATES: The meeting will be held on Tuesday, April 15, 2008 from 8 a.m. to 5:30 p.m. and Wednesday, April 16, 2008 from 8 a.m. to 1:30 p.m.

ADDRESSES: The meetings will be held at the Consortium for Ocean Leadership located at 1201 New York Ave, Suite 420, Washington, DC.

FOR FURTHER INFORMATION CONTACT: Dr. Charles L. Vincent, Office of Naval Research, 875 North Randolph Street, Suite 1425, Arlington, VA 22203–1995, telephone: 703–696–4118.

SUPPLEMENTARY INFORMATION: This notice is provided in accordance with the provisions of the Federal Advisory Committee Act (5 U.S.C. App. 2). The meeting will include discussions on ocean research to applications, ocean observing, professional certification programs, and other current issues in the ocean science and resource management communities. In order to maintain the meeting time schedule, members of the public will be limited in their time to speak to the Panel. Members of the public should submit written comments at least one week prior to the meeting to Dr. Charles L. Vincent, Office of Naval Research, 875 North Randolph Street, Suite 1425, Arlington, VA 22203–1995, telephone: 703–696–4118.

Dated: February 22, 2008.

T.M. Cruz,

Lieutenant, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–3893 Filed 2–28–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

[USN–2008–0008]

Privacy Act of 1974; System of Records

AGENCY: Department of the Navy, DoD.

ACTION: Notice to Amend a System of Records.

SUMMARY: The Department of the Navy is amending a system of records notice in its existing inventory of record systems subject to the Privacy Act of 1974, (5 U.S.C. 552a), as amended.

DATES: This proposed action will be effective without further notice on March 31, 2008 unless comments are received which result in a contrary determination.

ADDRESSES: Send comments to the Department of the Navy, PA/FOIA Policy Branch, Chief of Naval Operations (DNS–36), 2000 Navy Pentagon, Washington, DC 20350–2000.

FOR FURTHER INFORMATION CONTACT: Mrs. Doris Lama at (202) 685–6545.

SUPPLEMENTARY INFORMATION: The Department of the Navy systems of records notices subject to the Privacy Act of 1974, (5 U.S.C. 552a), as amended, have been published in the **Federal Register** and are available from the address above.

The specific changes to the record system being amended are set forth below followed by the notice, as amended, published in its entirety. The proposed amendments are not within the purview of subsection (r) of the Privacy Act of 1974, (5 U.S.C. 552a), as amended, which requires the submission of a new or altered system report.

Dated: February 25, 2008.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

N01000–3

SYSTEM NAME:

Navy Individual Service Review Board (ISRB) Proceedings Application File (March 18, 1997, 62 FR 12806).

CHANGES:

SYSTEM NAME:

Delete entry and replace with ''DoD Civilian/Military Service Review Board.''

SYSTEM LOCATION:

Delete entry and replace with ''Navy Personnel Command (PERS–312), 5720

DEPARTMENT OF TRANSPORTATION
DISTRICT 3 – SACRAMENTO AREA OFFICE
VENTURE OAKS, MS 15
P. O. BOX 942874
SACRAMENTO, CA 94274-0001
PHONE (916) 274-0614
FAX (916) 274-0648
TTY (530) 741-4509

Flex your power!
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March 26, 2008

08SAC0046
03-SAC- 5 / 160 / 50 / 51 / 80
American River Common Features General Evaluation Report
Notice of Preparation
SCH# 2005072046

Ms. Annalena Bronson
Central Valley Flood Protection Board
3310 El Camino Avenue, Room LL-40
Sacramento, CA 95821

Dear Ms. Bronson:

We have reviewed the American River Common Features General Re-evaluation Report Notice of Preparation documentation. Our comments are as follows:

- Caltrans' prior comments in our letters of July 27, 2005 and October 3, 2002 (copies enclosed) are still valid.

- In carrying out this project's levee improvement activities, it is very likely that truck haul routes used in transporting soil, rock, borrow and cleared vegetation disposal materials to and from the various proposed sites along the American and Sacramento Rivers and Natomas Cross Canal and Natomas East Main Drainage Canal could involve the use of Interstate 5, State Route (SR) 160, U.S. 50, SR51, and I-80. We note on page 2 in the "Study Area" discussion and on Page 6's map of the project levee areas that this "project's" scope is quite large. Clarification should be made regarding which of the multiple levee improvement areas will use trucks and which will use waterside barges to transport work materials.

- If off-site levee materials are being transported by truck to these work sites to modify levee bank areas and are using adjoining State roadway facilities, a project Traffic Management Plan (TMP) will be necessary. The TMP should be prepared for our review and include appropriate strategies to mitigate construction traffic impacts to the nearby roadway intersections, freeway interchanges, and mainlines. Truck haul routes and points of access to State roadway facilities used should be clarified in the plan. If Garden Highway will be used as an access to some of the improvement areas, the TMP should explain how Garden Highway is to be accessed, whether from I-5 or via a local road network. The project's individual levee site work plan dates should also be provided, if known, and the truck trip volumes. We recommend truck-hauling operations avoid peak traffic periods (6-10 AM and 3-7 PM) whenever possible. The Caltrans TMP Guidelines are enclosed for your use. For assistance, please contact Paul Wilkinson, the Caltrans District 3 Traffic Manager (DTM), at (916) 859-7978.

- If electronic warning signs are provided within State right-of-way at work sites to alert the traveling public of trucks entering or leaving State highways, an encroachment permit will be required. For permit assistance, please contact Julio Elvir at (530) 741-4204.

- Caltrans is interested in the work zone proximity of this project's planned levee improvements on the Sacramento River near the system of relief wells and piezometer installations near the downtown Sacramento I-5 freeway and within State property. Freeway Post Mile locations may have been established for these well and piezometer locations when they were installed to help prevent levee seepage near the subgrade section of Interstate 5 (more commonly called, "the Boat Section"). The distance of well locations from freeway bridge footings might have been specified as well to help locate where they are. We understand that Encroachment Permit # 0304-NMC-0918 was obtained from Caltrans District 3 in prior years when this installation work was done. Caltrans wishes to make sure that these wells and piezometer locations are not disturbed during the levee bank work. Preliminary planning installation maps, showing where the wells and piezometers were located in relation to our right-of-way lines and freeway facilities, and "As Built" maps, were prepared for Caltrans to update its right of way records of the Interstate 5 freeway corridor.

If you have any questions regarding these comments, please contact Ken Champion at (916) 274-0615.

Sincerely,

Dawn Cheser, Office Chief
Office of Transportation Planning - South

Enclosure

c: Scott Morgan, State Clearinghouse

DEPARTMENT OF TRANSPORTATION
DISTRICT 3 – SACRAMENTO AREA OFFICE
VENTURE OAKS, MS 15
P. O. BOX 942874
SACRAMENTO, CA 94274-0001
PHONE (916) 274-0614
FAX (916) 274-0648
TTY (530) 741-4509

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July 27, 2005

05SAC0112
03-SAC- 99 PM 35.370
American River Watershed Project Common Features
Sacramento River East Levee & Natomas Cross Canal Levee Modifications
Notice of Preparation
SCH# 2005072046

Ms. Annalena Bronson
The Reclamation Board
3310 El Camino Avenue, Room 110
Sacramento, CA 95821

Dear Ms. Bronson:

We have reviewed the Sacramento River East and Natomas Cross Canal Levee Modifications Project Notice Of Preparation documentation. We look forward to reviewing the draft Environmental Impact Report. Our comments are as follows:

- Our comments provided in our letter of October 3, 2002 (copy enclosed) are still valid.

- The document map of the Sacramento River work site shows Elverta and Power Line Roads as potential access roadways. If off-site levee materials are being transported by truck to this work site to modify these levees and are using adjoining State roadway facilities, a project Traffic Management Plan (TMP) will be necessary. The TMP should be prepared for our review and include appropriate strategies to mitigate construction traffic impacts to the nearby State Route 99/Elverta Road intersection and other nearby freeway interchanges. The TMP should also clarify whether Interstate 5 would be used via Power Line Road. The Caltrans TMP Guidelines are enclosed for your use. Truck haul routes and points of access to State roadway facilities used should be clarified in the plan. The planned project initiation and completion dates should also be noted, as well as truck trip volumes, daily hours of operations, and whether electronic warning signs are provided to alert the traveling public. We recommend truck hauling operations during non-peak traffic periods.

Please provide our office with a copy of the draft TMP requested above. If you have any questions regarding these comments, please contact Ken Champion at (916) 274-0615.

Sincerely,

KATHERINE EASTHAM, Chief
Office of Transportation Planning - Southwest

Enclosures

c: Scott Morgan, State Clearinghouse

Sutter County Community Services
1130 Civic Center Boulevard, Suite E
Yuba City, CA 95993

bc: John Holzhauser, Office of Traffic Operations – Sacramento
Michelle Millette, District 3 – Sutter County LDR Coordinator
Ken Champion, District 3 – Sacramento County LDR Coordinator

KC/ kc

DEPARTMENT OF TRANSPORTATION
DISTRICT 3 – Sacramento Area Office
Venture Oaks, MS 15
P.O. Box 942874
Sacramento, CA 94274-0001
PHONE (916) 274-0638
FAX (916) 274-0648
TTY (530) 741-4509

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October 3, 2002

02SAC0114
03-SAC- 99
American River Watershed Project (Common Features)
California Sacramento River East Levee/Natomas Cross Canal Levee Modifications
Notice of Preparation
SCH#1999052026

Ms. Karen Enstrom
Reclamation Board
1416 Ninth Street, Room 1601
Sacramento, CA 95814

Dear Ms. Enstrom:

Thank you for the opportunity to comment on the above mentioned project. Our comments are as follows:

- The project documentation should provide a map (s) describing the project "activity areas" and any nearby State highway facilities in order to clarify the scope of project and potential impacted highway and bridge structure areas.

- Any flood control improvements and protection measures located near State right-of-way should be identified and Caltrans should be notified. Any work conducted within State right-of-way will require an encroachment permit. For assistance, Bruce Capaul at (530) 741-4408 should be contacted.

- Haul routes for transporting soil and construction materials and any State highways used should be provided in the project discussion.

Please provide our office with the requested information, a copy of the DEIR, copies of draft mitigation measures, and any further action regarding this project. If you have any questions regarding these comments, please contact Ken Champion at (916) 274-0615.

Sincerely,

ORIGINAL SIGNED BY

JEFFREY PULVERMAN, Chief
Office of Regional Planning

bc: John Holzhauser, Office of Traffic Operations – Sacramento
Karen Peneschi, Office of Advance and System Planning
Steve Hetland, Special Funded - Sacramento
Jim Adams, Office of Right of Way Engineering
Tom Ganyon, Office of Right of Way-Local Assistance
Dennis Jagoda, Hydraulics
Bruce Capaul, Permits
KenChampion, District 3 – Sacramento County LDR Coordinator

KC/ kc

Posters from March 2008 Scoping Meetings

About the Re-evaluation Report

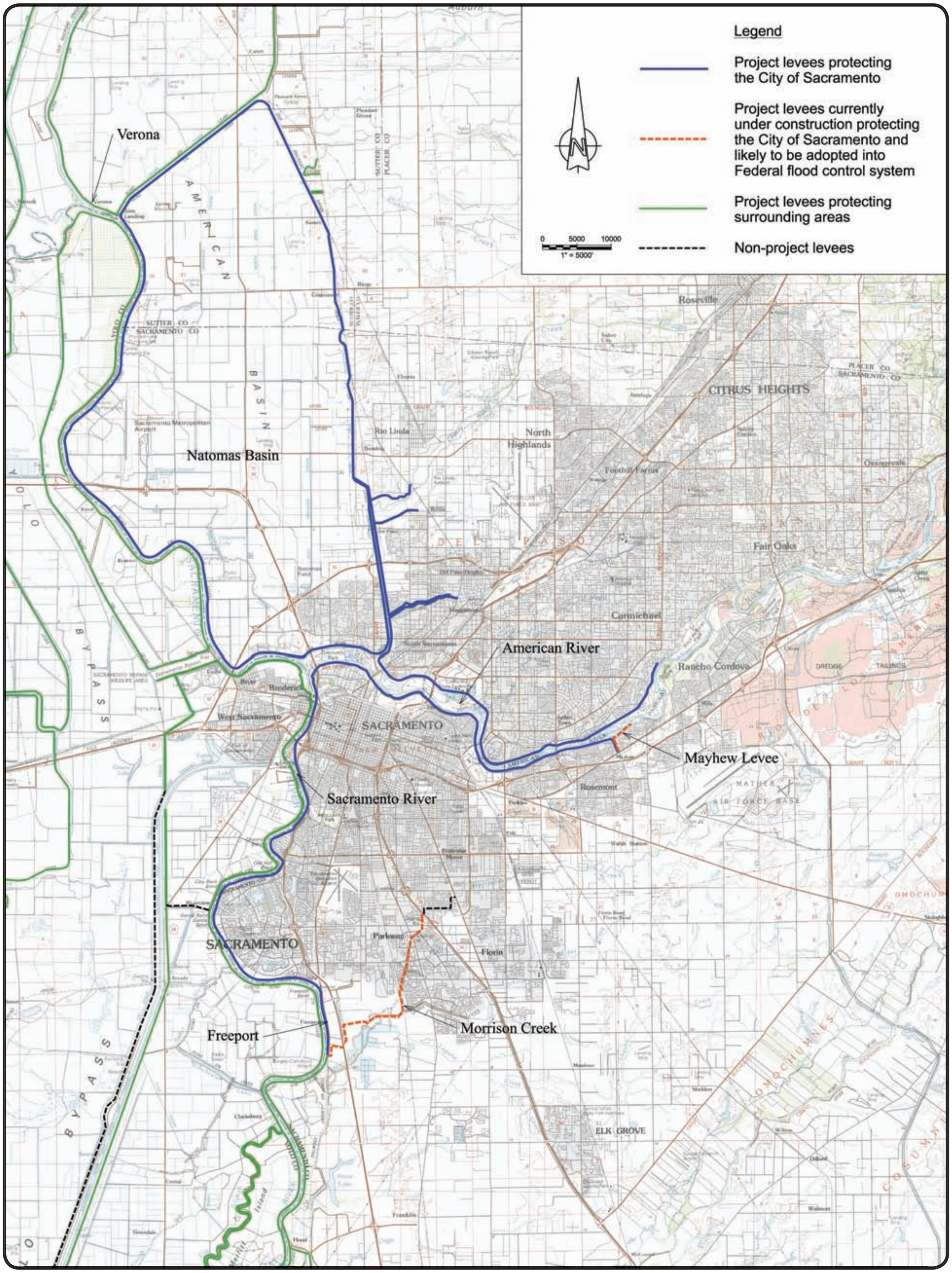
Flooding is a long-standing problem facing the Sacramento area. The recent floods of 1986 and 1997 devastated several communities, including homes, businesses, orchards and farmlands. In 1996 the Water Resources Development Act authorized the American River Common Features Project (CFP), designed to lessen flood risks in Sacramento. Since the authorization of the CFP 12 years ago, a great deal of progress has been made to improve the flood control system. However, new information and issues have been identified and new engineering standards have been instituted. As a result, there are continuing concerns about the integrity of Sacramento's flood control management system.

As a result, the U.S. Army Corps of Engineers plans to conduct a re-evaluation report called the American River Common Features General Re-evaluation Report (Common Features GRR) that will look at the existing CFP with the purpose of identifying alternatives to lower the risk of flooding to the City of Sacramento. The Common Features GRR will examine the City's flood management system as a whole, rather than on a site-by-site, project-by-project basis.

The purpose of the Common Features GRR is to review the CFP with the aim of making recommendations for changes or additions that will effectively and efficiently reduce flood risks within the American River Watershed. This includes the flood control features along the American and Sacramento Rivers that provide protection to the City of Sacramento and surrounding areas.

In a separate effort, the Sacramento Area Flood Control Agency (SAFCA) is currently working on a flood control program specific to Natomas to provide the area with 100-year flood protection as soon as possible, and ultimately, in cooperation with this study, 200-year protection. These improvements could be completed before the Common Features GRR is conducted because of the high risk of catastrophic flooding in Natomas. It is anticipated that SAFCA's program will eventually be incorporated into the Common Features GRR.

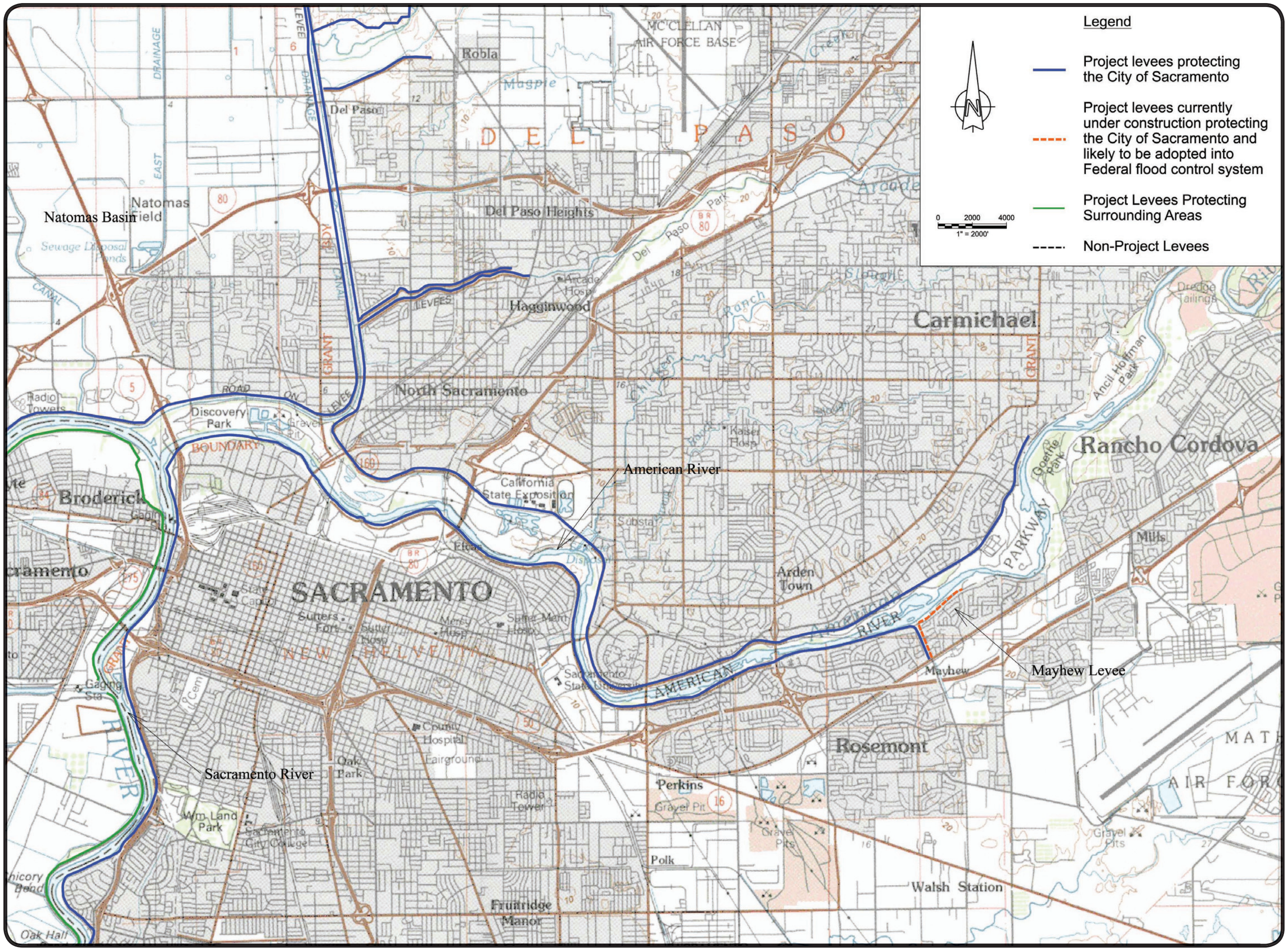
Study Area



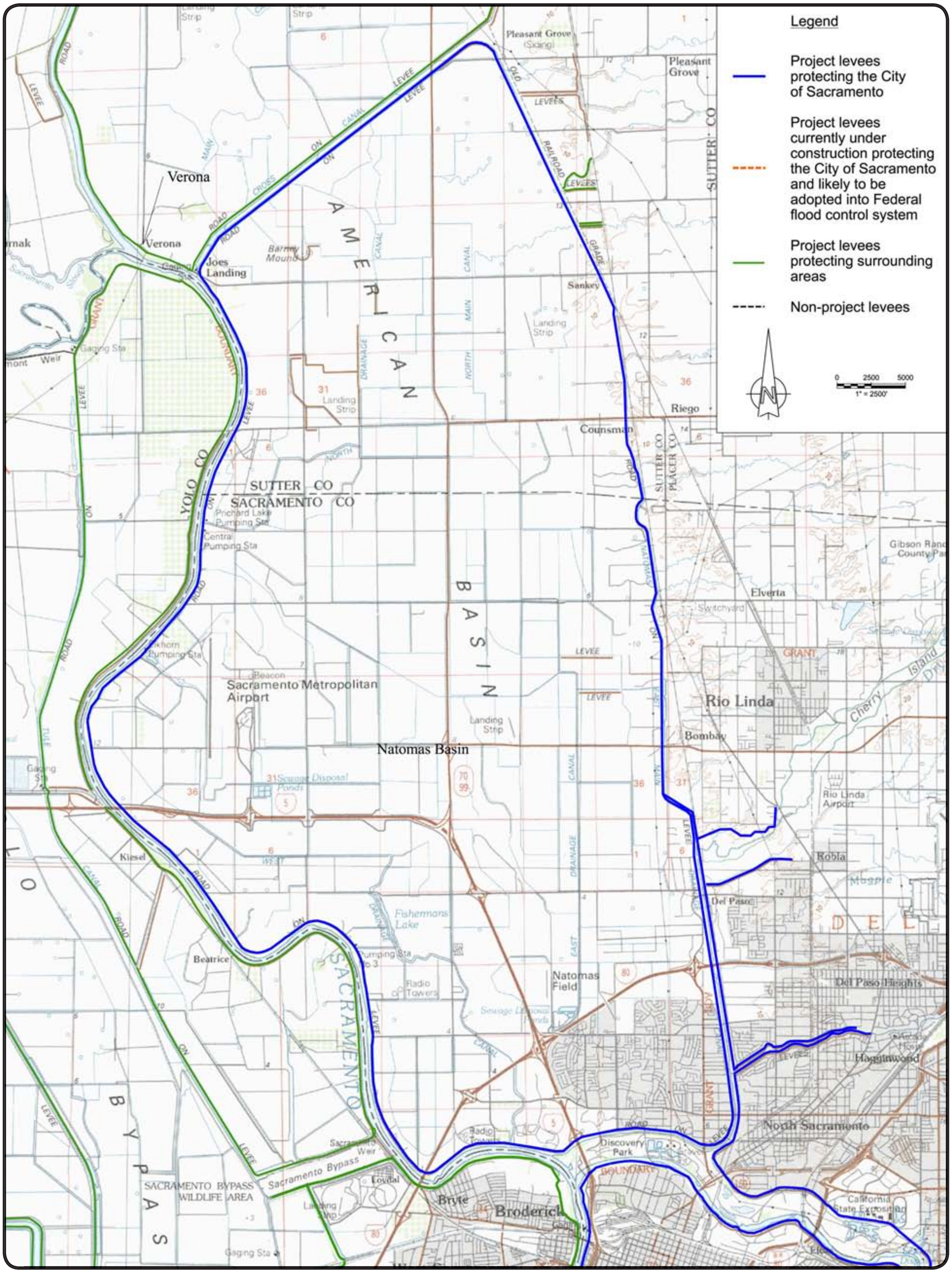
US Army Corps of Engineers Sacramento District

SAFCA

Lower American River



Natomas Basin



Sacramento River from American River to Freeport

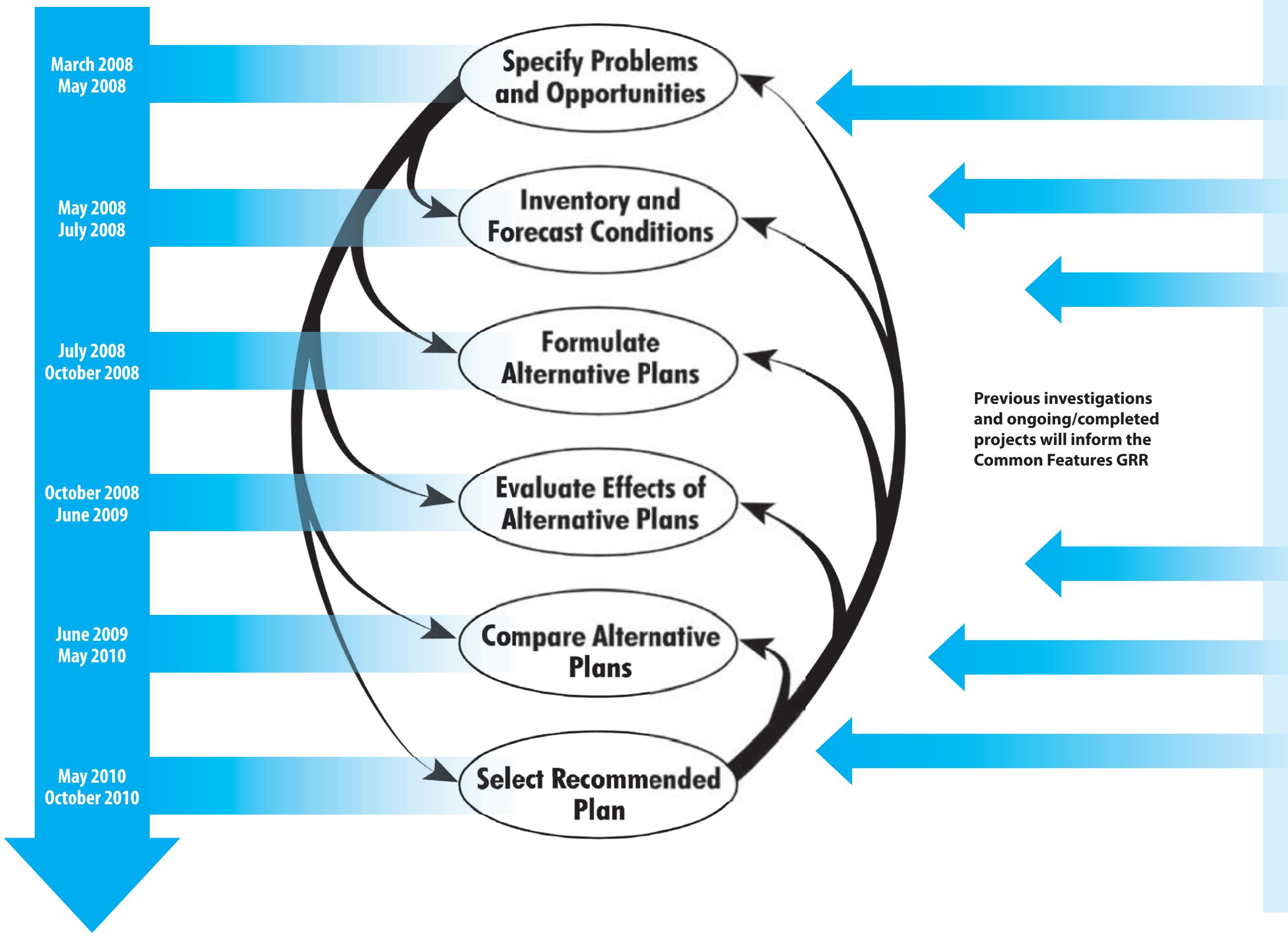
US Army Corps of Engineers
Sacramento District

SAFCA

Planning Process

The Corps' "Beehive" diagram represents the six planning steps and the iterative process of Corps project planning.

Corps decision making is generally based on the accomplishment and documentation of all of these steps. It is important to stress the iterative nature of this process. As more information is acquired and developed, it may be necessary to reiterate some of the previous steps. The six steps, though presented and discussed in a sequential manner for ease of understanding, usually occur iteratively and sometimes concurrently. Iterations of steps are conducted as necessary to formulate efficient, effective, complete and acceptable plans.



Completed and Ongoing Projects

A great deal of progress has been made since the major flood events in 1986 and 1997. The projects listed below are examples of recent efforts to increase the level of flood protection in the Sacramento area. These efforts will inform and be coordinated with the Common Features GRR planning process.

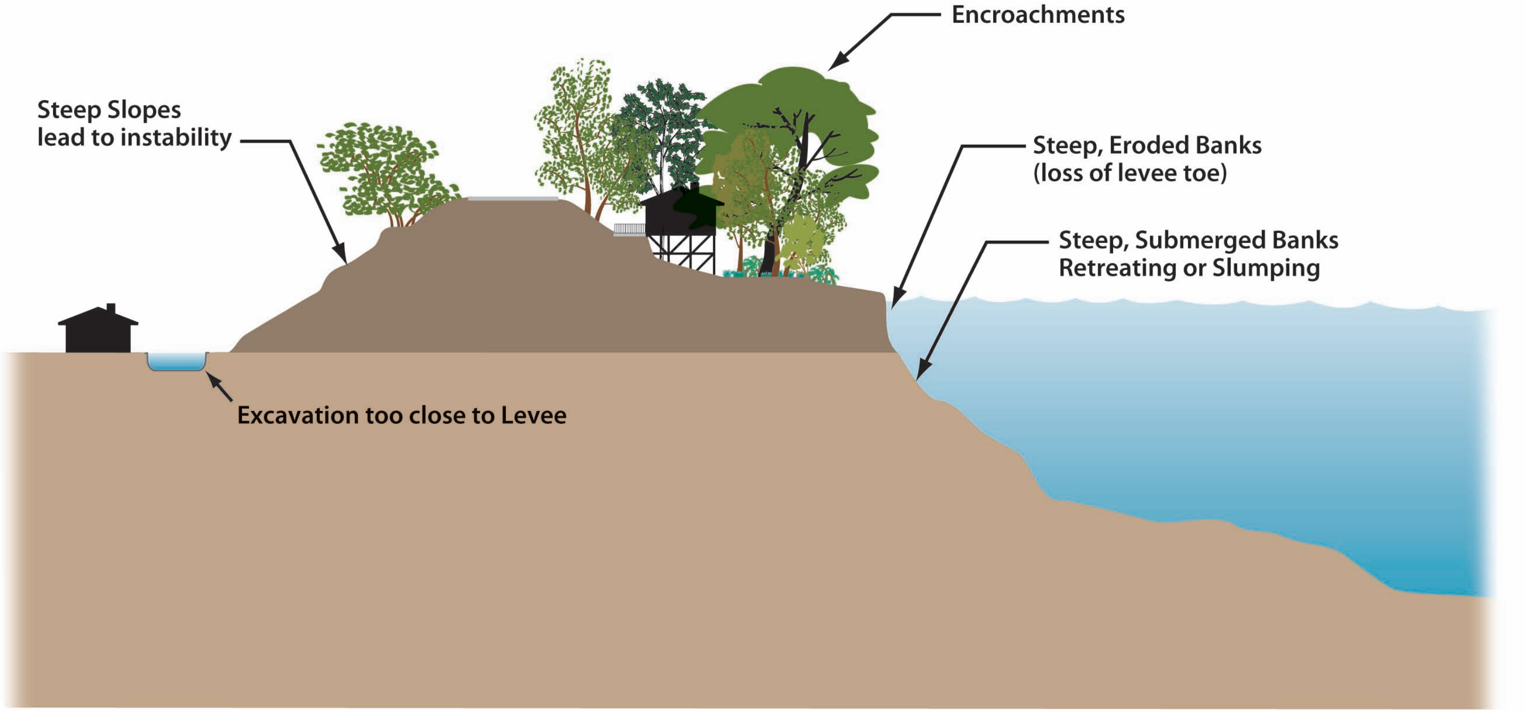
American River Common Features Projects

- Slurry Wall Construction along the Lower American River (24 miles completed)
- Upstream Telemetry Gages (completed)
- Erosion Protection (4 sites completed)
- Jet Grouting/Alternative Methods (ongoing)
- Seepage Remediation along the Sacramento River (completed)
- Mayhew Levee Raise and Drain Closure (under construction)
- Levee Raising and Strengthening (various sites remaining)

Other Major Flood Protection Projects

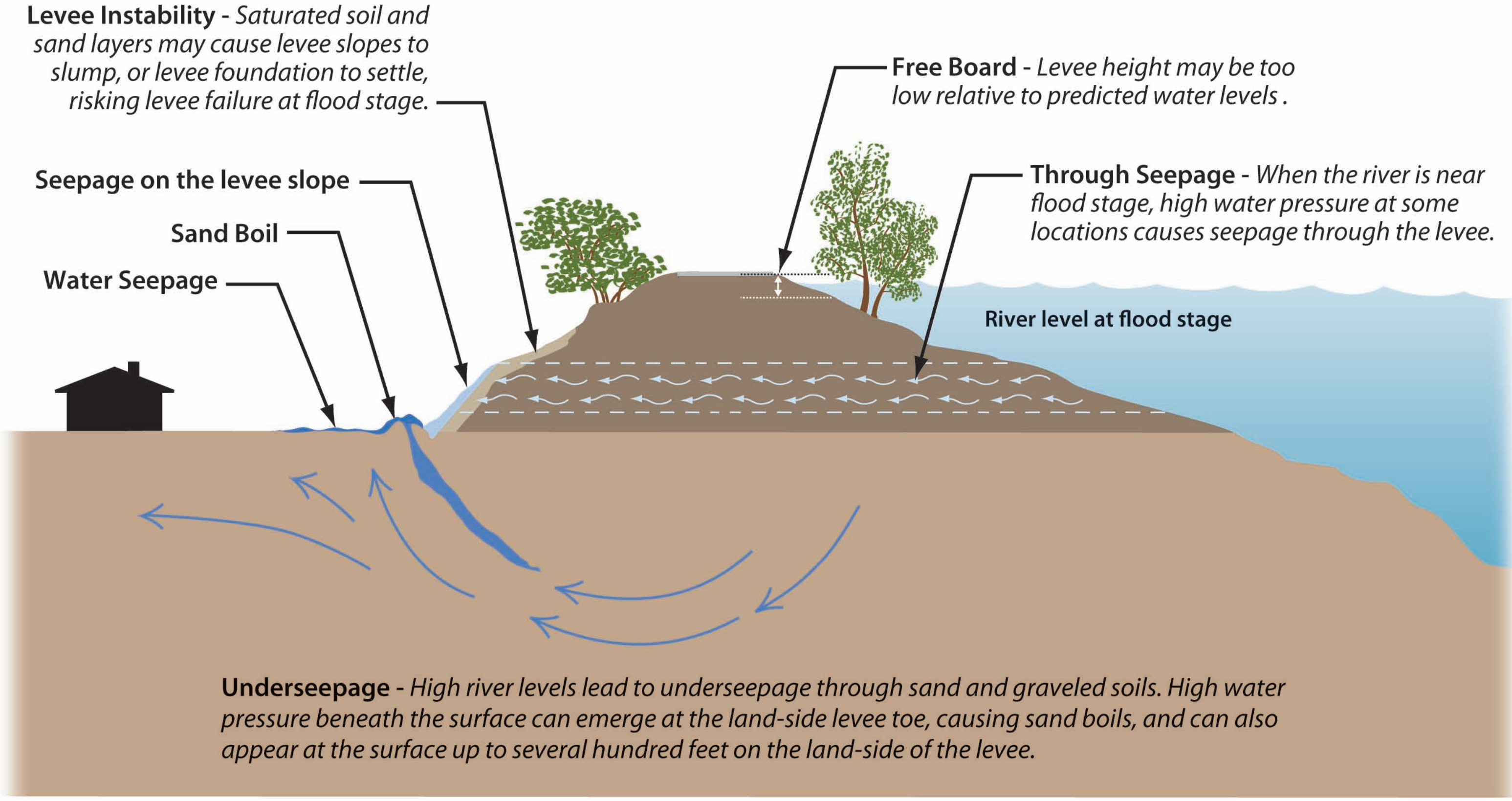
- Folsom Dam Reoperation (ongoing)
- Natomas Levee Improvement Project (ongoing)
- Sacramento River Bank Protection Project (Corps/ CVFPB) (ongoing)
- West Sacramento Levee Improvement Project (Corps/City of West Sacramento) (ongoing)
- South Sacramento Streams Group Project (Corps/ SAFCA) (ongoing)
- Joint Federal Project at Folsom Dam (Corps/Bureau of Reclamation/CVFPB/SAFCA)

Encroachments, Unstable Slopes, Erosion



- Unstable Slopes - irregular or overly steep slopes compromise the levee structure
- Encroachments including pools, homes, vegetation
- Erosion - water flow, wakes and waves, remove soil material, degrading the levee

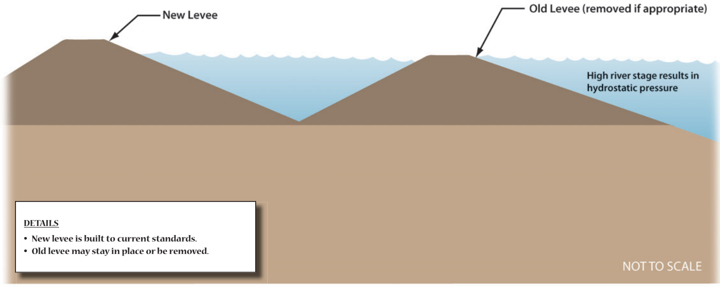
Seepage and Inadequate Freeboard



- Inadequate Freeboard - levee height may be too low relative to predicted water levels

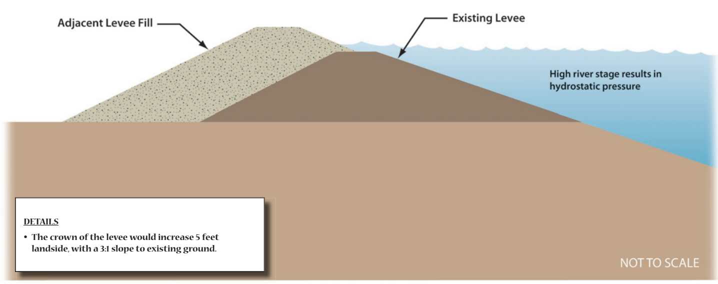
IMPROVEMENTS TO FLOOD CONTROL FEATURES THAT ADDRESS STABILITY, EROSION AND FREEBOARD

Setback Levee (stability, seepage, & freeboard)



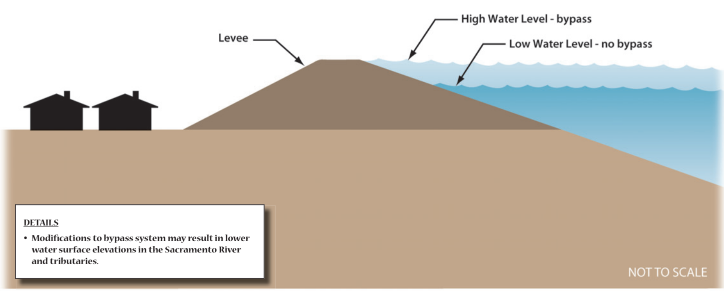
Concept:
A new levee is built toward the landside of an existing levee where the existing levee is not readily repairable or where more flooding capacity is desired.

Adjacent Levee Raise (stability, seepage, & freeboard)



Concept:
A new embankment strengthens the existing levee and enlarges the slopes.

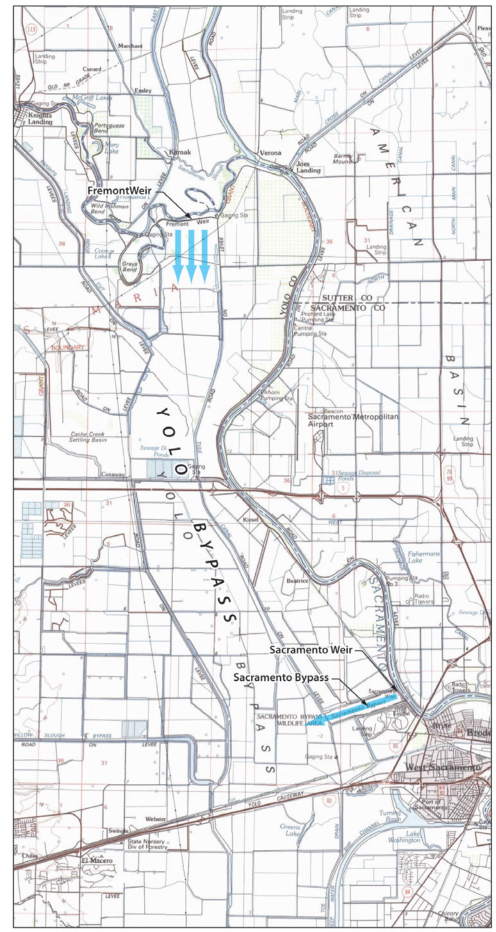
Diversion to Bypass System (seepage, stability, & freeboard)



Concept:
Reducing water surface elevations by modifying diversion to the bypass system may also reduce seepage and stability issues by reducing hydrostatic pressure. Lower water surface elevations will also alleviate freeboard issues.

Diversion to Bypass System

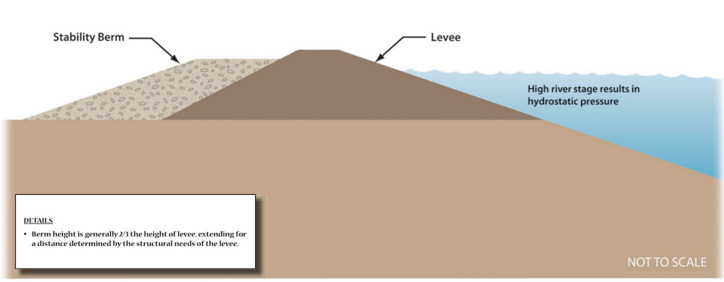
(seepage, stability, & freeboard)



Potential Solutions

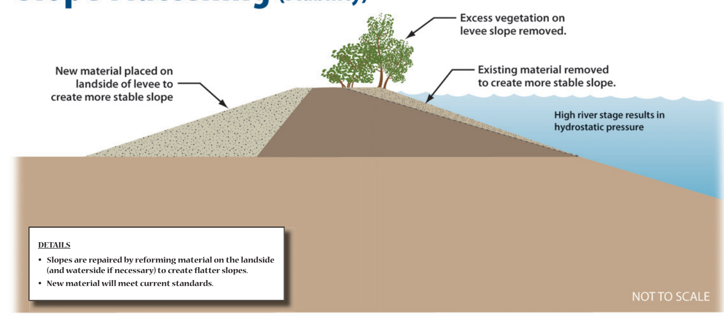
IMPROVEMENTS TO LEVEES THAT ADDRESS STABILITY, EROSION AND FREEBOARD

Stability Berm (stability)



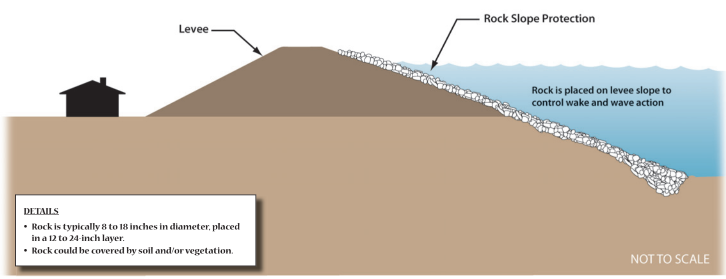
Concept:
Provides additional support to levee to increase strength.

Slope Flattening (stability)



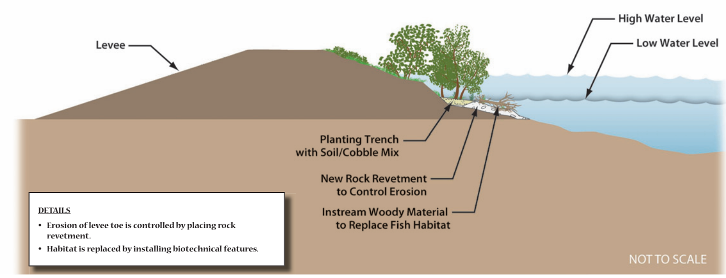
Concept:
Flatter slopes are more stable and less susceptible to erosion. Excess vegetation may inhibit levee maintenance and performance monitoring.

Rock Slope Protection (erosion)



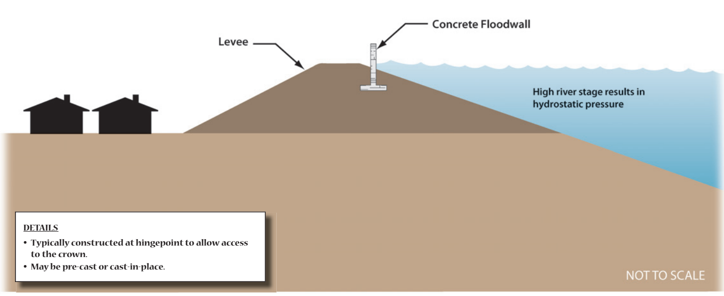
Concept:
Water-side erosion is prevented by placement of rock.

Biotechnical Erosion Protection (erosion)



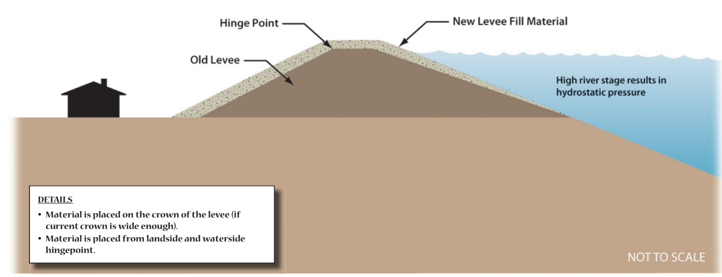
Concept:
Placing rock revetment at toe of eroding levee controls erosion. Installing biotechnical features replaces habitat and further controls erosion.

Flood Wall (freeboard)



Concept:
Additional levee height may be achieved through construction of a concrete wall on the levee crown.

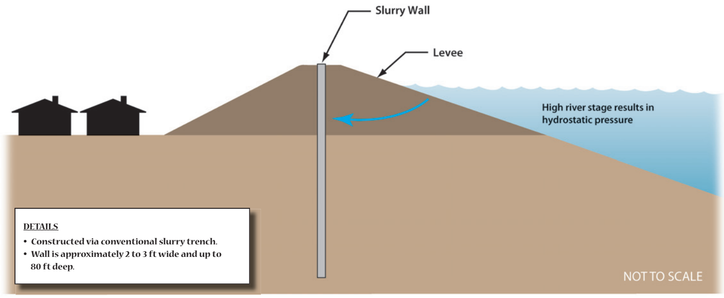
In-Place Levee Raise (freeboard)



Concept:
Flood protection is increased by adding material to crown and levee slope (land or water side).

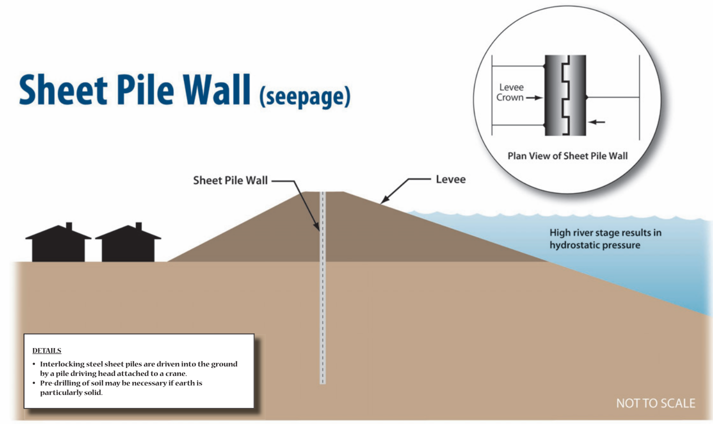
IMPROVEMENTS TO LEVEES THAT ADDRESS SEEPAGE

Slurry Wall (seepage)



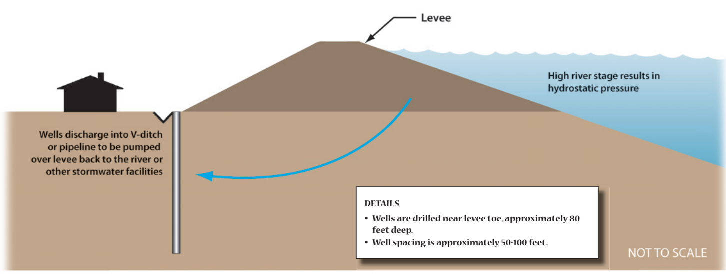
Concept:
Water pressure is contained and dispersed by a low-permeability wall constructed within the levee cross section.

Sheet Pile Wall (seepage)



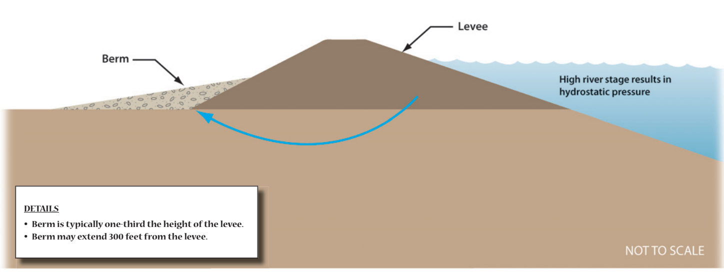
Concept:
Steel panels are driven into the levee core to provide a seepage barrier.

Relief Well (seepage)



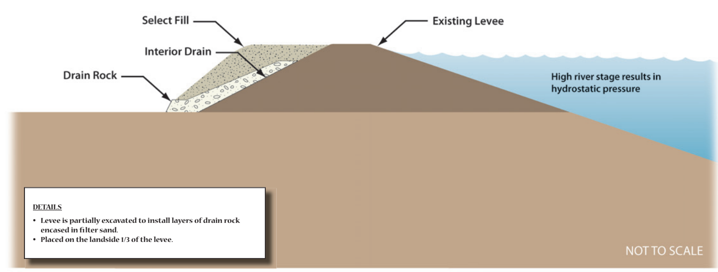
Concept:
Water pressure is relieved via passive wells, which control water discharge into a collection system.

Seepage Berm (seepage)



Concept:
Water pressure is contained and dispersed by a thickened soil layer.

Interior Drain (seepage)



Concept:
Capture any through-seepage and direct it away from the face of the levee.

U.S. Army Corps of Engineers

SAFCA

The process of determining the scope, focus and content of an EIS/EIR is known as "scoping". Scoping is a part of the NEPA/CEQA process in which the general public, interested agencies and stakeholders provide comments to the Lead Agency to help identify the key issues, range of actions, alternatives, and environmental affects to be analyzed in the EIS/EIR.

The following issues related to this project have been identified to date:

- Riparian vegetation and habitat effects;
- Cultural resources;
- Flood control and river hydraulic effect;
- Location of flood control infrastructure and effects on land use and access;
- Construction related effects such as those related to transportation, noise, and air quality;
- Economic issues

NEPA/CEQA Compliance

What is an EIS/EIR?

An EIS (Environmental Impact Statement) and an EIR (Environmental Impact Report) are documents that are required to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), respectively. The purpose of these documents is to analyze and disclose a project's potential effects on the natural and human environment and identify conservation measures and alternatives to avoid significant effects.

An EIS is prepared when there is Federal involvement in the project and an EIR is prepared when the project is subject to State or local jurisdiction. A joint document, an EIS/EIR, may be prepared when both a Federal and State agency are involved. The major steps to complying with both acts are outlined below.

NEPA (Environmental Impact Statement)		CEQA (Environmental Impact Report)
Notice of Intent	Official notice that an environmental document is being prepared	Notice of Preparation
Scoping	Defines the scope of the study by identifying issues and soliciting comments from the general public, agencies, and jurisdictions.	Scoping
Draft EIS	Describes the purpose and need/proposed project; alternatives considered; alternatives rejected or accepted; and a comprehensive evaluation of the environmental impacts that the alternatives would likely cause, and conceptual mitigation.	Draft EIR
EPA Filing: Federal Register		State Clearinghouse
Public and Agency Review	At least a 45-day period during which the public and agencies review the draft document and submit comments to the lead agencies.	Public and Agency Review
		Preparation of Response to Comments
Final EIS	Addresses the comments on the draft document and from any public hearing, presents the final evaluation of project-induced environmental impacts and ways to mitigate unavoidable impacts.	Final EIR
EPA Filing: Federal Register Notice		
Agency Decision/ Record of Decision	Lead agency uses information from the final document and the project record to issue a decision and document commitments and mitigation.	Agency Decision/Findings, Statement of Overriding Consideration, Mitigation Monitoring

Biological Assessment

American River Common Features
General Reevaluation Report

North Sacramento Streams Levee Improvement Project

September 2015

Contents

Appendices

Tables

Figures

American River Common Features Project
North Sacramento Streams Levee Improvement Project
Biological Assessment

1.0 Introduction

The U.S. Army Corps of Engineers (Corps) is requesting consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Federal Endangered Species Act (ESA) to evaluate, on a biological assessment (BA) level, potential effects associated with levee modifications proposed under the American River Common Features (ARCF) General Reevaluation Report (GRR) Project. In addition, the Sacramento Area Flood Control Agency (SAFCA) is proposing to implement some segments of the ARCF GRR in advance of the Federal project. This BA addresses the overarching ARCF GRR project, and SAFCA's North Sacramento Streams Levee Improvement Project (NSS), a subset of the ARCF GRR. The purpose of this BA is to meet Section 7 consultation requirements as well as requirements of the Magnuson-Stevens Fishery Conservation and Management Act of 1997 (NMFS 1997). This BA was prepared in accordance with the Corps' Engineering Regulation 1105-2-100 (Corps 2000a).

Section 7 of the ESA requires Federal agencies to conserve listed species and their critical habitat, and to consult with USFWS and NMFS (the Services) to ensure that actions they fund, authorize, or perform do not jeopardize the existence of any listed species or result in the destruction or adverse modification of their designated critical habitat. The actions covered in this BA are associated with future levee modifications proposed for the ARCF GRR Project (Figure 1).

The Magnuson-Stevens Fishery Conservation and Management Act of 1997 (MSA) governs the conservation and management of commercially harvested ocean fisheries. The purpose of the Act is to take immediate action to conserve, protect, and manage U.S. coastal fishery resources, anadromous species, and Essential Fish Habitat (EFH). EFH is the aquatic habitat (water and substrate) that is necessary for fish to spawn, breed, feed, or mature, and that allows production levels needed to: (1) support a long-term, sustainable commercial fishery, and (2) contribute to a healthy ecosystem (NMFS 1997). The ARCF study area is designated as EFH habitat for Pacific salmon under Section 305(b)(2) of the MSA. Species to be addressed in this BA include:

- Fish species with designated EFH under the MSA;
- Listed species under the Federal Endangered Species Act; and
- Species with designated critical habitat under the ESA.

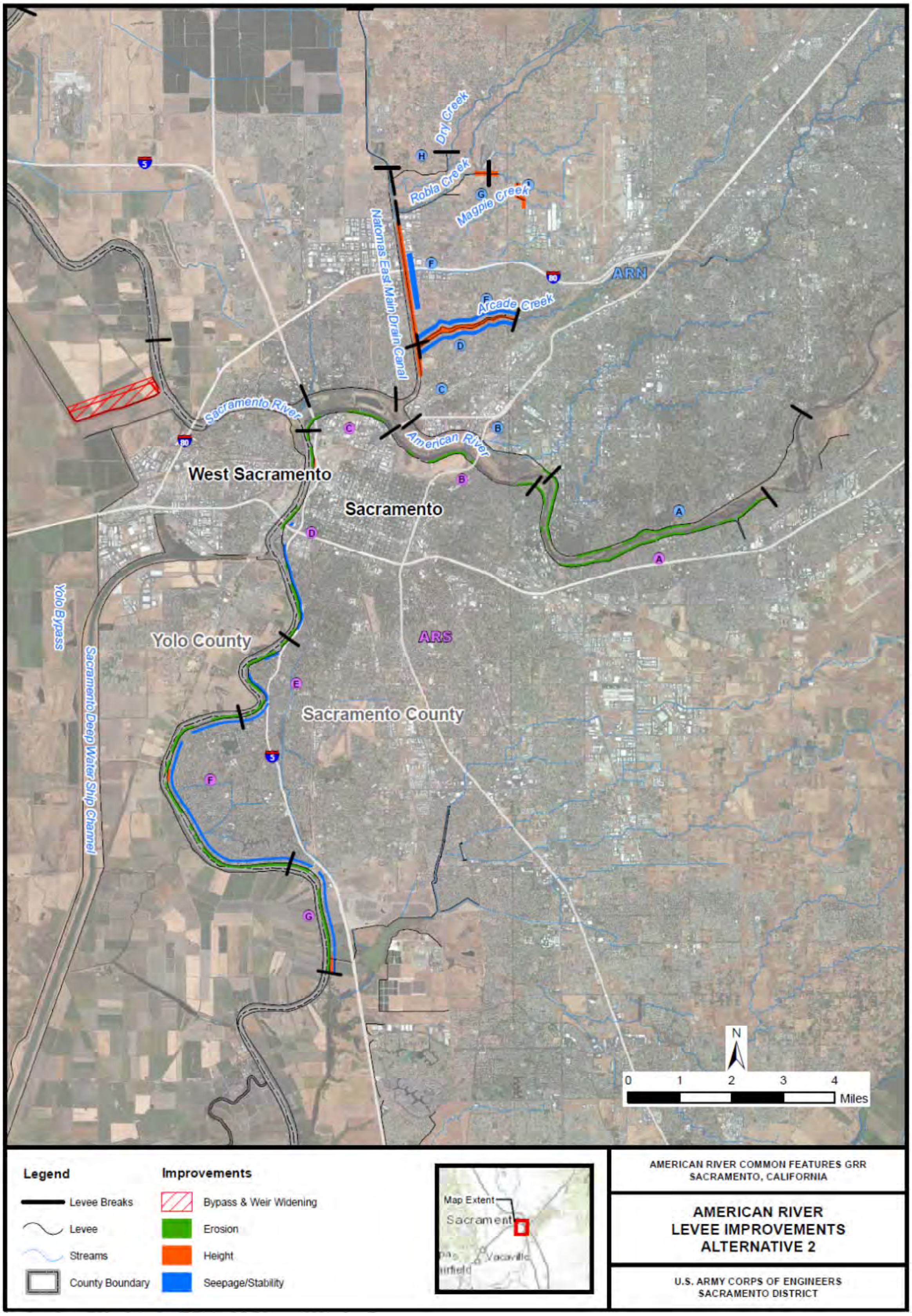


Figure 1. American River Common Features Study Area.

1.1 American River Common Features Study Area and Action Area

The study area is located within the Sacramento and American River Watersheds. The Sacramento River watershed covers approximately 26,000 square miles in central and northern California. Major tributaries of the Sacramento River include the Feather, Yuba, and American Rivers. The American River Watershed covers about 2,100 square miles northeast of the city of Sacramento and includes portions of Placer, El Dorado, Alpine, and Sacramento counties. The American River watershed includes Folsom Dam and Reservoir; inflowing rivers and streams, including the North, South, and Middle forks of the American River; and the lower American River downstream of Folsom Dam to its confluence with the Sacramento River in the city of Sacramento. The Sacramento and American Rivers, in the Sacramento area, form a flood plain covering roughly 110,000 acres at their confluence. The flood plain includes most of the developed portions of the city of Sacramento. Figure 1 shows the study area.

The city of Sacramento is the capitol of California, and thus is the government center for the state, which by itself has the 9th largest economy in the world. Many state offices located in downtown Sacramento, including the State Capitol building, are in areas that could be affected by flood events. Disruption of government services, and effects to emergency services and transportation corridors could have far ranging effects including life safety.

The ARCF study area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Dry, Robla, and Arcade Creeks and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento (Figure 1). This BA analyzes the effects of repairing the levees in the Sacramento area and widening the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass and alleviate the need to raise levees along the Sacramento River downstream of the bypass.

The action area for the ARCF GRR project includes the American River from below Folsom Dam to the confluence with the Sacramento River and the Sacramento River from the Sacramento Bypass down to below Freeport. In addition the action area includes the East Side Tributaries: the NEMDC, Dry, Robla, and Arcade Creeks, and the Magpie Creek Diversion Channel. The SAFCA NSS project includes approximately 5 miles of Arcade Creek and NEMDC, as well as an associated borrow site and staging areas. More information about these sites is included in the project description below.

The erosion repairs within the project area is likely to somewhat reduce the sediment supply for riverine reaches directly downstream because the erosion repair is holding the bank or levee in place. However, from a system sediment perspective, the bank material we are protecting in the project reaches is not a major source of sediment compared to the upstream reaches of the Sacramento, Feather and especially the Yuba River systems. All of the available sediment in the American River watershed is being contained behind Folsom Dam. For velocity, the site specific designs will be constrained from allowing any velocity increases outside the erosion repair site. Sediment impacts due to the bypass widening are not known at this time, except to say that the study would constrain the design to minimize impacts to sediment transport. Further studies associated with the Bypass widening would be conducted during the preconstruction engineering and design phase of the project, and any impacts to listed species that are discovered during these studies would be coordinated with the resource agencies at that time. The action area for the project is directly related to the study area where construction activities would occur.

The project is designed to allow for the release of 160,000 cubic feet per second (cfs) from Folsom Dam. The levees along the American River are unable to withstand these maximum flows for extended periods of time without increased risk of erosion and potential failure. The exact location where erosion would occur and to what extent erosion would occur during any given event is unknown. Erosion within the American River Parkway is being addressed as part of the Folsom Dam Water Control Manual Update currently under evaluation and a biological assessment is being prepared to initiate Section 7 consultation with both USFWS and NMFS. Therefore, the affects of erosion due to changes in operations from Folsom Dam are not analyzed in this BA because construction of the American River and Sacramento Bypass measures for the ARCF GRR, which are dependant on releases from Folsom Dam, would not occur until after a Biological Opinion is received for the Water Control Manual Update. Sacramento River and East Side Tributaries measures would be necessary to improve the flood risk management system in the Sacramento area regardless of the change in operation at Folsom Dam and are not dependant on Folsom Dam operations for their implementation. As a result, construction in these areas could occur regardless of the Folsom Dam Water Control Manual Update schedule.

The American River Common Features General Reevaluation Report (ARCF GRR) is being completed in accordance with the principles that have been outlined in the Corps' SMART Planning Guide (May 2012). SMART Planning requires that all feasibility studies should be completed within a target of 18 months (to no more than three years at the greatest), at a cost of no more than $3 million, utilizing 3 levels of vertical team coordination, and of a "reasonable" report size. The SMART Planning methodology and framework were developed to facilitate more efficient, effective, and consistent delivery of Planning Decision Documents. As a result of this effort, team members and decision makers are required to accept a lower level of detail and higher level of uncertainty during the pre-authorization study phase. All designs associated with this project are therefore preliminary, with the largest footprint considered for analysis of maximum affects to listed species and designated critical habitat. As design refinements and more site specific data becomes available, where practicable, it is anticipated that there will be reductions in effects to listed species and designated critical habitat.

On-going coordination with the Services will occur as the project progresses to the preliminary engineering design phase to ensure compliance with Section 7. The Corps would coordinate potential design refinements with the Services to avoid, minimize, and compensate for affects to listed species and reinitiate consultation if necessary. The study area includes the protected species and critical habitat listed in Table 1, as well as fall-/late fall–run Chinook salmon, which has EFH within the study area.

Table 1. Federally Protected Species and Critical Habitat Addressed in this Biological Assessment.

Common Name	Scientific Name	Federal Status
Threatened and Endangered Species		
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T
Sacramento River winter-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	E/MSA
Central Valley spring-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	T/MSA
Central Valley steelhead DPS	*Oncorhynchus mykiss*	T
Delta smelt	*Hypomesus transpacificus*	T
Green sturgeon southern DPS	*Acipenser medirostris*	T
Giant garter snake	*Thamnophis gigas*	T
Vernal pool fairy shrimp	*Branchinecta lynchi*	T
Vernal pool tadpole shrimp	*Lepidurus packardi*	E
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	T
Critical Habitat		
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	
Sacramento River winter-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	
Central Valley spring-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	
Central Valley steelhead DPS	*Oncorhynchus mykiss*	
Delta smelt	*Hypomesus transpacificus*	
Green sturgeon southern DPS	*Acipenser medirostris*	

Note: ESU = Evolutionarily Significant Unit, DPS = Distinct Population Segment, T = Threatened, E = Endangered, MSA = Magnuson-Stevens Fishery Conservation and Management Act.

1.2 Project Background and Authority

1.2.1 Authority

The ARCF project was authorized by Section 106(a)(1) of the Water Resources Development Act (WRDA) of 1996, (Public Law [PL] 104-303) (110 Stat. 3658, 3662-3663), as amended by Section 130 of the Energy and Water Development and Related Agencies Appropriations Act of 2008, (PL 110-161) (121 Stat. 1844, 1947). Additional authority was provided in Sections 366 and 566 of WRDA 1999, (PL 106-53), (113 Stat. 269, 319-20). Section 366 directed the Secretary to include specific levee improvement features in the overall project and Section 566(b) directed the Secretary to undertake additional study of American and Sacramento River levee modifications. Significant changes to the project cost were recommended in the Supplemental Information Report of March 2002. This report was submitted to the Assistant Secretary of the Army for Civil Works, but before it could be forwarded to Congress, Section 129 of the Energy and Water Development Appropriations Act of 2003, (PL 108-137), (117 Stat. 269, 1839) increased the authorized total cost of the project to $205,000,000. The current estimated cost of the authorized project is $274,100,000. In accordance with Section 902 of WRDA 1986 (Pub. L. 99-662, § 902, Nov. 17, 1986, 100 Stat. 4183), the allowable cost limit is $284,000,000.

To implement the NSS Levee Improvements Project, SAFCA would request permission from the Corps for:

- Alteration of Federal project levees, pursuant to Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408, referred to as "Section 408"); and
- Placement of fill in jurisdictional waters of the United States, pursuant to Section 404 of the Clean Water Act (33 USC 1344, referred to as "Section 404").

1.2.2 Background

After the flood of 1986, Congress directed the Corps to investigate the feasibility of reducing flood risk of the city of Sacramento. The Corps completed feasibility studies in 1991 and 1996, recommending a concrete gravity flood detention dam on the north fork of the American River at the Auburn site along with levee improvements downstream of Folsom Dam. Other plans evaluated in the report were Folsom Dam improvements and a stepped release plan for Folsom Dam releases. These additional plans also included levee improvements downstream of Folsom Dam. Congress recognized that levee improvements were "common" to all candidate plans in the report and that there was a Federal interest in participating in these "common features." Thus, the ARCF Project was authorized in WRDA 1996 and a decision on Auburn Dam was deferred to a later date. Major construction components for ARCF in the WRDA 1996 authorization include construction of seepage remediation along approximately 22 miles of American River levees and construction of levee strengthening and raising of 12 miles of Sacramento River levee in Natomas.

Following the flood of 1986, significant seepage was experienced on the Sacramento River from Verona (upstream end of Natomas) at River Mile (RM) 79 to Freeport at RM 45.5. In addition, both the north and south bank of the American River from RM 0 to approximately RM 11.4 experienced seepage. Seepage on the Sacramento River was so extensive that Congress, soon after the 1986 flood event, funded remediation in the Sacramento Urban Levee Improvement Project (Sac Urban). The Sac Urban Project constructed shallow seepage cutoff walls from Powerline Road in Natomas at approximately RM 64 down to Freeport.

Shortly thereafter, the Sacramento Valley experienced a flood event in 1997. Considerable seepage occurred on the Sacramento River as well as on the American River. Seepage on the American River was to be expected because remediation had yet to be constructed, but the occurrence of significant seepage on the Sacramento River in the reach remediated as part of the Sac Urban project was alarming and confirmed that deep underseepage was also of significant concern. As a result of this conclusion, seepage remediation on the American River (then in the late 1990s in the design phase) would need to be designed to remediate both through- and deep underseepage.

In 1999, Congress decided not to authorize Auburn Dam but instead to authorize improvements for Folsom Dam. By doing this, improvements to levees downstream of Folsom Dam could be fine tuned to work closely with the Folsom Dam improvements being discussed by Congress. Therefore, the ARCF project was modified by WRDA 1999 to include additional necessary features for the American River so that it could safely convey the proposed emergency release of 160,000 cfs from Folsom Dam. Major construction components for the ARCF project in the WRDA 1999 authorization include construction of seepage remediation and levee raises along four stretches of the American River, and construction of levee strengthening and raising of 5.5 miles of Natomas Cross Canal levee in Natomas. All American River features authorized in WRDA 1996 and 1999 have been constructed or are in design analysis for construction within a year or two.

Because of the considerable cost increase of seepage remediation on the American River, all funds appropriated by Congress throughout the late 1990s and the early part of the 2000s were used for construction activities on the American River instead of for design efforts in the Natomas Basin. Combining this with the recognition that all work in the Natomas Basin would also require significantly more effort than was anticipated at the time of authorization, it was decided in 2002 that a general reevaluation study would be required for at least the Natomas Basin portion of the ARCF project. This general reevaluation started in 2006.

At approximately the same time that the reevaluation study was beginning, the Folsom Dam Post Authorization Change report (PAC) was being completed by the Sacramento District. Results of this study showed that additional levee improvements were needed on the American River and on the Sacramento River below the American River in order to truly capture the benefits of the Folsom Dam projects. These levee improvements consisted primarily of addressing erosion concerns on the American River and seepage, stability, erosion, and height concerns on the Sacramento River below the American River. However, the full extent of the levee improvements necessary to address these concerns was not known. With the construction of the Sac Urban project, it was thought that the seepage and stability problems had been addressed. However, the 1997 flood event proved otherwise. Because of this, it was realized that additional reevaluation studies are also needed to include the additional two basins comprising the city of Sacramento, as well as the Natomas Basin.

The purpose of the ARCF project is to reduce the flood risk for the city of Sacramento. The following problems were identified within the Sacramento levee system:

- Seepage and Underseepage;
- Levee Erosion;
- Levee Stability;
- Levee Overtopping;
- Access for Maintenance and Flood Fighting;
- Vegetation and Encroachments;
- Releases from Folsom Dam;
- Floodplain Management; and
- Additional Upstream Storage from Existing Reservoirs.

1.3 Future Consultation Approach

In order to evaluate the maximum affects to listed species this BA looks at the largest foreseeable footprint. The Corps will consult on Alternative 2 (Proposed Alternative) which is the tentatively selected plan and the Locally Preferred Plan. Following project authorization as the Corps begins the design phase of the project, footprint refinements will likely reduce the effects to listed species. Coordination with the resource agencies will continue into the design phase to obtain input to avoid, minimize, or compensate for affects to listed species. The Corps would consult with the resource agencies of any project footprint changes, including potential reductions of impacts prior to the initiation of construction. This future coordination would attempt to reduce any mitigation required for the project and also would determine if additional consultation is needed for the project.

In addition, SAFCA, the project's local sponsor, is proposing to implement some reaches of the ARCF GRR in advance of the Federal project. SAFCA would seek permission from the Corps pursuant to 33 USC §408 (Section 408) for alteration of the Federal levee system. Additionally, SAFCA would seek credit from the Corps under Section 221 of the Flood Control Act of 1970. This BA supports implementation of SAFCA's NSS Levee Improvement Project.

2.0 Description of the Action and Project Evaluation Approach

2.1 Introduction

The ARCF GRR has identified a number of problems associated with the flood risk management system protecting the city of Sacramento and surrounding areas. There is a high probability that flows in the American and Sacramento Rivers will stress the network of levees protecting Sacramento to the point that levees could fail. The consequences of such a levee failure would be catastrophic, since the area inundated by flood waters is highly urbanized and the flooding could be up to 20 feet deep.

The majority of the Sacramento River levee within the study area requires seepage, slope stability, height, and erosion improvements in order to meet Corps criteria. Construction of the levee improvement measures will require complete vegetation removal within the construction footprint required to install the cutoff wall and raise the levee for approximately one mile. On the waterside, where construction does not remove vegetation, on the lower one-half of the slope to 15 feet waterward of the waterside levee toe, the vegetation will be left in place and a Vegetation Variance (VV) will be sought by the Sacramento District. To show that the safety, structural integrity, and functionality of the levee would be retained, an evaluation of underseepage and waterside embankment slope stability was completed given that a tree fell resulting in scouring of the root ball area.

An analyses section/index point was chosen for the VV analyses which was considered to be representative of the most critical channel and levee geometry and the without project analyses showed the section does not meet underseepage and slope stability criteria. The cross-section geometry of the index point incorporated tree fall and scour by using a maximum depth of scour for cottonwoods as approximately 11.0 feet; the associated soil removed was projected at a 2:1 slope from the base of the scour toward both the landside, and waterside slopes. The base scour width was equal to the maximum potential diameter at breast height (dbh) of cottonwoods (12.0 feet) projected horizontally at a depth of 11.0 feet below the existing ground profile. The results show that the tree fall and scour did not significantly affect levee performance and that the levee meets Corps seepage and slope stability criteria considering the seepage and stability improvement measures are in place (“with project” conditions). Therefore, it is a reasonable conclusion that a VV to allow vegetation to remain would not jeopardize the safety, structural integrity, and functionality of the Sacramento River levee. The Sacramento Weir and Bypass levees would be constructed in compliance with the Corps ETL as these would be new levees. No vegetation removal would be required within the existing or expanded Sacramento Bypass. Table 2 below summarizes the project reaches and whether or not a variance would be requested outside of the construction footprint.

Table 2. Summary of ETL Compliance Method by Waterway.

	Vegetation Variance	SWIF
Sacramento River (lower ½ of levee slope which is outside construction footprint)		
Waterside	X	
Landside		X
American River		
Trench Landside[1]		X
Bank Protection		X
North Area Tributaries[2]		
NEMDC	X	X
Dry/Robla Creeks	X	X
Arcade Creek	X	X
Magpie Creek[3]	X	X

1 The waterside footprint for the trench construction would require removal of vegetation and therefore compliance with the ETL.
2 A variance is included for these tributaries waterside slopes outside of the construction footprint, and a SWIF would be prepared by the non-Federal partners for the landside slopes and access.
3 The new levee constructed along Raley Boulevard would be constructed in compliance with the ETL.

2.1.1 Alternative Formulation and Screening

A wide variety of management measures were developed to address the planning objectives. These measures were evaluated and then screened using the Corps planning process. Formulation strategies were then developed to address various combinations of the planning objectives and planning constraints. Based upon these strategies, various combinations of the measures were assembled to form an array of preliminary plans. The preliminary plans were then evaluated, screened and reformulated, resulting in a final array of alternatives.

The formulation strategies used to address the objectives and constraints included:

- Measures to reduce flood stages;
- Measures to address seepage and underseepage;
- Measures to address stability;
- Measures to achieve the urban levee level of protection;
- Measures to address erosion;
- Measures to address maintenance and emergency response access; and
- Non-structural measures.

Approximately 35 different measures were developed to address these formulation strategies. The measures then went through a preliminary screening process prior to combining them into alternatives. This screening was done by evaluating the measures against the four planning criteria established in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies: completeness, efficiency, effectiveness, and acceptability. In addition, the local sponsor identified a planning criterion of ability to implement the project.

2.1.2 Measures Considered, But Eliminated From Future Consideration

Some measures originally identified that could contribute to addressing Sacramento's flood problems and needs were reviewed and dropped from further consideration. These measures included:

- Upstream storage on the American River (Auburn Dam);
- Transitory storage in upstream basins;
- Yolo Bypass improvements;
- Reoperation of upstream reservoirs: and
- Construction of a diversion structure just upstream of the existing I Street Bridge on the Sacramento River.

The Corps has a long history of studying upstream storage on the American River. Auburn Dam was proposed for authorization by the Corps in both 1991 and 1996, with no authorization granted by Congress. Since that time, Congress has consistently directed the Corps to focus on downstream elements rather than upstream storage under the scope of this study, as levee improvements are considered to be the first increment necessary to improve the overall system. As a result, this alternative was eliminated from consideration under this study. However, upstream storage may be considered to be a viable measure to further reduce the level of risk to the flood risk management system under future studies.

The I Street Bridge diversion structure was proposed to limit flood flows through the city of Sacramento and push excess flows into the Yolo Bypass in order to limit the need for levee repairs downstream of the structure. This measure was not carried forward for a variety of reasons. The estimated implementation time would leave the urban Sacramento River at risk for an unacceptably long period of time. Operation of the structure would inundate the Yolo Bypass more frequently than current operations, causing an unknown disruption to the Yolo County agricultural economy. In addition, the construction of a permanent structure in the Sacramento River channel is inconsistent with the goals and objectives of the Central Valley Flood Protection Plan, a key planning effort by the State of California; moving forward with a measure that is inconsistent with this plan could risk the partnership between the Corps and the State for the ARCF GRR.

The remaining three measures listed above include upstream transitory storage, Yolo Bypass improvements, and reoperation of upstream reservoirs. These three measures were all eliminated from further consideration because none would reduce flood stages to a low enough level to eliminate the need for downstream levee repairs. As a result, the downstream levee repairs remain the common element between these measures and remain the primary focus of Alternative 2, the tentatively selected plan, detailed in Section 2.2 below.

In addition, some non-structural measures were considered, and eliminated, including flood proofing individual structures, relocating residents out of the flood plain, and raising structures to above the floodplain. All of these non-structural measures were eliminated because the sheer number of residents in the floodplains, particularly in the American River South study area in the Pocket and Meadowview neighborhoods, made this alternative cost-prohibitive when compared to the proposed alternatives.

2.2 Alternative 2 – Improve Levees and Widen the Sacramento Weir and Bypass

Alternative 2, the tentatively selected plan, involves the construction of fix-in-place levee remediation measures to address seepage, stability, erosion, and height concerns identified for the American River levees, NEMDC, Arcade, Dry/Robla, and Magpie Creeks. The levees along the Sacramento River would be improved to address identified seepage, stability, erosion, and a minimal amount of height concerns. Most height concerns along the Sacramento River would be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass. A summary of the measures proposed under this study are included in Table 3.

Table 3. Proposed Measures for the American River Common Features Project.

Waterway/Location	Extent of Action	Proposed Measure
American River	North and south levees from the confluence with the Sacramento River upstream for approximately 12 miles.	• Construct bank protection or launchable rock trenches
Sacramento River	East levee from the American River to Morrison Creek.	• Install cutoff walls • Construct bank protection • Construct levee raise
NEMDC	East levee from Dry/Robla Creek to the American River	• Install cutoff walls • Construct floodwalls
Arcade Creek	North and south levees from NEMDC to Marysville Boulevard	• Install cutoff walls • Raise floodwalls
Dry/Robla Creek		• Raise floodwalls
Magpie Creek Diversion Canal	Upstream of Raley Boulevard	• Construct floodwalls
Magpie Creek area	South of Raley Boulevard	• Construct new levee
Magpie Creek area	East of Raley Boulevard	• Acquire property to create a flood detention basin • Widen the Raley Boulevard/Magpie Creek bridge and raise the elevation of the roadway • Remove the Don Julio Creek culvert
Sacramento Weir and Bypass	North bypass levee to 1,500 feet north.	• Widen the Sacramento Weir and Bypass by approximately 1,500 feet • Construct a new section of weir and levee • Remove the existing Sacramento Bypass north levee

All proposed measures are detailed in Sections 2.2.1 through 2.2.4 below. Due to the urban nature and proximity of existing development within the American River North and South basins, Alternative 2 proposes fix in place remediation. The purpose of this alternative would be to improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 4 summarizes the levee problems discussed above and the proposed measure for each waterway.

Table 4. Alternative 2 - Proposed Remediation Measures by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench	---
Sacramento River	Cutoff Wall	Cutoff Wall	Bank Protection	Sacramento Bypass and Weir Widening, Levee Raise
NEMDC	Cutoff Wall	Cutoff Wall	---	Floodwall
Arcade Creek	Cutoff Wall	Cutoff Wall	---	Floodwall
Dry/Robla Creeks	---	---	---	Floodwall
Magpie Creek[2]	---	---	---	Floodwall, Levee Raise

1 American River seepage, stability, and overtopping measures were addressed in the American River Common Features, WRDA 1996 and 1999 construction projects.
2 In addition to the Floodwall, Magpie Creek will include construction of a new levee along Raley Boulevard south of the creek, and construction of a detention basin on both sides of Raley Boulevard. In addition, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

2.2.1 Vegetation and Encroachments

In addition to the proposed levee improvements measures shown in Table 3, the following measures and policies would be addressed during construction:

- Utility encroachments will be brought into compliance with Corps policy as a part of project construction activities. Utilities that penetrate the levee would be removed during excavation of the levee and replaced with one of two fixes as construction commences. These two fixes include: (1) a surface line over the levee prism, or (2) a through-levee line equipped with positive closure devices.
- Private encroachments such as fences and stairs in the levee shall be removed by the non-federal sponsor prior to construction.

The Corps' Engineering Technical Letter (ETL) 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures, calls for the removal of wild growth, trees, and other vegetation, which might impair levee integrity or flood-fighting access in order to reduce the risk of flood damage. The vegetation requirements include a 15 foot waterside, landside, and vertical vegetation-free zone. In certain instances, to further enhance environmental values or to meet state or Federal laws and/or regulations, a variance can be requested from the standard vegetation guidelines set forth in this ETL.

The ARCF GRR has identified significant and extensive seepage, stability, overtopping, and erosion problems with the levees that increase the risk of flooding for the Sacramento area. Due to the potential for catastrophic consequences associated with a levee failure in this urban area, all identified problems, including vegetation and encroachments, require correction in order to reduce the flood risk to an acceptable level. However, risk reduction measures must be implemented in a "worst first" manner in order to immediately maximize the amount of risk reduction for each increment of investment. The engineering analysis conducted to date generally indicates that seepage and erosion concerns pose a significantly higher risk of levee failure than those associated with vegetation and encroachments. However, specific instances of vegetation and encroachment problems have been identified as high risk and require resolution concurrent with other high risk issues.

In the case of construction associated with the recommended plan, vegetation and encroachment removal is secondary to the primary flood risk management measures (i.e. seepage cutoff barrier, levee raise, slope flattening). In an effort to modernize the levee system to meet current engineering standards, vegetation and encroachment issues (including landside levee access) in the study area will be resolved through a combination of construction actions associated with implementation of the recommended plan and formal agreements. The formal agreements involve the integrated use of a SWIF agreement with the local maintaining agency (LMA) and a variance from vegetation standards in ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.

System Wide Improvement Framework

The SWIF is an agreement between the Corps and the non-Federal sponsor that allows the LMA to defer compliance with ETL 1110-2-583. Under the SWIF agreement, the LMA would address landside vegetation and encroachment issues (including landside levee access) through the implementation of their standard operation and maintenance (O&M) actions over time. Therefore, vegetation not impacted by project construction would be addressed by the LMA in accordance with the State's Levee Vegetation Management Strategy in the Central Valley Flood Protection Plan (CVFPP) over the next 20 to 40 years. The SWIF will be planned and implemented by the non-Federal sponsor and includes the following criteria:

- An engineering inspection and evaluation shall be conducted to identify trees and other woody vegetation (alive or dead) on the levee and within 15 feet of the levee toe that pose an unacceptable threat to the integrity of the levee. Identified trees shall be removed and associated root balls and roots shall be appropriately remediated. Based on the engineering inspection and evaluation, trees and other woody vegetation that do not pose an unacceptable threat need not be removed.

- In cases of levee repair or improvement projects, vegetation within the project footprint shall be removed as part of construction activities.
- Trees and other woody vegetation that are not removed must be monitored as part of routine levee maintenance to identify changed conditions that cause any of these remaining trees and other woody vegetation to pose an unacceptable threat to levee integrity. Otherwise, such trees and woody vegetation are to be maintained according to the levee vegetation management criteria included in the CVFPP which establish a vegetation management zone (including the landside levee slope, crown and upper 1/3 of the waterside slope) in which trees are trimmed up to 5 feet above the ground (12-foot clearance above the crown road) and thinned for visibility and access while brush, trees and other woody vegetation less than four inches in diameter at breast height, weeds or other such vegetation over 12 inches high are to be removed in an authorized manner.

Vegetation Variance

A vegetation variance would be sought during the preconstruction engineering and design phase before construction to allow vegetation to remain on the lower 2/3 of the waterside slope and out 15 feet from the waterside toe. If granted, the variance would allow for vegetation to remain in these areas. To show that the safety, structural integrity, and functionality of the levee would be retained with a variance, an evaluation of underseepage and waterside embankment slope stability was completed by Corps geotechnical engineers.

This evaluation was completed for the section/index point at levee mile (LM) 5.92 on the Sacramento River. This index point was chosen for the variance analyses because it was considered to be representative of the most critical channel and levee geometry, underseepage and slope stability conditions, and vegetation conditions. The cross-section geometry of the index point incorporated tree fall and scour by using maximum potential diameter at breast height (dbh) of cottonwoods (12.0 feet) projected horizontally at a depth of 11.0 feet below the existing ground profile. The results show that the tree fall and scour did not significantly affect levee performance and that the levee meets Corps seepage and slope stability criteria considering the seepage and stability improvement measures are in place (“with project” conditions). Therefore, it is a reasonable conclusion that by allowing vegetation to remain as stated above, the safety, structural integrity, and functionality of the Sacramento River levee would be retained.

The vegetation variance request would be developed during the design phase to allow for vegetation to remain on the lower portion of the waterside levee slope (Figures 8 and 9). Vegetation on the upper waterside levee slope would be removed as part of project construction. If a variance is not approved, the recommendations for this portion of the project will be reformulated and further environmental compliance efforts would be required.

Construction of Alternative 2 is proposed to take approximately 13 years. The construction reaches have been prioritized based on a variety of factors, including the condition of the levee, the potential damages that would occur due to levee failure, and construction feasibility considerations, such as the availability of equipment at any given time. The tentative schedule of construction is shown in Table 5. The project reaches are shown in Figure 2 below.

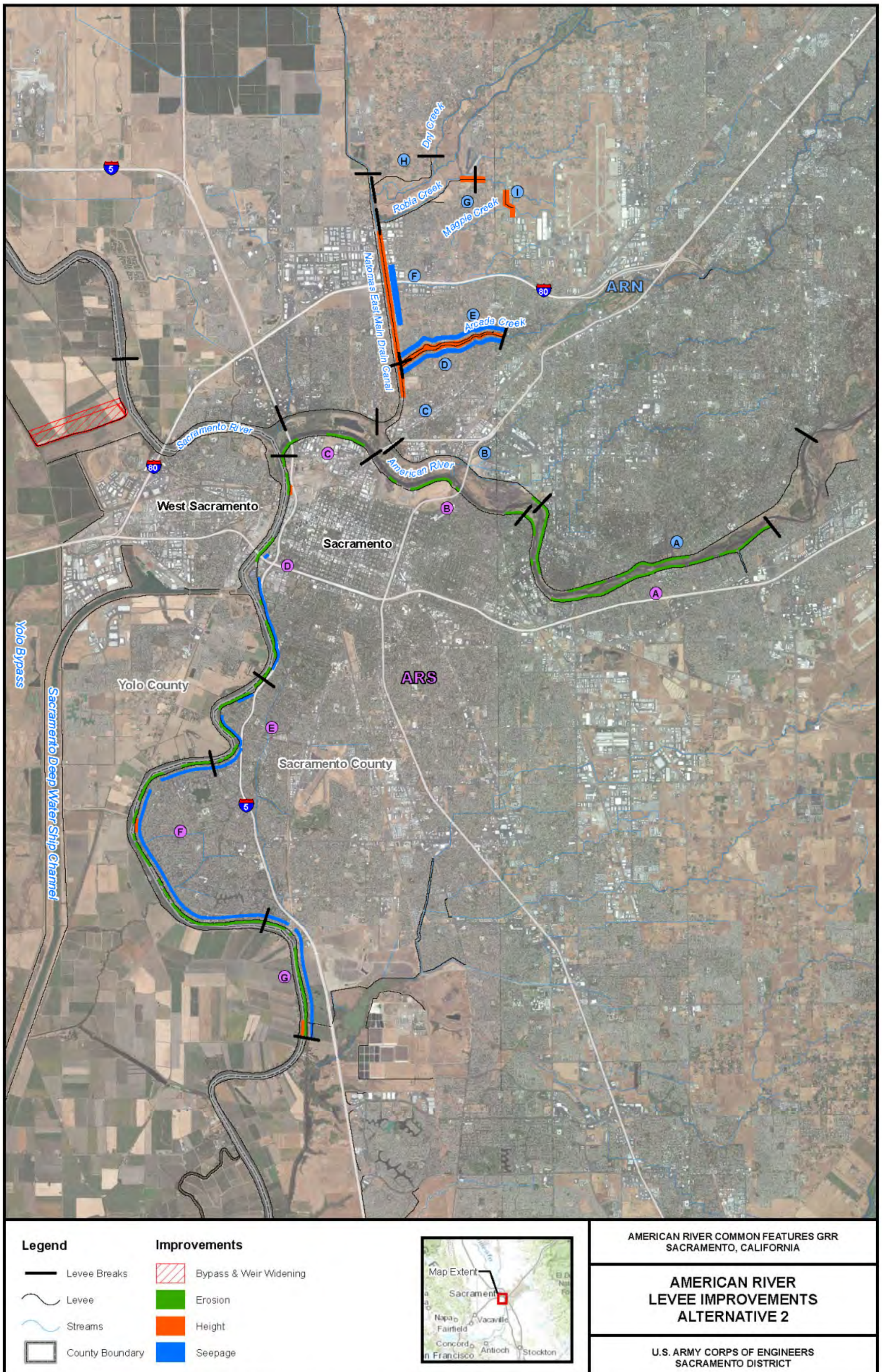


Figure 2. Individual Reach Identification in the ARCF Study Area.

Table 5. Tentative Construction Schedule for Alternative 2.

PRIORITY	WATERWAY	REACH[1]	YEAR OF PROJECT CONSTRUCTION												
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Sacramento River	ARS F													
2	Sacramento River	ARS E													
3	American River	ARS A													
4	Sacramento River	ARS G													
5	Sacramento River	ARS D													
6	American River	ARS B													
7	American River	ARN A													
8	American River	ARS C													
9	American River	ARN B													
10	Sacramento Weir & Bypass	--													
11	Arcade Creek	ARN D													
12	NEMDC	ARN F													
13	Arcade Creek	ARN E													
14	NEMDC	ARN C													
15	Dry/Robla Creek	ARN G													
16	Magpie Creek	ARN I													

[1] Individual reach ID's can be seen in Figure 2.

2.2.2 Borrow Sites, Haul Routes, and Staging Areas

Borrow Sites

It is estimated that a maximum of 1 million cubic yards (cy) of borrow material could be needed to construct the project. Because this project is in the preliminary stages of design, detailed studies of the borrow needs have not been completed. Actual volumes exported from any single borrow site would be adjusted to match demands for fill. Borrow sites would be selected that do not cause an impact to endangered species or their habitat and therefore, consultation for borrow sites is not required.

To identify potential locations for borrow material, soil maps and land use maps were obtained for a 20-mile radius surrounding the project area. These potential borrow locations are shown on Figure 3. Borrow sites would be lands that are the least environmentally damaging and would be obtained from willing sellers. The criteria used to determine potential locations were based on current land use patterns and soil types from the Natural Resources Conservation Service (NRCS). The data from land use maps and NRCS has not been field verified, therefore, to ensure that sufficient borrow material would be available for construction the Corps looked at all locations within the 20 miles radius for 20 times the needed material. This would allow for sites that do not meet specifications or are not available for extraction of material.

The excavation limits on the borrow sites would provide a minimum buffer of 50 feet from the edge of the borrow site boundary. From this setback, the slope from existing grade down to the bottom of the excavation would be no steeper than 3H:1V. Excavation depths from the borrow sites would be determined based on available suitable material. The borrow sites would be stripped of top material and excavated to appropriate depths. Once material is extracted, borrow sites would be returned to their existing use whenever possible, or these lands could be used to mitigate for project impacts, if appropriate.

Clean rock would be commercially acquired in order to construct the American and Sacramento River bank protection sites. For the Sacramento River, it is assumed that the rock would be acquired from a commercial source in the Bay Area and barged up the Sacramento River to the construction sites. Rock for the American River sites would be acquired from a commercial source within a 50-mile radius and would be hauled in trucks to the construction sites.

Haul routes would be determined during the design phase and would be dependant on what borrow sites and staging areas are selected for project construction. To the maximum extent feasible, haul routes would be selected based on existing commercial haul routes and levee roads and would avoid impacts to Federally listed species.

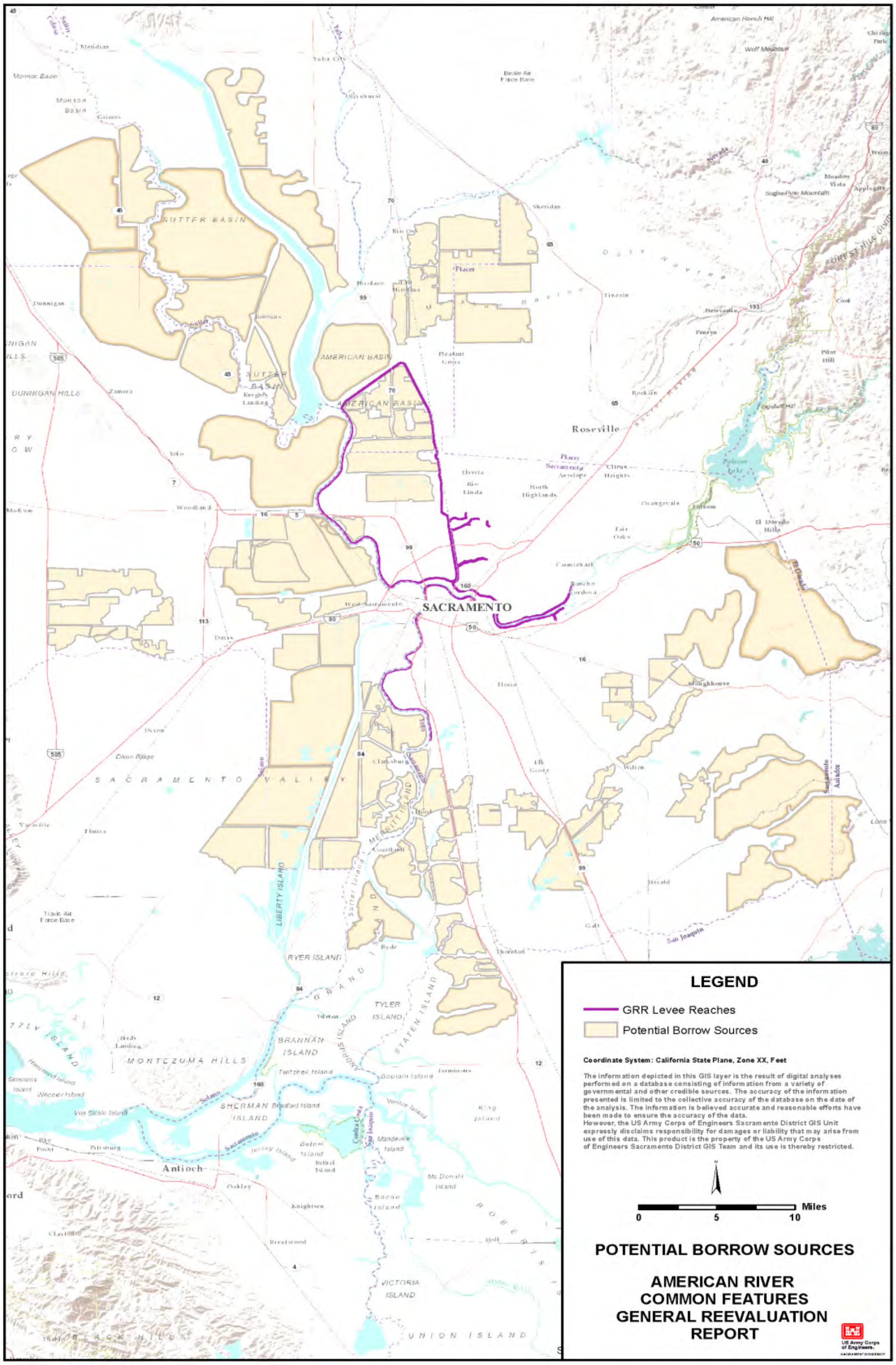


Figure 3. Potential Borrow Sites within 20-miles of Study Area.

SAFCA has selected a borrow site to provide suitable material for the NSS Levee Improvements based on proximity to the project area. The preferred borrow source, Borrow Site 2/Site 2K is shown in Figure 4. Approximately 27,000 cy of material will be excavated from the 5.5-acre borrow site in order to construct the levee improvements. Borrow Site 2 would be returned to pre-project conditions following construction activities.

SAFCA's goal in selecting haul routes is to use existing levee crowns for hauling wherever possible (Figure 5). However, there are locations where hauling on paved public roads is the best available option because the levee crown is already paved for public use or because there is inadequate room on the waterside of the levee to develop a temporary toe road without affecting standing water or low flow channels. Final haul routes would be selected based on constraints, the construction schedule, and in coordination with the City.

Borrow Site 2 is in close proximity to the NEMDC levee and East Levee Road located on the levee crown. From these two sites, haul trucks would use East Levee Road from the borrow site down to a point just north of the existing Del Paso/Main Avenue Bridge over NEMDC. At this point, haul trucks would divert off the road, down the levee slope, and pass under the bridge on an existing road. Just downstream of the Del Paso/Main Avenue Bridge, a short span temporary bridge would cross a narrow section of the low flow NEMDC channel. A temporary culvert crossing of the low flow channel is also possible. From the temporary bridge (or culvert) crossing, the haul trucks would proceed up a new sloping ramp constructed on the waterside of the NEMDC east levee to the levee crown. Trucks would then continue down the levee crown to the Arcade Creek north levee. At the Arcade Creek north levee, trucks would cross the existing Union Pacific Railroad (UPRR) tracks at the existing at-grade crossing and proceed along the north levee crown to the improvement sites.

To access the Arcade Creek south levee and the work proposed on the NEMDC east levee, haul trucks would continue south following an access ramp down the levee slope to Arcade Creek. At the creek, a short temporary bridge would be constructed to cross the low flow channel. A temporary culvert crossing of the low flow channel is also possible. From the temporary bridge (or culvert) crossing, the haul trucks would proceed up a new sloping ramp constructed on the waterside of the NEMDC east levee to the levee crown in the vicinity of the existing railroad at-grade crossing near the existing City of Sacramento Pump Station. Trucks would then proceed up the Arcade Creek south levee crown, or south to the improvement sites on the NEMDC east levee south of Arcade Creek.

Figure 4. North Sacramento Streams Borrow Site 2/Site 2K.

Figure 5. North Sacramento Streams Haul Routes.

Along the proposed haul routes, there are many opportunities to make use of existing undeveloped toe roads or develop new toe roads without affecting channel areas to facilitate truck passage and to avoid active work sites. Several temporary bridge crossings of the low-flow channel may also be needed to connect the north and south side levee waterside toe roads on Arcade Creek to facilitate movement of material and equipment around active work areas. Railroad car undercarriages on temporary abutment supports would be one option for temporary bridge crossings. Spans of up to 85 feet are possible. Locations for toe roads, ramps on levee slopes, and temporary bridge crossings would be finalized as part of final project design. Gravel on levee crowns along haul routes would be maintained as needed during periods of hauling, including watering for dust control and periodic grading to control rutting.

Storm Water Pollution Prevention Plan (SWPPP) requirements would apply to haul routes during construction. Following construction, temporary ramps would be removed, temporary bridges and abutments would be removed, and all disturbed areas would be revegetated.

Staging Areas

While staging areas have not been identified at this point in the planning phase, sites will be selected that do not require the removal of large vegetation or habitat that is valuable for endangered species. Staging areas would be selected that do not cause an impact to federally listed species or their habitat and therefore, this BA does not address staging areas and consultation for staging areas is not anticipated. Prior to construction, any staging areas would be cleared, grubbed, and stripped.

For SAFCA's NSS project, four potential staging areas have been identified for potential use to support construction (Figure 6). Several of these areas have been used previously to support levee improvements along Arcade Creek. The areas would require little preparation other than surface stripping, and temporary connection roads and ramps to the levee crown. The primary use for the staging areas would be for temporary trailers, parking, and material staging and for stockpiling and blending of excavated soils with imported borrow to make the excavated soils suitable for use in levee reconstruction. This would involve stockpiles of material to be processed, a processing area where excavated soils and imported soils would be spread out and processed to mix and moisture condition the material, and stockpiles of processed material. Importing, processing, and exporting material for levee reconstruction would all be continuous activities once the work flow is established during the start of the construction season. Other disturbed areas would be also be stabilized. Staging areas would be returned to pre-project conditions following construction activities unless the owner agrees to some grade raising to help dispose of excess construction soils.

Figure 6. North Sacramento Streams Staging Areas.

The following sections contain more detailed information on the specific measures proposed under this alternative for the American River North and South study areas.

2.2.3 American River

Levees along the American River under Alternative 2 require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed for the American River levees: (1) a maximum of 31,000 linear feet (LF) of bank protection, and (2) a maximum of 65 acres/45,000 LF of launchable rock trench. Both of these measures are described in detail in the subsections below. These numbers are maximized because there is some overlap identified to account for the uncertainty of site-specific conditions. For example, for some reaches both bank protection and launchable rock trench impacts were estimated even though both measures would not be constructed in the same reach. Figure 7 shows the erosion protection locations on the American River.

Bank Protection

The Corps conducts ongoing erosion repairs to sites on the Sacramento River levees under the Sacramento River Bank Protection Project (SRBPP). As part of the SRBPP NMFS Biological Opinions, the Corps is required to conduct post-construction monitoring in order to evaluate the relative success of on-site habitat features that are incorporated into the repairs. Under the SRBPP, bank protection designs have been constantly evolving, as the results of the monitoring help inform engineers to adapt the designs to optimize for site-specific conditions in meeting the objective of the habitat features. The Corps will use the best available information and SRBPP design templates as a basis for designing site-specific bank protection repairs for this project. As a result, the bank protection measure described below is a basic example of a typically designed bank protection site.

This measure consists of placing rock revetment on the river's bank to prevent erosion. This measure entails installing revetment along the stream bank based on site-specific analysis (Figure 7). When necessary, the eroded portion of the bank would be filled and compacted prior to the rock placement. The sites would be prepared by clearing and stripping of loose material and understory growth prior to construction. In most cases large vegetation would be permitted to remain at these sites. Temporary access ramps would be constructed, if needed, using imported borrow material that would be trucked on site.

The placement of rock onto the bank will occur from a land based staging area using long reach excavators and loader. The loader brings the rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the water side of the levee.

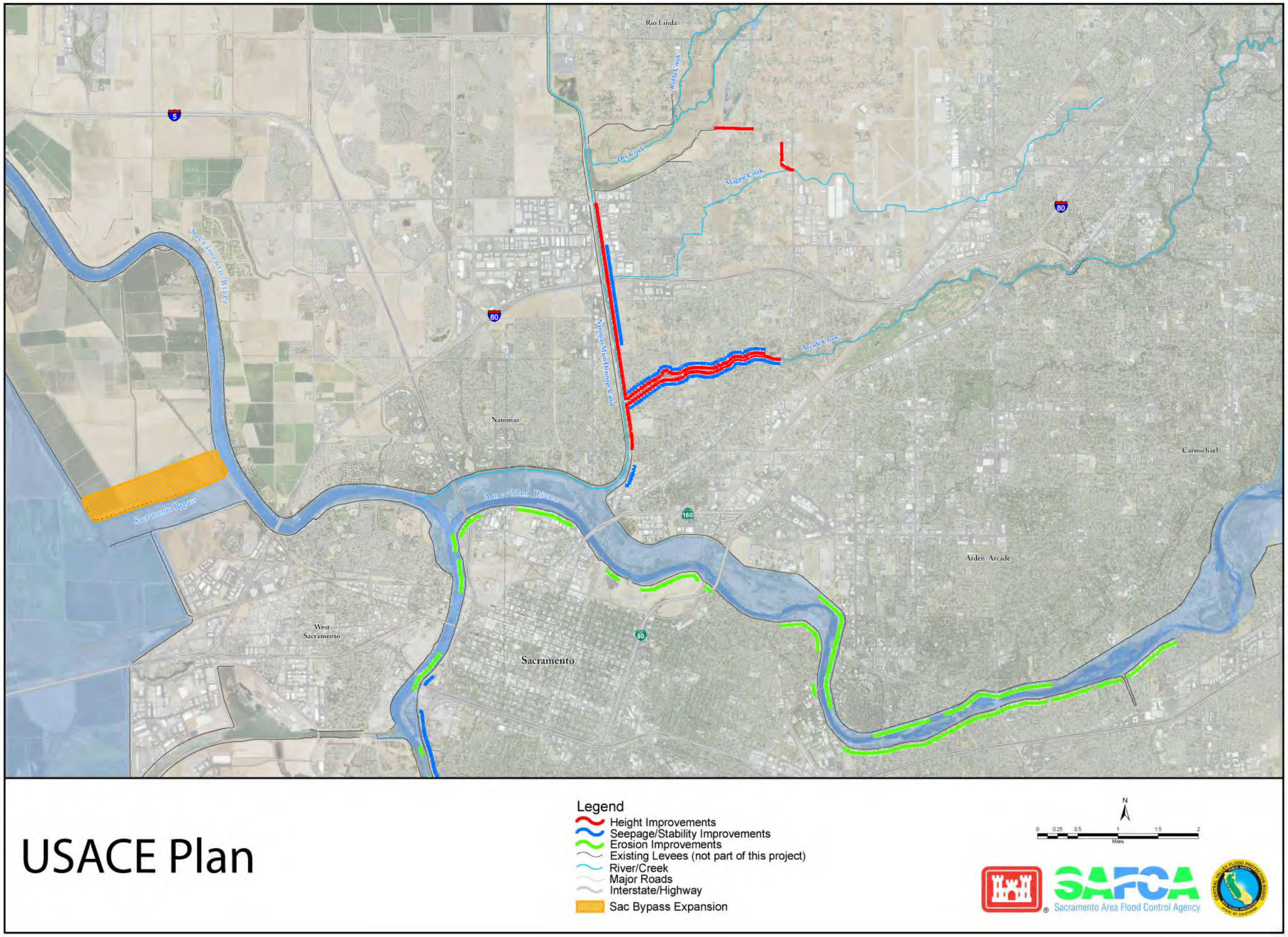


Figure 7. American River and East Side Tributaries Proposed Measures.

The revetment would be placed on the existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a planting berm would be constructed in the rock to allow for revegetation of the site. The planting berm varies in width from 5 to 15 feet (Figure 8). In all cases the planting will occur outside the vegetation free zone as required by the ETL.

Riparian vegetation installed on the planting berm would include large woody species such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*), white alder (*Alnus rhombifolia*), and box elder (*Acer negundo var. californicum*); shrub-scrub species such as elderberry (*Sambucus* spp.), redbud (*Cercis Canadensis*), and coyote brush (*Baccharis pilularis*); and understory species such as California rose (*Rosa californica*), California blackberry (*Rubus ursinus*), and wild grape (*Vitus californica*); and native grasses such as annual fescue (*Vulpia* spp.), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.).

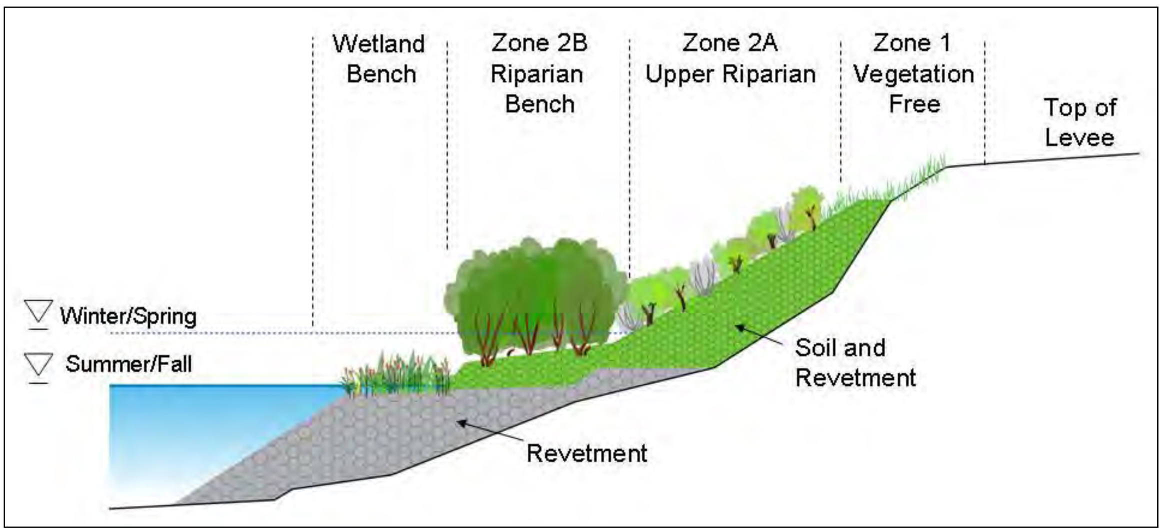


Figure 8. Planting Berms with Vegetation and Wetland Bench.

<u>Launchable Rock Trench</u>

This measure includes construction of a launchable rock filled trench, designed to deploy once erosion has removed the bank material beneath it (Figure 9). All launchable rock trenches would be constructed outside of the natural river channel. The vegetation would be removed from the footprint of the trench and the levee slope prior to excavation of the trench. The trench configuration would include a 2:1 landslide slope and 1:1 waterside slope and would be excavated at the toe of the existing levee. All soil removed during trench excavation would be stockpiled for potential reuse. The bottom of the trench would be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and amount of rock required.

After excavation, the trench would be filled with revetment that would be imported from an offsite location. After rock placement the trench would be covered with a minimum of 3 feet of the stockpiled soil for a planting berm. Rock placed on the levee slope would be covered with 2 feet of stockpiled soil. All disturbed areas would be reseeded with native grasses and small shrubs where appropriate. Trees and shrubs could be permitted on the berm if planted outside the specified vegetation free zone as required by the ETL. This alternative would not increase flows in the American River that would cause additional erosion along the banks. If flow changes occur that could cause loss of floodplain between the levee and the existing natural channel (the Parkway land) it will be addressed under the Folsom Reoperation Biological Assessment and EIS/EIR if applicable.

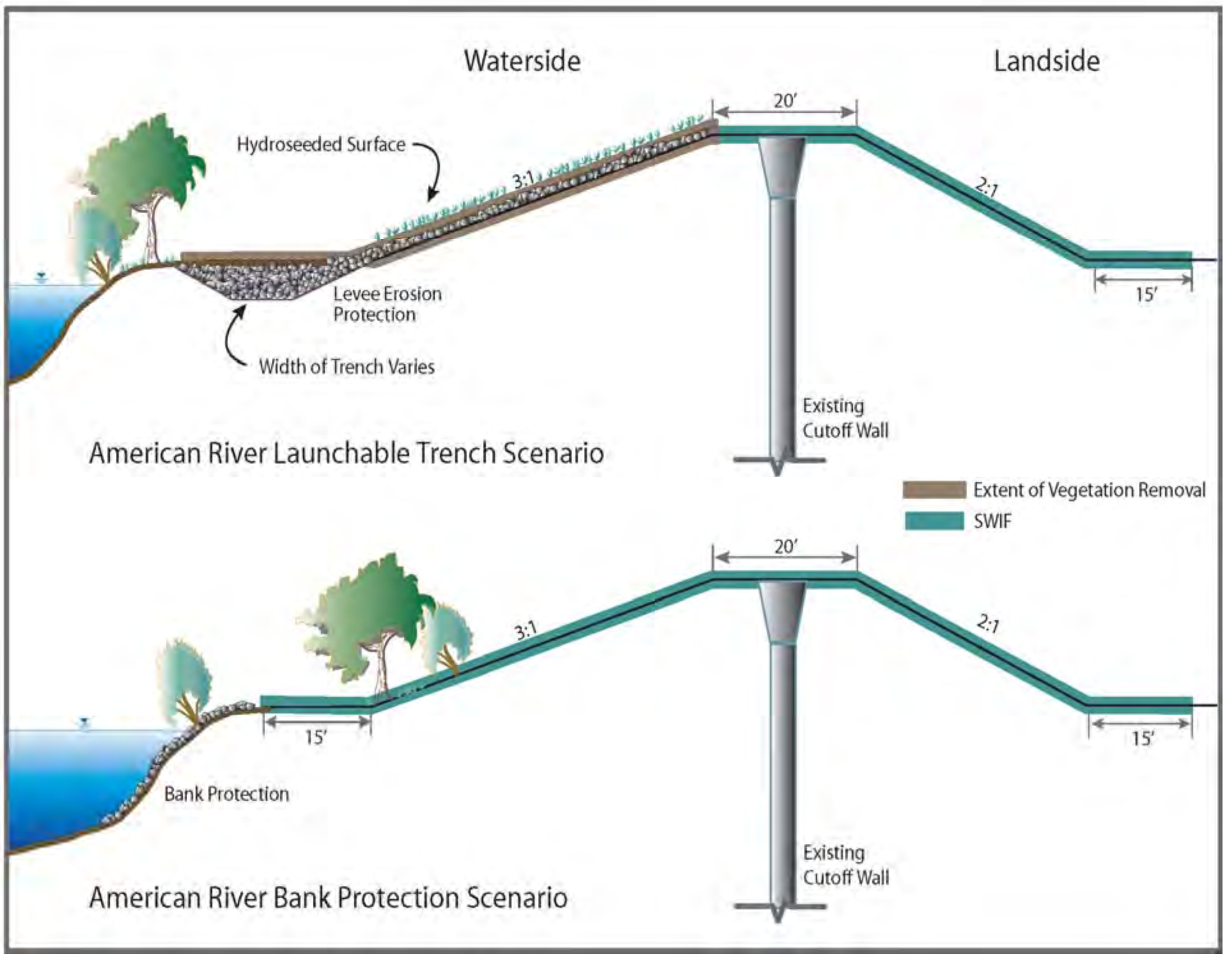


Figure 9. Erosion Protection – Launchable Rock Trench and Bank Protection Scenarios.

2.2.4 Sacramento River

Levees along the Sacramento River require improvements to address seepage, stability, and erosion. Approximately 50,300 LF of bank protection and cutoff wall or slope stability work is proposed for the Sacramento River. In addition, these levees require a total of one mile of intermittent height improvements in order to convey additional flows that exceed current design levels. Figure 10 shows the proposed measures for the Sacramento River.

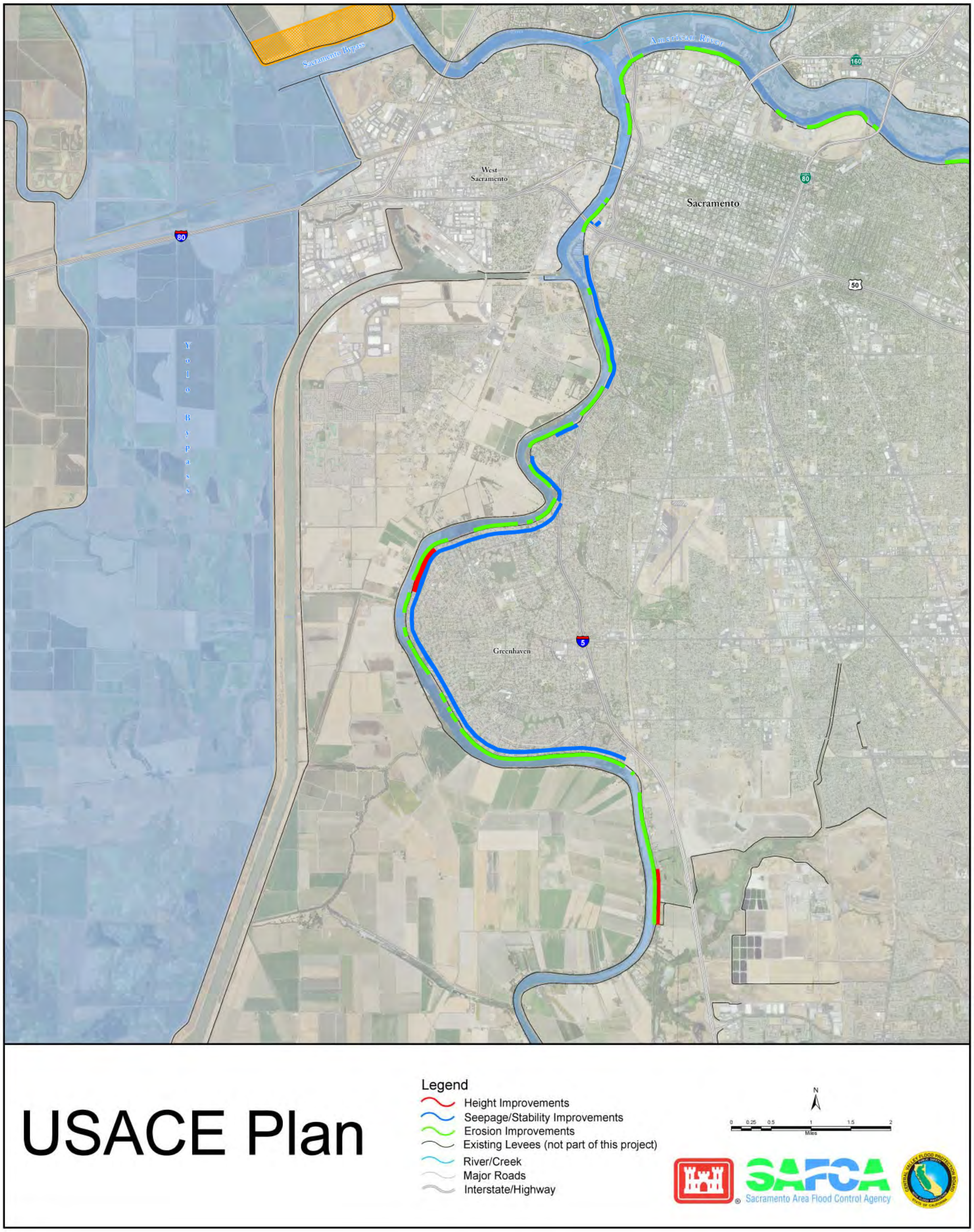


Figure 10. Sacramento River Proposed Measures.

Where the existing levee does not meet the levee design requirements, as discussed in Section 2.2 above, slope flattening, crown widening, and/or a minimal amount of levee raise is required. This improvement measure addresses problems with slope stability, geometry, height and levee crest access and maintenance. To begin levee embankment grading, loose material and vegetation understory would be cleared, grubbed, stripped, and, where necessary, portions of the existing embankment would be excavated to allow for bench cuts and keyways to tie in additional embankment fill. Excavated and borrow material (from nearby borrow sites) would be stockpiled at staging areas. Haul trucks and front end loaders would bring borrow materials to the site, which would then be spread evenly and compacted according to levee design plans.

The levee would be raised approximately 1 to 3 feet which would result in the levee footprint extending out a maximum of 5 feet on the landside from the existing levee. The levee crown patrol road would be re-established at the completion of construction. A typical design for these levees is shown in Figure 11 below.

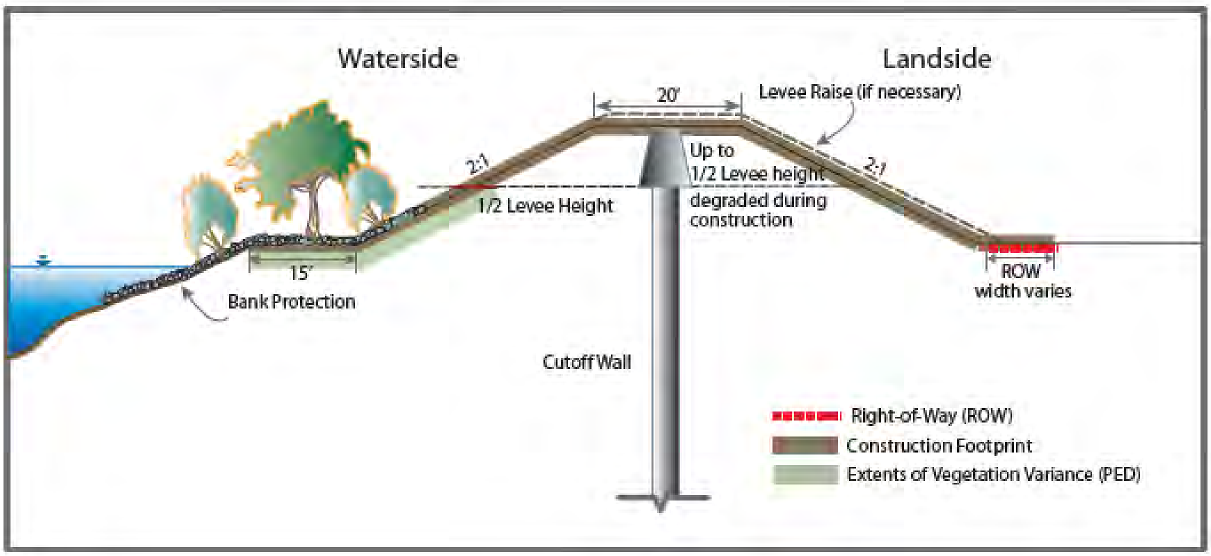


Figure 11. Fix-In-Place with Cutoff Wall and Levee Raise.

__Cutoff Walls__

To address seepage concerns, a cutoff wall will be constructed through the levee crown (Figure 9). The cutoff wall would be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of approximately 85 feet. For cutoff walls of greater depth the DSM method would be utilized.

Prior to construction of either method of cutoff wall, the construction site and any staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded up to half the levee height to create a large enough working platform (approximately 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids. This method of slurry wall installation will also reduce the risk of slurry mixture following seepage paths and leaking into the river or into landside properties.

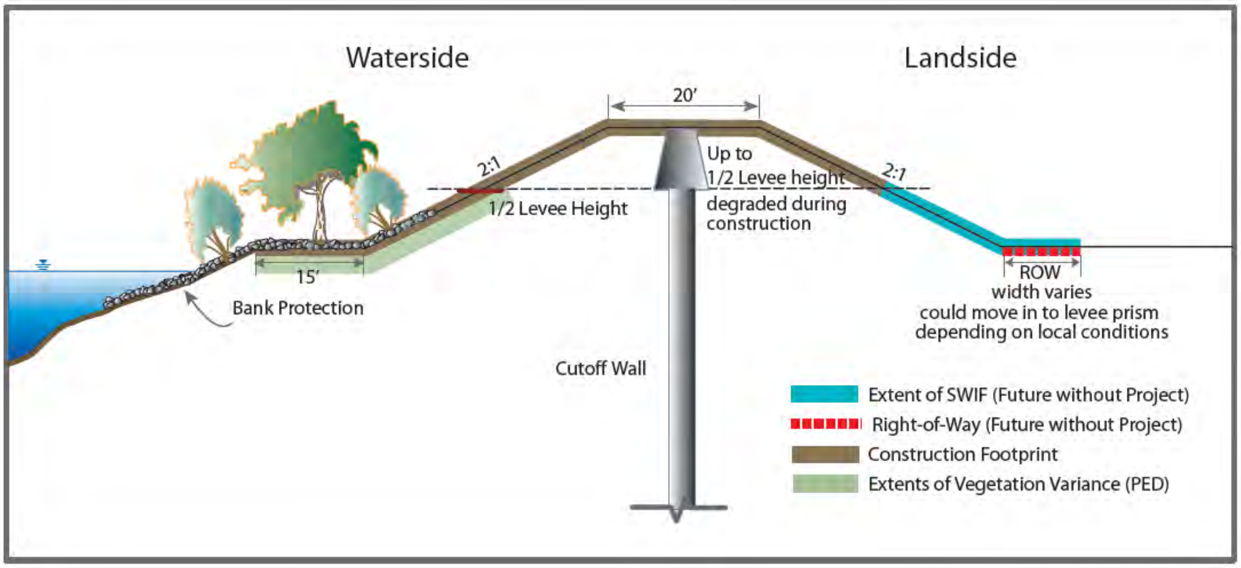


Figure 12. Fix-In-Place with Cutoff Wall and No Levee Raise.

Open Trench Cutoff Wall

Under the open trench method, a trench approximately 3 feet wide would be excavated at the top of levee centerline and into the subsurface materials up to 85 feet deep with a long boom excavator. As the trench is excavated, it is filled with low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench is mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture is backfilled into the trench, displacing the temporary slurry. Once the slurry has hardened, it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

DSM Cutoff Wall

The DSM method involves a crane supported set of two to four mixing augers used to drill through the levee crown and subsurface to a maximum depth of approximately 140 feet. As the augers are inserted and withdrawn, a cement bentonite grout would be injected through the augers and mixed with the native soils. An overlapping series of mixed columns would be drilled to create a continuous seepage cutoff barrier. A degrade of up to one half the levee height would be required for construction of the DSM wall. For both methods, once the slurry has hardened it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

Bank Protection

Bank protection on the Sacramento River would be addressed via either the launchable rock trench method described for the American River in Section 2.2.1 above, or by standard bank protection with planting berm (Figure 9). The standard bank protection measure for the Sacramento River consists of placing rock protection on the bank to prevent erosion. This measure entails filling the eroded portion of the bank, where necessary, and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. Large trees on the lower 1/2 slope will be protected in place to retain SRA habitat. The sites would be prepared by removing vegetation along the levee slopes at either end of the site for construction of a temporary access ramp, if needed. The ramp would then be constructed using imported borrow material that would be trucked on site.

The placement of rock onto the levee slope would occur from atop the levee and/or from the water side by means of barges. Rock required within the channel, both below and slightly above the water line at the time of placement, would be placed by an excavator located on a barge. Construction would require two barges: one barge would carry the excavator, while the other barge would hold the stockpile of rock to be placed on the channel slopes. Rock required on the upper portions of the slopes would be placed by an excavator located on top of the levee. Rock placement from atop the levee would require one excavator and one loader for each potential placement site. The loader brings the rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the water side of the levee.

The revetment would be placed via the methods discussed above on existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a small planting berm would be constructed in the rock to allow for revegetation of the site (Figure 13).

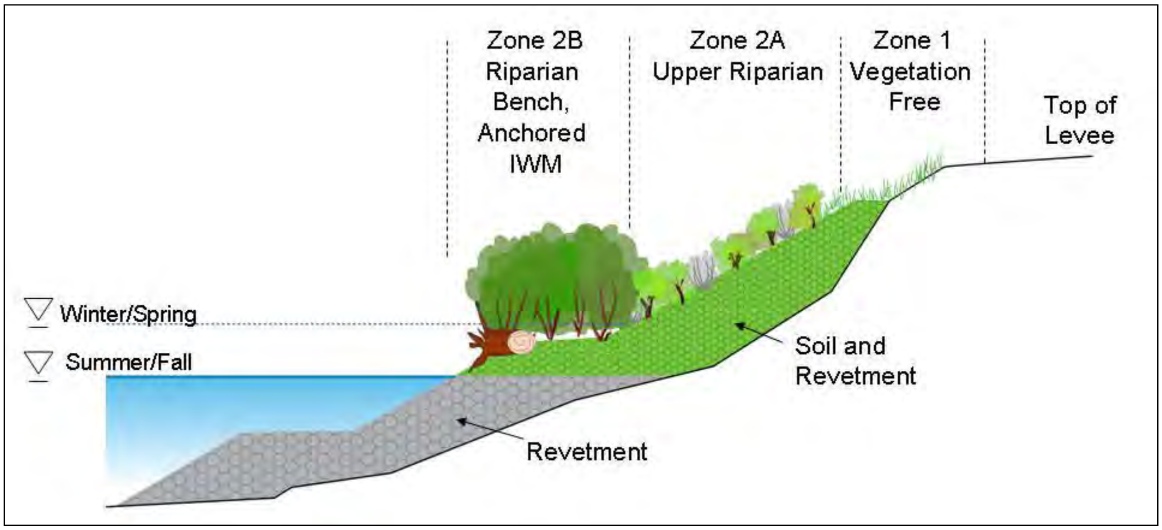


Figure 13. Planting Berm with Vegetation and Woody Material.

2.2.5 East Side Tributaries

The East Site Tributaries include measures proposed for the Natomas East Main Drain Canal (NEMDC), Arcade Creek, Dry/Robla Creek, and Magpie Creek. Arcade Creek and portions of NEMDC are included in the North Sacramento Stream Project, SAFCA's early implementation action on the ARCF GRR. The proposed measures for the East Side Tributaries under the ARCF GRR are shown on Figure 7 above.

Natomas East Main Drain Canal (NEMDC)

The east levee of the NEMDC requires 6,000 LF of improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A conventional open trench centerline cutoff wall would be constructed at these locations to address the seepage and stability problems (Figure 14). The open trench cutoff walls would be constructed as described for the Sacramento River levee in Section 2.2.2 above.

In addition, SAFCA is proposing to address seepage and stability in advance of the Federal project on a 1,700 foot reach of the NEMDC from Station 3028+00 to Station 3051+00, just south of the Arcade Creek south levee. For this reach, SAFCA proposes to construct a cement bentonite (CB) slurry cutoff wall at the waterside toe of the levee. This measure is described in greater detail in the Arcade Creek discussion below.

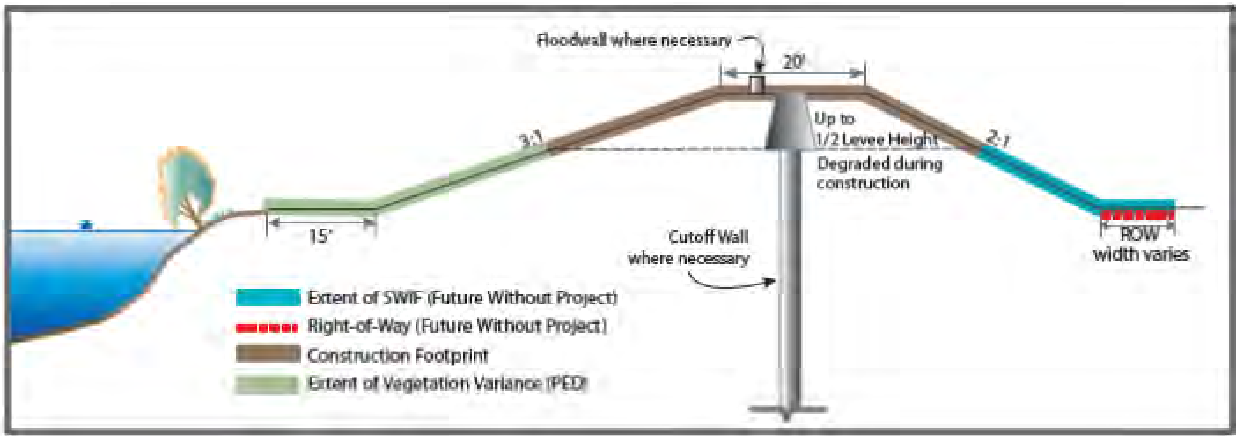


Figure 14. Conventional Open Trench Cutoff Wall or Floodwall Scenario.

Arcade Creek

The Arcade Creek levees require improvements to address seepage, slope stability, and overtopping when the event exceeds the current design. A centerline cutoff wall would be constructed to address seepage along 22,000 feet of the levee (Figure 12). There is a ditch adjacent to the north levee at the landside toe which provides a shortened seepage path, and could affect the stability of the levee. The ditch would be replaced with a conduit or box culvert and then backfilled. This would lengthen the seepage path and improve the stability of the levee (Figure 12). The majority of the Arcade Creek levees have existing floodwalls which vary in height from 1 to 4 feet, however there remains a height issue in this reach. A 1 to 4-foot floodwall raise would allow the levees to pass flood events greater than the current design level. The new floodwall or added height would result in a total floodwall height of approximately 4 to 6 feet. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown for construction (Figure 14). The waterside slope would be re-established to its existing slope and the levee crown would grade away from the wall and be surfaced with aggregate base.

SAFCA's NSS project is primarily focused on addressing seepage and slope stability concerns on Arcade Creek. Figure 15 below shows Arcade Creek in detail, broken down into Arcade Creek North (ACN) and Arcade Creek South (ACS) reaches. The NSS project includes centerline cutoff walls for most of the Arcade Creek levees (ACS A, ACS B, and ACN B). For the ACS C and ACN C reaches, stretching generally from Rio Linda Boulevard to Marysville Boulevard, SAFCA proposes to construct a CB slurry cutoff wall at the waterside toe of the levee, rather than a centerline cutoff wall. In addition, on the ACN C reach, SAFCA proposes to reconstruct the waterside slope from Station 5075+00 to Station 5100+00, and from Station 5100+00 to Marysville Boulevard, SAFCA proposes to construct a sheet pile cutoff wall at the centerline of the levee, rather than the waterside toe cutoff wall. For the ACN A reach, SAFCA proposes to install pressure relief wells along the landside toe of the levee. The waterside toe slurry cutoff walls and sheet pile walls are described in greater detail below.

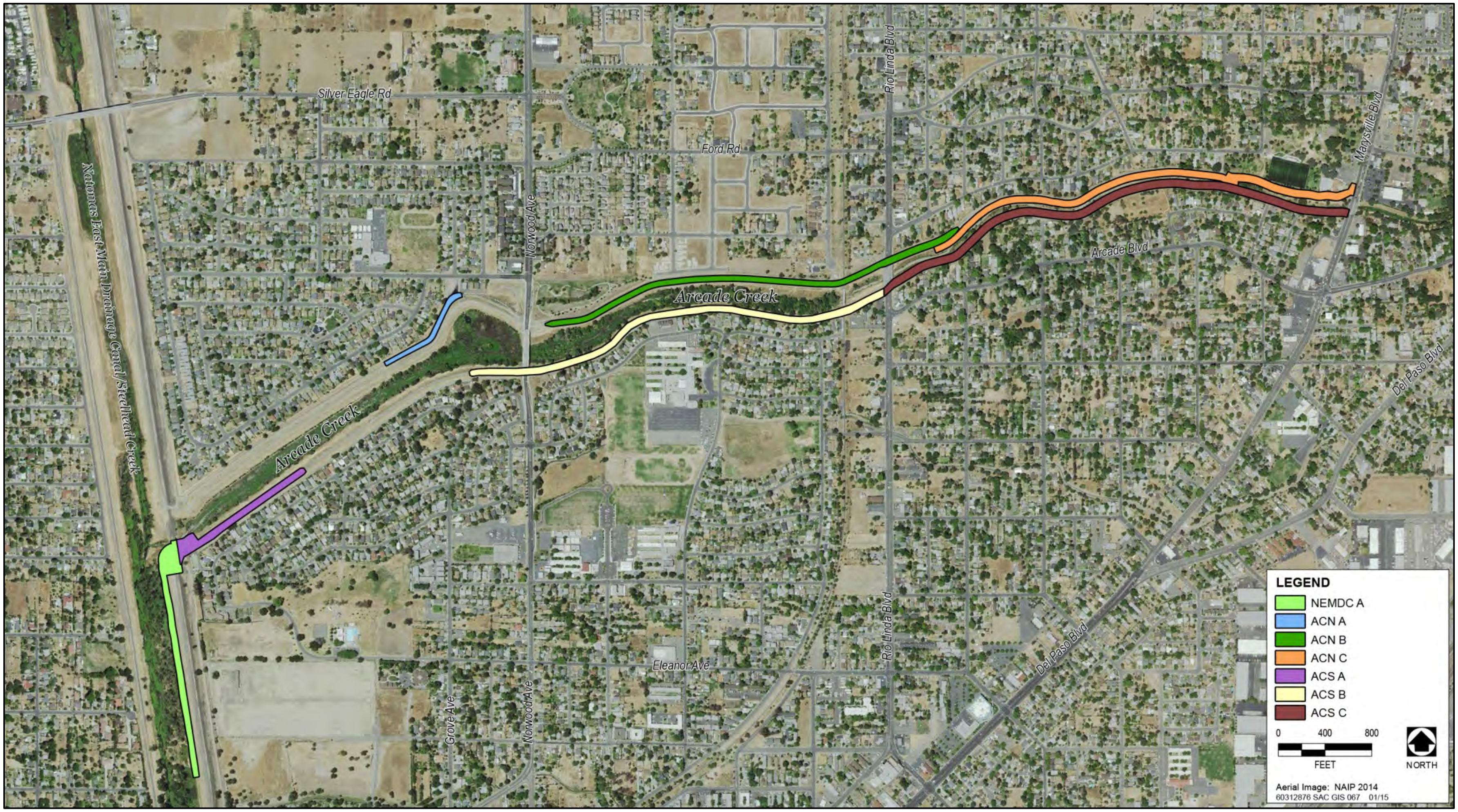


Figure 15. North Sacramento Streams Levee Improvement Project Area Reaches.

Toe Slurry Cutoff Wall Construction

Construction of the toe CB slurry cutoff walls to depths ranging from 15 to 30 feet along the existing waterside levee toe would be accomplished primarily with small- to medium-size excavators depending on required wall depth. This equipment and the associated sequence of excavation and placement of the centerline CB material into the trench, would require constructing a work bench along the toe. The bench elevation would be selected based on existing topography, required working room for cutoff wall installation, optimizing earthwork, and minimizing the need for bench elevation changes along the levee that could complicate slurry wall construction.

Excavations for the bench would extend deep enough below existing grade to remove organic material and soft, unsuitable foundation soils. Some dewatering and groundwater control is anticipated in connection with this excavation. Bench excavation would also extend into the existing waterside slope of the levee as needed to ensure that new selected bench fill material is integrated effectively with existing low permeability blanket material on the levee slope. This provides an integral seepage barrier with the cutoff wall over the full height of the levee. To the fullest extent possible, all excavated non-organic soil suitable for reuse would be processed and used for reconstruction to minimize off-hauling materials.

Some portions of ACN C reach, as described above, would require a more substantial excavation and reconstruction of the waterside slope to provide a low permeable seepage levee slope barrier, which may not currently exist. Here again, the bench fill material would be integrated with the slope reconstruction fill to provide an integral seepage barrier with the cutoff wall over the full height of the levee slope.

After the foundation has been excavated and accepted, properly moisture conditioned embankment materials would be placed in accordance with accepted levee construction standards and compacted to create the bench working surface for slurry wall construction. Each lift would be moisture-conditioned and compacted to the specified density using suitable tamping foot compactors.
After backfilling to the working surface for cutoff wall construction, the CB wall would be installed. For CB centerline wall construction, it is assumed that 50 percent of the material from the trench can be salvaged and processed with other excavated soil or borrow material for reuse in levee reconstruction. The remaining material from the trench excavation is assumed unsuitable for reuse and would be disposed of as described previously.

After installation of the cutoff wall, properly moisture-conditioned embankment materials would be placed to complete the bench construction to a minimum height of approximately 3 feet over the top of the cutoff wall and complete reconstruction of cuts on the waterside slope. Embankment material would be blended and processed material suitable for reuse. Each lift would be moisture-conditioned and compacted to the specified density using suitable tamping foot compactors.
After the bench is completed, the top and waterside slope would be covered with rip rap to control erosion over the completed cutoff wall. Above the bench, all disturbed construction areas would be revegetated. Gravel surfacing on the levee crown would be supplemented or replaced within the levee repair limits wherever damaged by haul vehicles and other construction-related traffic.

Sheet Pile Cutoff Walls

Sheet pile cutoff walls are installed with a crane and hydraulic ram that hammers or pushes the sheet pile into the ground to the desired depth. In levee reach ACN C near Marysville Boulevard where the wall would be located along the approximate existing levee crown centerline, the asphalt concrete surfacing would be removed prior to sheet pile placement. No levee degradation is needed except to develop an access platform for the crane of sufficient width. A 3-foot-wide by 3-foot-deep trench would be excavated along the sheet pile alignment. The sheet piling would be driven in the trench. The trench would then be backfilled with suitable levee fill materials placed on both sides and over the top of the completed wall. After backfilling the trench the existing asphalt-concrete pavement would be reconstructed.

Dry and Robla Creeks

The Dry and Robla Creeks levees require improvements to address overtopping for when flood events exceed the design level. Height improvements would be made with a new floodwall constructed to a height of 4 to 6 feet along 2,500 LF of the south levee. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown for construction (Figure 16). Construction of the floodwall would be consistent with the description for NEMDC, above. The waterside slope would be re-established to its existing slope and the levee crown would grade away from the wall and be surfaced with aggregate base.

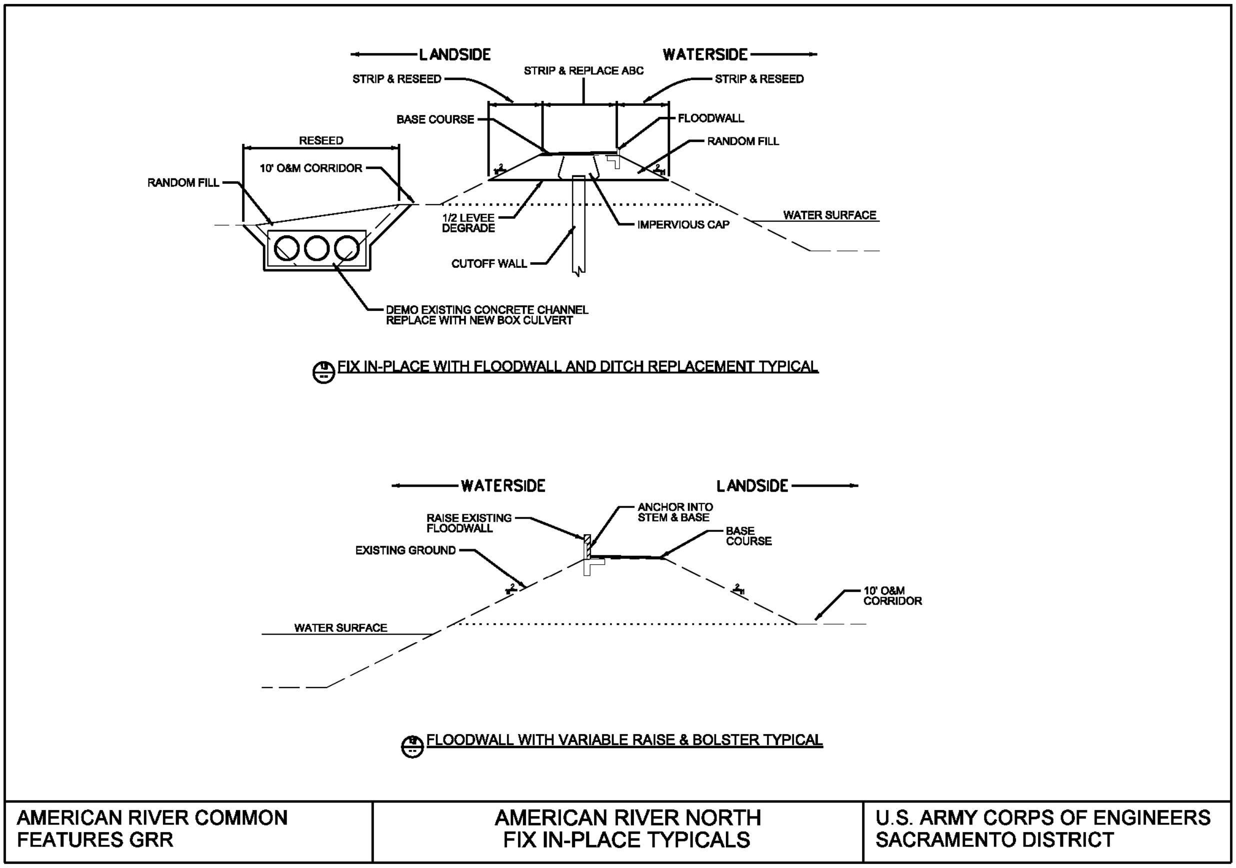


Figure 16. Floodwall with Variable Raise and Bolster Typical.

Magpie Creek Diversion Canal

A number of features are proposed for the Magpie Creek Diversion Canal. The existing project levee on the diversion canal would be raised by approximately 3 to 4 feet for a distance of approximately 2,100 feet. Construction of the raise would be similar to the levee raise described for the Sacramento River above. Additionally, a new, approximately 1,000-foot-long levee would be constructed adjacent to Raley Boulevard, south of the Magpie Creek bridge. The footprint of the existing and new levee is shown on Figure 17.

In addition to the above levee improvements, an approximately 79-acre flood detention basin would be created for the overflow of flood waters in the Magpie Creek area. The flood detention basin would mostly be created through the acquisition of property in the floodplain that is currently flooded during high water events. The flood detention basin would be located on both sides of Raley Boulevard near Magpie Creek. The frequency of flooding of this property would not change with implementation of the proposed measures, however, there would be a increase in surface elevation on the property during these events and the property may remain flooded for longer durations.

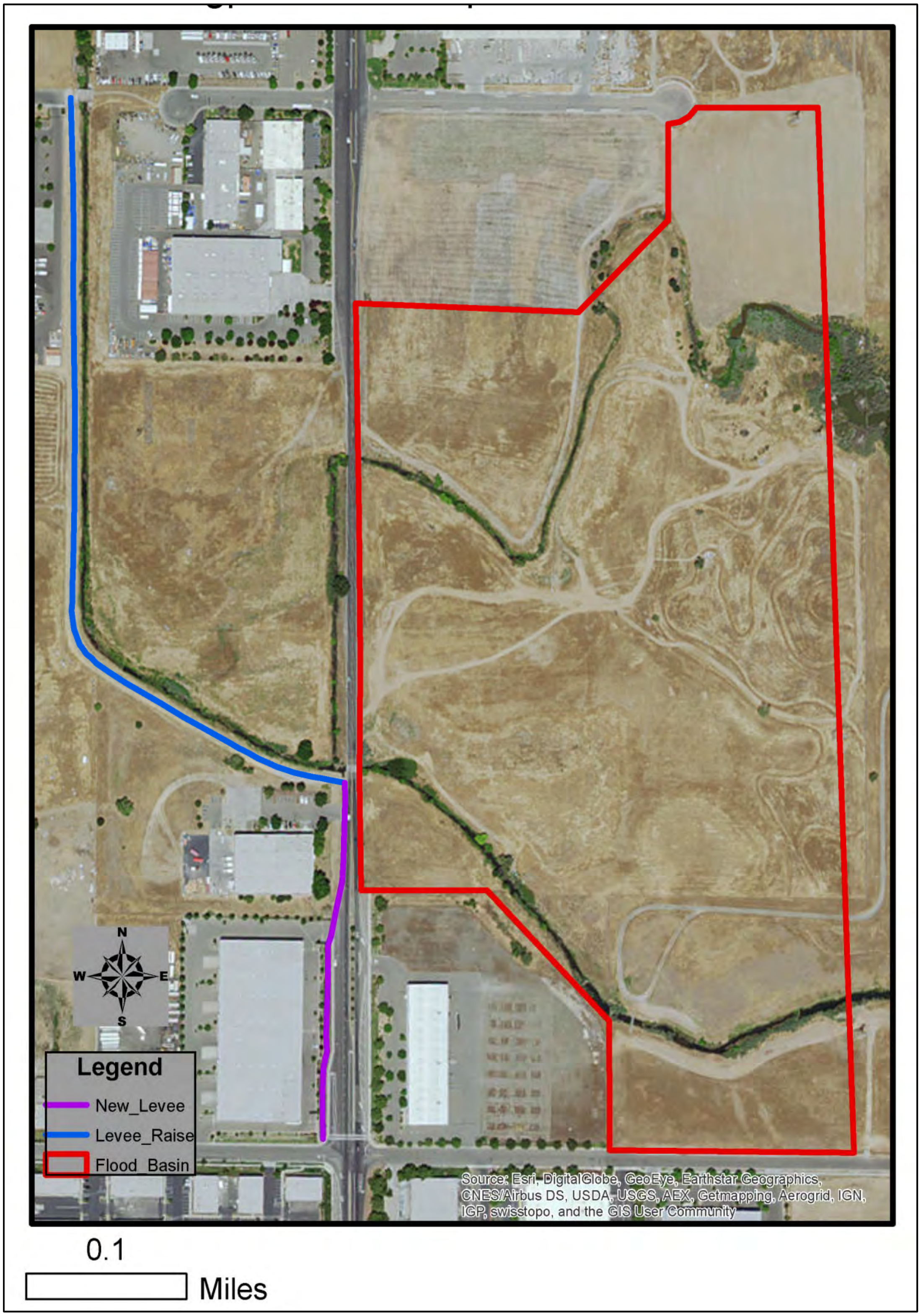


Figure 17. Magpie Creek Proposed Measures.

The features and design proposed for Magpie Creek were originally associated with a separate project, the Magpie Creek Flood Control Project, which was planned and designed by the Corps and SAFCA in 2004. In September 2004, USFWS issued a Biological Opinion to the Corps on the Magpie Creek Flood Control Project (Appendix E). Since the design has not changed at this time from the 2004 project, the 2004 Biological Opinion is considered to be valid and addresses the potential impacts associated with this portion of the ARCF GRR. These effects are summarized throughout this BA, as appropriate.

2.2.6 Sacramento Weir and Bypass

The Sacramento Weir was completed in 1916. It is the only weir that is manually operated – all others overflow by gravity on their own. It is located along the right bank of the Sacramento River approximately 4 miles upstream of the Tower Bridge, and about 2 miles upstream from the confluence with the American River. Its primary purpose is to protect the city of Sacramento from excessive flood stages in the Sacramento River channel downstream of the American River. The weir limits flood stages (water surface elevations) in the Sacramento River to project design levels through the Sacramento/West Sacramento area. Downstream of the Sacramento Weir, the design flood capacity of the American River is 5,000 cfs higher than that of the Sacramento River. Flows from the American River channel during a major flood event often exceed the capacity of the Sacramento River downstream of the confluence. When this occurs, floodwaters flow upstream from the mouth of the American River to the Sacramento Weir.

The project design capacity of the weir is 112,000 cfs. It is currently 1,920 feet long and consists of 48 gates to divert floodwaters to the west through the mile-long Sacramento Bypass to the Yolo Bypass. Each gate has 38 vertical wooden plank "needles" (4 inches thick by 1 foot wide by 6 feet long). It is cumbersome and expensive to operate, and questions have long been asked about whether this 1916 design is appropriate for today’s water management needs (DWR 2010).

Though the weir crest elevation is 24.75 feet, the weir gates are not opened until the river reaches 27.5 feet at the I Street gage with a forecast to continue rising. This gage is about 1,000 feet upstream from the I Street Bridge and about 3,500 feet upstream from the mouth of the American River. The number of gates to be opened is determined by the National Weather Service /Department of Water Resources (DWR) river forecasting team to meet either of two criteria: (1) to prevent the stage at the I Street gage from exceeding 29 feet, or (2) to hold the stage at the downstream end of the weir to 27.5 feet (DWR 2010). The weir gates are then closed as rapidly as practicable once the stage at the weir drops below 25 feet. This provides "flushing" flows to re-suspend sediment deposited in the Sacramento River between the Sacramento Weir and the American River during the low flow periods when the weir is open during the peak of the flood event (DWR 2010).

Under Alternative 2, the Sacramento Weir and Bypass would be expanded to roughly twice their current width to accommodate increased bypass flows. The existing north levee of the Sacramento Bypass would be degraded and a new levee would be constructed approximately 1,500 feet to the north. The existing Sacramento Weir would be expanded to match the wider bypass. At this time, it is not known whether the new segment of weir would be constructed consistent with the 1916 design described above, or whether it would be designed to be a gravity-type weir. The new north levee of the bypass would be designed to be consistent with the existing Sacramento Bypass north levee, however, it would also include a 300-foot-wide seepage berm on the landside with a system of relief wells. A hazardous, toxic, and radiological waste (HTRW) site near the existing north levee would be remediated by the non-Federal sponsor prior to construction.

To avoid potential effects to the Yolo Bypass, the new segment of the Sacramento Weir would be operated only during high water situations, when flows from Folsom Dam exceed 115,000 cfs. Operation of the existing Sacramento Weir and Bypass would remain the same, as described above. While not specifically modeled, there are not expected to be any water quality impacts. The approximate change in water diversions, which are shown in Table 6 below, would vary based on the size of the flood event. The frequency of water diversion is expected to be the same, which is to use the current Sacramento Weir operation based on a stream gage at the I Street Bridge (Schlunegger 2014). Under these operation assumptions, Alternative 2 would result in a diversion of flows from the Sacramento River to the Yolo Bypass that would slightly raise water surface elevations in the Yolo Bypass when flows in the American River exceed 115,000 cfs.

With the Folsom Dam improvements in place, releases from Folsom Dam would be above 115,000 cfs for flood events greater than 1/100 ACE event. Therefore, for events up to and including the 1/100 ACE event, only the existing weir will be operated per the criteria previously established. For events greater than the 1/100 ACE event when the release from Folsom Dam will go above 115,000 cfs, the new weir will be opened. With the increased flood storage space and anticipatory releases at Folsom Dam, this translates into a reduction of flows into the Yolo Bypass with Alternative 2 in place compared to the existing conditions. See Table 6 for a comparison of the flows at various locations for the Existing Condition, the Future Without Project Condition (Folsom Dam improvements), and Future With Project Condition (Alternative 2) in place. For the 1/100 ACE event and greater, the benefits of the Folsom Dam improvements would be realized in the form of reduced flows compared to the existing condition.

Table 6. Comparison of 10, 100 and 200 year Frequency Flows under Various Conditions.

10 year event	**Existing Condition**	**Future Without Project Condition with JFP**	**Future With Project Condition (Alternative 2)**
American River	43,000cfs	72,000cfs	72,000cfs
Sacramento Bypass	50,000cfs	66,000cfs	66,000cfs
Yolo Bypass below Sac Bypass	270,000cfs	296,000cfs	296,000cfs
100 year event	**Existing**	**Future Without Project and Alt. 1**	**Alt. 2 (TSP)**
American River	145,000cfs	115,000cfs	115,000cfs
Sacramento Bypass	131,000cfs	115,000cfs	115,000cfs
Yolo Bypass below Sac Bypass	555,000cfs	535,000cfs	535,000cfs
200 year event	**Existing**	**Future Without Project and Alt. 1**	**Alt. 2 (TSP)**
American River	320,000cfs	160,000cfs	160,000cfs
Sacramento Bypass	183,000cfs	149,000cfs	164,000cfs
Yolo Bypass below Sac Bypass	656,000cfs	631,000cfs	643,000cfs

The widening of the Sacramento Weir and Bypass diverts flood flows from the Sacramento and American River into the Yolo Bypass. At a 10-year level event, the Yolo Bypass is already flooded with water from levee toe to levee toe. By the time flows in the American River exceed 115,000 cfs, water would be approximately 5 to 6 feet below the top of the Yolo Bypass levees. As a result, to avoid impacts to the Yolo Bypass, the widened portion of the weir will only be operated when flood releases from Folsom Dam are above the existing objective release of 115,000 cfs which would occur during flood events greater than 1/100 ACE event. Therefore, for events up to the 1/100 ACE event, there would be no change in flow conditions in the Sacramento and Yolo Bypasses.

For flood events greater than 1/100 ACE event when releases from Folsom Dam would go above 115,000 cfs (such as a 1/200 ACE event in which the Folsom release goes up to 160,000 cfs), there would be an increase in flows in the Sacramento Bypass of approximately 15,000 cfs. In the Yolo Bypass, this equates to an increase of approximately 0.10-foot of water surface elevation. During the 200-year event, the Yolo Bypass is already flooded from levee to levee with depths of up to 21 feet. The addition of these flows would equate to approximately one or two tenths of a foot, which would amount to less than 1 foot of additional width on both levee slopes. This amounts to a total addition of approximately 4.8 acres of flooded area along the existing levee slopes of the Yolo Bypass.

2.2.7 Additional North Sacramento Streams Project Components

Erosion Protection

The only erosion protection currently envisioned includes placement of rip rap on waterside benches where waterside toe slurry walls are constructed. Following construction, levee slopes and other areas disturbed by construction would be revegetated and brought back to pre-project conditions. Locations where erosion is identified along the waterside levee slope and riverbank have been evaluated to determine whether levee integrity or stability may be affected. Insufficient embankment protection may cause a levee to be undermined by erosive forces due to wave action and/or high flow velocities along the levee bank. In many cases, the placement of embankment protection material, such as engineered armoring (rip-rap), would dissipate wave and velocity forces and reduce the potential for erosion to occur. Other factors to be considered prior to installing embankment protection material include grading the levee waterside slope to address stability issues, and environmental impacts within the vicinity of the embankment repair site.

Utility Relocation

SAFCA prepared an inventory and assessment of existing encroachments and penetrations within the NSS Levee Improvements Project area. Known utilities that cross or are adjacent to the levee include gas pipelines; storm drainage and pump station discharge pipes; and numerous water supply mains, culverts, electrical conduits, and sanitary sewers. The construction contractor can work around many of these utilities. However, some utilities may need to be temporarily removed or relocated prior to construction. Temporary bypass pumping may be required for sanitary sewers. SAFCA and the construction contractor would coordinate closely with utility owners to manage the utilities in advance of construction. Disturbed utilities would be restored after construction consistent with CVFPB requirements. Coordination between SAFCA and the utility owner would be required for those utilities that do not currently have CVFPB encroachment permits.

Stormwater Pollution Prevention

Temporary erosion/runoff best management control measures would be implemented during construction to minimize stormwater pollution resulting from erosion and sediment migration from the construction, borrow, and staging areas. These temporary control measures may include implementing construction staging in a manner that minimizes the amount of area disturbed at any one time; secondary containment for storage of fuel and oil; and the management of stockpiles and disturbed areas by means of earth berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures would be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and would be included in a Stormwater Pollution Prevention Plan (SWPPP).

After completion of construction activities, the temporary facilities (construction trailers and batch plants) would be removed and the site would be restored to pre-project conditions. Site restoration activities for areas disturbed by construction activities, including borrow areas and staging areas, will include a combination of regrading, reseeding, constructing permanent diversion ditches, using straw wattles and bales, and applying straw mulch and other measures deemed appropriate.

Proposed Sequence of Project Construction

It is anticipated that the North Sacramento Streams levee improvements would be implemented in one construction season (2016). The construction season would take place from April 15 to November 1. An approximate construction sequence includes the following:

- **Mobilization:** Mobilization would include setting up construction offices and the slurry batch plant and transporting heavy earthmoving equipment to the site. These activities may take up to 1 month.
- **Vegetation and encroachment removal:** Trees and other encroachments that impact remedial measures would be removed consistent with established SAFCA policies regarding vegetation and encroachments. These activities may take 1–4 weeks depending upon the reach being remediated.
- **Levee degradation for cutoff wall installation:** Beginning of levee degradation would follow vegetation and encroachment removal and precede cutoff wall installation. Degradation would take a total of about 4 months but it would not likely be conducted in one simultaneous operation. Rather, levee reaches would be degraded for specific lengths of cutoff wall to minimize the total length of degraded levee at any one time. Construction would take approximately 3 months.
- **Cutoff wall installation:** This activity would begin with construction of the work pad once a sufficient length of levee was degraded and was available for construction. Assuming four headings, construction would take approximately 4 months.
- **Drainage blanket construction:** Drainage blanket would be constructed prior to placing overlying slope reconstruction fill. Portions of drainage blanket extending up levee cut slopes would be placed as the adjacent slope reconstruction material is placed. Construction would take approximately 1 month since such construction is a small part of the proposed project.
- **Toe cutoff wall erosion protection:** Toe cutoff wall rip rap erosion protection would be placed after the toe cutoff wall bench has been completed to final lines and grades. Construction would take approximately 2 months.

- **Utility relocation:** Any required utility relocation would be conducted concurrent with the levee degradation, toe cutoff wall bench construction, and reconstruction operations. Construction would take approximately 4 months.
- **Levee reconstruction:** Levee reconstruction would begin once there was sufficient length completed cutoff wall to efficiently begin reconstructing the levee embankment. Total time estimated for levee reconstruction is about 6 months.
- **Seepage Wells:** Seepage wells can be installed at any time during the construction season. Installation and development of relief wells and reconstruction of paved channel and basin inverts would likely take about 2 month.
- **Site restoration and demobilization:** Upon completion of the main construction activities, the levee patrol road would be resurfaced, disturbed areas would be revegetated, staging and borrow areas would be restored, and the contractor would demobilize the site(s). These activities are expected to take about 2 months.

Construction would be staged and sequenced with the appropriate stakeholders: the City, County, Reclamation District, utility and service providers, biological resource construction work windows, and other environmental and land use/real estate constraints, to the greatest extent practical to minimize impacts and effects on the community.

High Hazard Levee Encroachment and Vegetation Removal

Encroachment Management

The National Flood Insurance Program (NFIP) standards for levee accreditation and the State's ULDC both require removal or modification of encroachments that pose an unacceptably high risk to the performance and safety of a levee either by undermining its structural integrity or by interfering with necessary inspection, operation, and maintenance activities. To address this requirement, SAFCA has identified and evaluated all of the encroachments in the NSS Levee Improvements area. Each of these encroachments has been evaluated to determine whether it constitutes an unacceptably high risk to the performance of the levee either by undermining the stability of the levee or by interfering with necessary patrolling, operation, and maintenance activities. Based on this evaluation, the encroachments have been classified as either:

- High-risk – poses a threat to levee integrity, removable prior to the levee being accredited;
- High-risk – impedes operation, maintenance, and inspection, removable within 3 years after the levee is accredited; or
- Low-risk – not identified as high hazard.

In the NSS Levee Improvements area, high-risk encroachments to be removed are limited to residential landscaping located at approximately 10 locations along the landside of the south and north levees of Arcade Creek (mainly between Marysville Boulevard and Rio Linda Boulevard) and along the Robla Creek South Levee, east of Rio Linda Boulevard.

Vegetation Management

The levee accreditation element of the proposed project also includes a vegetation management component. Although the NFIP does not identify specific standards for managing vegetation on levees, ULDC provides criteria that reflect the underlying risk management objectives of the NFIP. Under these criteria, vegetation on levees must be modified or removed if it presents an unacceptable risk to the structural integrity or impedes operation and maintenance of the levee.
In the NSS Levee Improvements area, approximately 8 high-risk trees along Arcade Creek have been identified for removal. All of the trees are either nonnative (7) or snags (3). Five are located on the waterside of the levees. These trees are in addition to any trees that would be removed as a result of implementation of levee improvements in the NSS Levee Improvements area.

2.3 Operation and Maintenance

Operation and maintenance (O&M) of the levees in the Sacramento area are the responsibility of the local maintaining agencies, including the American River Flood Control District, Maintenance Area 9, the California Department of Water Resources, and the City of Sacramento. The applicable O&M Manual for the Sacramento area levees is the Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project. Typical levee O&M in the Sacramento area currently includes the following actions:

- Vegetation maintenance up to four times a year by mowing or applying herbicide.
- Control of burrowing rodent activity monthly by baiting with pesticide.
- Slope repair, site-specific and as needed, by re-sloping and compacting.
- Patrol road reconditioning up to once a year by placing, spreading, grading, and compacting aggregate base or substrate.
- Visual inspection at least monthly, by driving on the patrol road on the crown and maintenance roads at the base of the levee.
- Post-construction, groundwater levels would be monitored using the piezometers.

Following construction, the O&M manual for these reaches would be adjusted to reflect the vegetation variance and the SWIF plan. Under the adjusted O&M manual, large trees that are protected in place under the variance would be allowed to remain on the waterside slopes, but smaller shrubs would be removed and grasses would be regularly mowed to allow for inspection and access.

Vegetation maintenance includes keeping maintenance roads clear of overhanging branches. Some of the vegetation along the levees includes elderberry shrubs. As part of long-term O&M, elderberry shrubs will be trimmed by the three levee maintenance districts. The following table describes the maximum amount of elderberry acreage that will be trimmed each year as a result of O&M. Trimming consists of cutting overhanging branches along the levee slopes on both the landside and waterside. Some shrubs may be located adjacent to the levee with branches hanging over the levee maintenance road. Up to a third of a shrub will be trimmed in a single season. Trimming will occur between November 1 and March 15. Loss of habitat will be offset through the development of a conservation area as described in the conservation measures below. Each year the local maintaining authority will document the amount of valley elderberry longhorn beetle habitat that they have trimmed and report that number to the Corps to ensure compliance with this biological opinion. If the local maintaining agency has a need to exceed the amount of valley elderberry longhorn beetle habitat which needs to be trimmed or affected due to routine maintenance then they will request the Corps reinitiate consultation on this biological opinion for those actions.

2.4 Full Consultation Biological Assessment Approach

The description of baseline conditions and the evaluation of potential impacts have been organized by waterway, which includes the American River, Sacramento River, NEMDC, Arcade Creek, Dry/Robla Creek, Magpie Creek, and the Sacramento Weir/Bypass areas. For species that are described and covered in this consultation, habitat preferences and distributions are based on published data, agency documents, and review of the California Natural Diversity Database (CNDDB) (CDFW 2013a). Species distributions were assessed throughout the ARCF study area, and where appropriate, within specific regions.

Descriptions of baseline conditions are based on information published in peer-reviewed scientific literature, resource agency publications, as well as aerial photography viewed in Google Earth Pro within the project area. Baseline conditions are described with a focus on features that affect habitat conditions for threatened and endangered species, including Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, delta smelt, green sturgeon, giant garter snake, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, western yellow-billed cuckoo, and other special status bird species.

Table 7 summarizes the species addressed in this Biological Assessment and where the Corps assumes their habitat is present within the study area.

Table 7. Presence of Listed Species within the Study Area.

	Valley Elderberry Longhorn Beetle	Vernal Pool Fairy Shrimp	Vernal Pool Tadpole Shrimp	Giant Garter Snake	Winter-run Chinook Salmon	Spring-run Chinook Salmon	Central Valley Steelhead	Green Sturgeon	Delta Smelt	Western Yellow-billed Cuckoo
American River	Yes	No	No	No	Yes	Yes	Yes	Critical Habitat to Highway 160	No	Yes
Sacramento River	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Natomas East Main Drainage Canal	Yes	No	No	No	No	No	Yes	No	No	No
Arcade Creek	Yes	No	No	No	No	No	No	No	No	No
Dry/Robla Creek	Yes	No	No	No	No	No	Yes	No	No	No
Magpie Creek	Yes	Yes	Yes	No	No	No	No	No	No	No
Sacramento Bypass	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No

2.5 Proposed Conservation and Mitigation Measures

2.5.1 Compensation Timing

Compensation timing refers to the time between the initiation of construction at a particular site and the attainment of the habitat benefits to protected species from designated compensation sites. In general, compensation time is the time required for on-site plantings to provide significant amounts of shade or structural complexity from instream woody material recruitment. Significant long-term benefits have often been considered as appropriate to offset small short-term losses in habitat for listed species in the past, as long as the overall action contributes to recovery of the listed species. The authority to compensate prior to or concurrent with project construction is given under WRDA 1986 (33 United States Code [USC] § 2283).

2.5.2 Valley Elderberry Longhorn Beetle Conservation and Mitigation Measures

The following is a summary of measures that would be implemented during construction based on the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (Conservation Guidelines) (USFWS 1999a). These measures will be implemented to minimize any potential effects on valley elderberry longhorn beetles or their habitat, including restoration and maintenance activities, long-term, protection, and compensation if shrubs cannot be avoided. If shrubs cannot be avoided, compensation shall be implemented as shown in Tables 10 and 11 below. These measures could be adjusted in compliance with the most current guidance at the time of construction.

- The Corps assumes complete avoidance of the valley elderberry longhorn beetle when a 100-foot (or wider) buffer is established and maintained around elderberry shrubs.
- When work will occur within the 100-foot buffer, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.
- Any damage done to the buffer area will be restored.
- Buffer areas will continue to be protected after construction.

- No insecticides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas.
- Elderberry shrubs that cannot be avoided would be transplanted to an appropriate riparian area at least 100 feet from construction activities.
- If possible, elderberry shrubs would be transplanted during their dormant season (approximately November, after they have lost their leaves, through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation will apply.
- Elderberry compensation would be planted in the American River Parkway. The Corps has six existing sites which are offsetting previous Corps flood control projects along the lower American River and near Folsom Dam. The Corps will find areas within the lower American River parkway which will either expand existing compensation areas or provide for connectivity between conserved valley elderberry longhorn beetle habitat. Sites within the Parkway will be coordinated with County Parks and the Service during the design phase of the project. Sites will be designed and developed prior to any effects to valley elderberry longhorn beetle habitat. The Corps will create 69.91 acres of riparian habitat which supports valley elderberry longhorn beetle within the lower American River parkway.
- The Corps will work to develop compensation areas prior to or concurrent with any take of valley elderberry longhorn beetle habitat.
- Management of these lands will include all measures specified in USFWS's conservation guidelines (1999a) related to weed and litter control, fencing, and the placement of signs.
- Monitoring will occur for ten consecutive years or for seven non-consecutive years over a 15-year period. Annual monitoring reports will be submitted to USFWS.
- Off-site areas will be protected in perpetuity and have a funding source for maintenance (e.g., endowment).

2.5.3 Giant Garter Snake Conservation and Mitigation Measures

The following measures will be implemented to minimize effects on giant garter snake habitat that occurs within 200 feet of any construction activity. These measures are based on USFWS guidelines for restoration and standard avoidance measures included as appendices in USFWS (1997).

- Unless approved otherwise by USFWS, construction will be initiated only during the giant garter snakes' active period (May 1–October 1, when they are able to move away from disturbance).
- Construction personnel will participate in USFWS-approved worker environmental awareness program.

- A giant garter snake survey would be conducted 24 hours prior to construction in potential habitat. Should there be any interruption in work for greater than two weeks, a biologist would survey the project area again no later than 24 hours prior to the restart of construction.
- Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel to the maximum extent feasible.
- Habitat temporarily affected for one season (the 5.5 acre borrow site along the NEMDC and the 75 acres along the toe drain of the Sacramento Bypass levee) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants. If for any reason construction extends into another active season the Corps will replace the habitat on-site and purchase credits at a ratio of 1:1 at a Service approved conservation bank.
- Habitat temporarily affected for more than three or more seasons will be restored and twice as much habitat will be created.
- Habitat permanently affected in the Sacramento Bypass in the form of drainage ditches and irrigation canals will be compensated for through the purchase of 135 acres of credits at a USFWS-approved conservation bank.
- One year of monitoring will be conducted for the 80.5 acres that are temporarily affected.
- The Corps will purchase credits at a conservation bank prior to any permanent disturbance of giant garter snake habitat.

For SAFCA's NSS project, the following measures are additionally proposed to reduce impacts to GGS from use of Borrow Site 2:

- A biological monitor shall be on-site during all ground-disturbing activities at Borrow Site 2.
- At least 10 days prior to the commencement of ground disturbing activities and after May 1, exclusionary fencing will be erected around the perimeter of Borrow Site 2K. Prior to fencing installation, the fence line shall be mowed (with a minimum height of 6 inches) in order to conduct a surface survey of potential burrows. Fencing shall be installed with a minimum of 6 inches buried in the ground and a minimum of 24 inches above ground. Fence staking shall

be installed on the inside of the exclusion area. One-way escape funnels shall be installed every 50 to 100 feet and sealed along the fence line, to provide an escape for any giant garter snake that may be within the exclusion area. The fencing shall enclose the entirety of the site, or additional exclusionary fencing can be extended 200 to 400 feet beyond the proposed entrance area. The fencing will be inspected before the start of each work day and maintained by the project proponents until completion of the project. The fencing will be removed only when project activities within Borrow Site 2 are completed.

2.5.4 Vernal Pool Crustacean Conservation and Mitigation Measures

The following measures from the 2004 Biological Opinion from the Magpie Creek Flood Control Project would be implemented to avoid and minimize impacts to potential vernal pools in the vicinity of the Magpie Creek construction area:

- Preservation component: For every acre of habitat directly or indirectly affected, at least two vernal pool credits will be dedicated within a Service-approved ecosystem preservation bank or, based on Service evaluation of site-specific conservation values, three acres of vernal pool habitat may be preserved on the project site or another nonbank site as approved by the Service.
- Creation component: For every acre of habitat directly affected, at least one vernal pool creation credit will be dedicated within a Service-approved habitat creation bank or, based on Service evaluation of site-specific conservation values, two acres of vernal pool habitat will be created and monitored on the project site or another non-bank site as approved by the Service.
- Listed vernal pool crustacean habitat and associated uplands utilized as on-site compensation will be protected from adverse effects and managed in perpetuity or until the Corps, the applicant, and the Service agree on a process to exchange such areas for credits within a Service-approved conservation banking system. Off-site conservation at a Service-approved non-bank location will be protected and managed in perpetuity through a Service-approved conservation easement, Service-approved management plan, and a sufficient endowment fund to manage the site in perpetuity in accordance with the management plan.
- If habitat is avoided (preserved) on site, then a Service-approved biologist (monitor) will inspect any construction-related activities at the proposed project site to ensure that no unnecessary take of listed species or destruction of their habitat occurs. The biologist will have the authority to stop all activities that may result in such take or destruction until appropriate corrective measures have been completed. The biologist also will be required to immediately report any unauthorized impacts to the Service and the California Department of Fish and Game.

- Adequate fencing will be placed and maintained around any avoided (preserved) vernal pool habitat to prevent impacts from vehicles.
- All on-site construction personnel will receive instruction regarding the presence of listed species and the importance of avoiding impacts to these species and their habitat.
- The applicant will ensure that activities that are inconsistent with the maintenance of the suitability of remaining habitat and associated on-site watershed are prohibited. This includes, but is not limited to: (i) alteration of existing topography or any other alteration or uses for any purposes, including the exploration for or development of mineral extraction; (ii) placement of any new structures on these parcels; (iii) dumping, burning, and/or burying of rubbish, garbage, or any other wastes or fill materials; (iv) building of any new roads or trails; (v) killing, removal, alteration, or replacement of any existing native vegetation; (vi) placement of storm water drains; (vii) fire protection activities not required to protect existing structures at the project site; and (viii) use of pesticides or other toxic chemicals.

The proposed project will result in 0.25 acre of indirect effects to vernal pools/swales of potentially suitable vernal pool shrimp and vernal pool tadpole shrimp habitat. The applicant has identified and agreed to purchase 0.5 vernal pool preservation credits at a Service-approved conservation bank or Service-approved fund. Credits will be purchased prior to the effect on any vernal pool habitat. The agreed upon conservation responsibilities of the applicant are as follows:

- Prior to any earth-moving activities at the proposed project site, the applicant shall purchase at least 0.5 vernal pool preservation credits within a Service-approved ecosystem preservation bank or fund account.

2.5.5 Western Yellow-Billed Cuckoo Conservation Measures

The following measures would be implemented to avoid and minimize impacts to potential yellow-billed cuckoo habitat in the study area:

- Prior to construction, surveys will be conducted to determine the presence of yellow-billed cuckoos within the project area in accordance with any required Service survey protocols and permits at the time of construction.
- If surveys find cuckoos in the area, vegetation removal will be done outside of the cuckoo nesting season.
- Riparian habitat that is removed due to project construction along the American River will be replanted within the American River Parkway. The Corps intends to expand existing conserved riparian lands within the parkway that could support the yellow-billed cuckoo. The design of replacement riparian areas will be coordinated with the Service to ensure that the habitat benefits both valley elderberry longhorn beetle and yellow-billed cuckoos.

2.5.6 Fisheries Conservation and Mitigation Measures

Green Sturgeon

The Corps proposes to develop a green sturgeon habitat, mitigation, and monitoring plan (HMMP) to address the long-term negative impacts to green sturgeon designated critical habitat with the specific elements that are described below:

- The green sturgeon HMMP shall be developed in coordination with the Interagency Ecological Program (IEP) green sturgeon project work team and consulted on with NMFS prior to the construction of any work within the designated critical habitat of sDPS green sturgeon related to the ARCF GRR.
- The Corps shall either refine the SAM or develop an alternative green sturgeon survival and growth response model based on using and updating the existing Hydrologic Engineering Center Ecosystem Function Model (HEC-EFM) that reflects green sturgeon's preference for benthic habitat.
- The green sturgeon HMMP shall also be developed with measurable objectives for completely offsetting all adverse impacts to all life stages of sDPS green sturgeon (as modeled using refined approaches described above and considering design refinements that occur in the PED phase of project implementation.
- The HMMP shall also, restore or compensate for the number of acres of soft bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. This mitigation shall be coordinated with the Interagency Working Group (IWG) or a Bank Protection Working Group (BPWG) and must be carried out within the lower Sacramento River/North Delta in order to offset the adverse modification to designated critical habitat.
- Mitigation actions shall be initiated prior to the construction activities affecting sDPS green sturgeon and their critical habitat.
- The sDPS green sturgeon HMMP will include measurable performance standards at agreed upon intervals and will be monitored for a period of at least ten years following construction.

The following additional conservation measures would be implemented to reduce the adverse effects to listed Chinook, steelhead, delta smelt, and green sturgeon:

- In-water construction activities (e.g., placement of rock revetment) will be limited to the work window of August 1 through November 30. If the Corps wants to work outside of this window they will consult with USFWS and NMFS.
- The Corps will purchase 42 acres of delta smelt credits from a USFWS-approved conservation bank to off-set the loss of 14 acres of shallow water habitat.
- The Corps will purchase an additional 32 acres of delta smelt credits from a USFWS-approved conservation bank to off-set the loss of spawning habitat due to the placement of riprap on the river bed.
- Erosion control measures (BMPs), including Storm Water Pollution Prevention Program and Water Pollution Control Program, that minimize soil or sediment from entering the river. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations to minimize effects to Federally listed fish and their designated critical habitat.
- Screen any water pump intakes, as specified by NMFS and USFWS screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt.
- No grading or altering of the lands within the existing Sacramento Bypass will occur as part of the project.
- The Corps shall participate in an existing IWG or work with other agencies to participate in a new BPWG to coordinate stakeholder input into future flood risk reduction actions associated with the ARCF GRR.
- The Corps shall coordinate with NMFS during PED as future flood risk reduction actions are designed to ensure conservation measures are incorporated to the extent practicable and feasible and projects are designed to maximize ecological benefits.
- The Corps shall include as part of the Project, a Riparian Corridor Improvement Plan with the overall goal of maximizing the ecological function and value of the existing levee system within the Sacramento Metropolitan Area.
- The Corps shall develop a HMMP with an overall goal of ensuring the conservation measures achieve a high level of ecological function and value. The HMMP shall include:
    - Specific goals and objectives and a clear strategy for maintaining all of the project conservation elements for the life of the project.
    - Measures to be monitored by the Corps for 10 years following construction and shall update their O&M manual to ensure the HMMP is adopted by the local

sponsor to ensure the goals and objectives of the conservation measures are met for the life of the project.

- o Include specific goals and objectives and a clear strategy for achieving full compensation for all project-related impacts to listed fish species.
- o The Corps shall continue to coordinate with NMFS during all phases of construction, implementation, and monitoring by hosting annual meetings and issuing annual reports throughout the construction period as described in the HMMP.
- o The Corps shall host an annual meeting and issue annual reports for five years following completion of project construction.

- The Corps shall ensure that, for salmon and steelhead, the maximum SAM WRI deficits for each seasonal water surface elevation as determined appropriate with input from the IWG or the BPWG are fully offset through the purchase of credits at a NMFS approved conservation bank (as described in this BA).
- The Corps shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place or if not feasible, new IWM will be anchored in place.
- The Corps shall ensure that the planting of native vegetation will occur as described in the HMMP. All plantings must be provided with the appropriate amount of water to ensure successful establishment.
- The Corps shall provide a copy of the BO, or similar documentation, to the prime contractor, making the prime contractor responsible for implementing all requirements and obligations included in the documents and to educate and inform all other contractors involved in the project as to the requirements of the BO.
- A NMFS-approved Worker Environmental Awareness Training Program for construction personnel shall be conducted by the NMFS-approved biologist for all construction workers prior to the commencement of construction activities. Written documentation of the training will be submitted to NMFS within 30 days of the completion of training.
- The Corps shall consider installing IWM along future flood risk reduction projects associated with the ARCF GRR at 40 to 80 percent shoreline coverage at all seasonal water surface elevations in coordination with the IWG or the BPWG. The purpose is to maximize the refugia and rearing habitats for juvenile fish.
- The Corps shall protect in place all riparian vegetation on the lower waterside slope of any levee unless removal is specifically approved by NMFS.
- The Corps shall develop a Vegetation Variance for all elements of the ARCF GRR that are adjacent to habitat that is occupied by federally listed salmon, steelhead and green sturgeon, including the main channel of the Sacramento River (as proposed) and the Sacramento Bypass.
- Additional mitigative concerns, not considered in a SAM analysis, will be included in the MMP (See Appendix I) along the Sacramento Bypass reach, including potential adult and

juvenile passage issues, loss of shoreline riparian vs. gain in floodplain, and contradicting ESA species habitat requirements. These issues will be considered and appropriate actions will be taken where possible in coordination with other agencies.

For SRA habitat impacted by construction, the following measures would be implemented to compensate for the habitat loss:

- Compensation timing refers to the time between the initiation of construction at a particular site and the attainment of the habitat benefits to protected species from designated compensation sites. In general, compensation time is the time required for on-site plantings to provide significant amounts of shade or structural complexity from instream woody material recruitment. Significant long-term benefits have often been considered as appropriate to offset small short-term losses in habitat for listed species in the past, as long as the overall action contributes to recovery of the listed species. The authority to compensate prior to or concurrent with project construction is given under WRDA 1986 (33 United States Code [USC] §§ 2201–2330).
- For identified designated critical habitat, where feasible all efforts will be made to compensate for impacts where they have occurred or in close proximity. Impacts to designated critical habitat, SRA and instream components combined and the compensation value of replacement habitat will be based on the interagency approved Standard Assessment Model (SAM) used throughout the Sacramento River basin and Delta flood control system.
- Compensation sites would be monitored and vegetation would be replaced as necessary based on performance standards in the Mitigation Monitoring Plan (MMP) as detailed in Appendix I of the EIS/EIR.

Depending on the species of interest (e.g., delta smelt), the severity of the short- term habitat losses due to bank erosion repair actions may not be compensated by long-term gains, whereas longer lived species (e.g., steelhead, Chinook) have longer periods for compensation to be provided. The following compensation time periods (based loosely on life expectancy) should be considered as guidelines for compensation:

- Green sturgeon, 15 years;
- Chinook salmon, 5 years;
- Central Valley steelhead, 4 years; and
- Delta smelt, 1 year.

2.5.7 Additional Minimization and Conservation Measures

- Obtain an ETL approved vegetation variance exempting sites from vegetation removal prior to final design and construction phase for the Sacramento River.
- Minimize the removal of existing vegetation in the proposed project area. Any disturbance or removal of vegetation will be replaced with native riparian vegetation, outside of the vegetation-free zone, as established in the ETL. Compensation for impacts to native riparian habitat will occur on a 2:1 basis on-site or in close proximity to the impact area. Riparian vegetation impacted under the SAFCA 408/404 actions will be replaced on a 3:1 canopy acreage basis.
- Erosion control measures (BMPs) including Storm Water Pollution Prevention Program and Water Pollution Control Program that minimize soil or sediment from entering the river. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations to minimize effects to Federally listed fish and their designated critical habitat.
- Implement BMPs to prevent slurry seeping out to river and require piping system on land side only.
- Stockpile construction materials such as portable equipment, vehicles, and supplies, at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.
- Stockpile all liquid chemicals and supplies at a designated impermeable membrane fuel and refueling station with a 110% containment system.
- Construction will be scheduled when listed terrestrial and aquatic species would be least likely to occur in the project area. If construction needs to extend into the timeframe that species are present, then coordination/reinitiation with the resource agencies will need to occur.
- Site access will be limited to the smallest area possible in order to minimize disturbance. Litter, debris, unused materials, equipment, and supplies will be removed from the project area daily. Such materials or waste will be deposited at an appropriate disposal or storage site.
- To minimize ground and vegetation disturbance during project construction, project limits shall be clearly marked, including the boundaries of designated equipment staging areas; ingress and egress corridors; stockpile areas for spoils disposal, soil, and materials; and equipment exclusion zones.
- Project-related vehicles shall observe a 20-mile-per-hour speed limit within construction areas, except on County roads and on State and Federal highways.Immediately (within 24 hours) cleanup and report any spills of hazardous materials to the resource agencies. Any

such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.

- Designating a Service-approved biologist as the point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all employee education program conducted by the Corps.

Furthermore, the Corps will seek to avoid and minimize construction effects on listed species and their critical habitat to the extent feasible. A number of measures will be applied to the entire project or specific actions, and other measures may be appropriate at specific locations within the study area. Avoidance activities to be implemented during final design and construction may include, but are not limited to, the following:

- Identifying all habitats containing, or with a substantial possibility of containing, listed terrestrial, wetland, aquatic, and/or plant species in the potentially affected project areas. To the extent practicable efforts will be made to minimize effects by modifying engineering design to avoid potential direct and indirect effects.
- Incorporating sensitive habitat information into project bid specifications.
- Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
- Minimizing vegetation removal to the extent feasible.
- Minimizing, to the extent possible, grubbing and contouring activities.
- Where feasible compensating for impacts close to where impacts have occurred.

2.5.8 Summary of Environmental Commitments

Items below present a general summary of environmental commitments that the Corps will adhere to as part of the ARCF GRR.

If habitat compensation efforts for listed species or designated critical habitat do not perform, or adequately compensate for habitat losses per established guidelines, then the Corps will purchase compensation at a mitigation bank approved by the USFWS and/or NMFS or work with the Services to determine where appropriate mitigation can be created.

- The Corps will obtain an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The Corps will be complying with the ETL on the American River via a SWIF. Full ETL compliance would occur on the East Side Tributaries sites. This approval process is in alignment with the Corps' Levee Safety Program's goal of maintaining public safety as the primary objective and assuring application of consistent and well-documented approaches.

- The Corps will use a rock soil mixture to facilitate re-vegetation of the proposed project area. A (70:30) rock to soil ratio would be implemented. The soil-rock mixture would be placed on top of the of the rock revetment to allow native riparian vegetation to be planted to insure that SRA habitat lost is partially replaced or enhanced. Alternatively, a rock lined soil trench approach could be taken.
- In addition to an approved vegetation variance, the Corps will minimize the removal of existing vegetation in the proposed project area. Disturbance or removal of trees or larger woody vegetation will be replaced with native riparian species, outside of the vegetation-free zone, as established in the ETL.
- Vegetation removal, particularly tree removal, shall be conducted between September 16 and January 31, to the extent feasible, to minimize potential loss of active bird nests and bat maternity roosts.
- Construction will be scheduled when listed terrestrial and aquatic species would be least likely to occur in the project area, approximately May or June through October, depending on the species present on a site-specific basis. If construction needs to extend into the timeframe that species are present coordination with the resource agencies will occur.

The Corps is committed to implementing project compensation and mitigation as detailed above, however site selection and real estate coordination has not occurred at this time and would be determined during the design phase of the project. A draft mitigation and monitoring plan will accompany the final EIS/EIR, and would be updated throughout the design phase as detailed design efforts allow for finalizing the mitigation plans. The mitigation and monitoring plan would be coordinated with the Services during the design phase. The Corps would go through the following process in order to determine sites for implementing compensation for impacts to riparian habitat, including VELB and yellow-billed cuckoo compensation sites:

- The Corps would assess opportunities for on-site compensation to the maximum extent practicable. This assessment would include considering site-specific conditions, including whether the site is protected from future erosion by bank protection, or remains at risk of berm and vegetation loss due to the launchable rock trench.
- If on-site compensation is not possible, the Corps would evaluate opportunities to expand existing Corps mitigation sites within the American River Parkway, such as the River Bend Park mitigation site.
- If the Corps requires additional lands for compensation, the Corps would evaluate other opportunities within the American River Parkway in coordination with County Parks, USFWS, NMFS, and the ARFCD.

- If the above three opportunities are exhausted and further compensation is still required, the Corps would seek credits at a USFWS-approved mitigation bank.

SAFCA will mitigate for impacts to riparian habitat caused by levee improvements along Arcade Creek, and for removal of high-hazard trees that may affect the performance and reliability of existing levees on the Arcade Creek. SAFCA has identified some locations where native riparian vegetation could be established. Planting locations were selected to increase the patch size, improve habitat connectivity, and expand age class and species diversity of woodland habitat. These improvements would enhance nesting opportunities for native bird species.

Arcade Creek Habitat Improvements

Impacts caused by levee improvements and high-hazard tree removal along Arcade Creek would be mitigated on-site to the extent feasible by improving and expanding native wetland and riparian habitat adjacent to the low-flow channel within the reach between Rio Linda Boulevard and Marysville Boulevard, which is currently dominated by nonnative annual grasses and broadleaf weeds. Following construction, native wetland vegetation (e.g., Santa Barbara sedge, Baltic rush) would be planted along the banks of Arcade Creek, and one row of large riparian tree species (e.g., valley oak) would be planted along each bank of the low-flow channel. The tree spacing would be determined by the capacity of the floodplain to accommodate vegetation without impacting the desired flood performance. The dense, high overhead canopy of the trees as they mature would provide important shade to the low-flow channel and bank, cover for small mammals and a connected migration corridor for flying and gliding animals (both vertebrates and invertebrates). The SRA habitat along the active channel would benefit water quality by keeping temperatures lower (cooler water retains higher levels of dissolved oxygen needed to sustain native fish and aquatic invertebrates), and provide leaf drop and other organic material to support aquatic food webs. In addition, shade from streamside trees would help suppress some growth of dense red sesbania and willows in the understory to maintain flood conveyance, and prevent new colonization of invasive species.

Robla Creek Habitat Improvements

Replacement riparian woodlands are proposed either on Robla Creek Mitigation Site A, approximately 6 acres north of Rio Linda Boulevard, or on Robla Creek Mitigation Site B (approximately 7.1 acres south of Rio Linda Boulevard). Both sites are adjacent to and west of Robla Creek (Figure 18). Site A is a previous borrow site and is at a lower elevation making this area better suited for wetland mitigation. Site B is connected to the Robla Creek floodplain and is the site of a future multi-use recreational trail. SAFCA would provide right-of-way for future construction of the trail.

Figure 18. North Sacramento Streams Potential Robla Creek Mitigation Sites.

3.0 Federally Protected Species and Critical Habitat

Federally protected species and critical habitat that may be affected by the proposed action within the ARCF study area were determined through consultation with USFWS and NMFS. The Central Valley fall-/late fall–run Chinook salmon, which is an Evolutionarily Significant Unit (ESU) of special concern but is not Federally listed, is included because the project's effects on EFH must also be assessed.

3.1 Plants

Federally listed plant species are associated with habitat such as, salt marsh, dunes, or cismontane woodland/valley and foothill grasslands. Salt marsh habitat and cismontane woodland/valley and foothill grasslands are also very unlikely to occur along or adjacent to the levees. Due to the general lack of supporting habitat, potential impacts to Federally listed plants are not considered in this BA.

3.2 Invertebrates

3.2.1 Valley Elderberry Longhorn Beetle

Status and Distribution

The valley elderberry longhorn beetle is listed as a threatened species under the ESA (USFWS 1980). USFWS previously issued a proposed rule and a 12-month review finding on October 2, 2012 (77 FR 60238), to remove the valley elderberry longhorn beetle from the Federal endangered species list and to remove the designation of critical habitat for this species. In a proposed rule issued on September 17, 2014 (79 FR 55874), the USFWS withdrew the proposed rule to delist the species based on the best scientific and commercial data available and evaluation that indicated that threats to the species and its habitat have not been reduced such that removal of the species from the Federal endangered species list is appropriate and warranted.

The valley elderberry longhorn beetle's range extends from southern Shasta County to Fresno County (Talley et al. 2006). Along the eastern edge of the species' range, adult beetles have been found in the foothills of the Sierra Nevada at elevations up to 2,220 feet, and beetle exit holes have been located on elderberry plants at elevations up to 2,940 feet. Along the western edge of the species' range, adult beetles have been found on the eastern slopes of the Coast Ranges at elevations of up to

500 feet, and beetle exit holes have been detected on elderberry plants at elevations up to 730 feet (Barr 1991).

Critical habitat for the valley elderberry longhorn beetle occurs in two locations near the city of Sacramento (USFWS 1980). One area is enclosed by the Western Pacific railroad tracks and Highway 160, approximately one-half mile north of the American River near its confluence with the Sacramento River. The second site is located along the south bank of the American River at River Bend Park, just upstream of RM 13. Both of these areas are within the study area, however they would not be impacted by the proposed project. No bank protection measures are proposed in the area near Highway 160, and River Bend Park is upstream of the termination of the American River levees.

Life History and Habitat Requirements

Because historic loss of riparian habitat in the study area has already occurred, the rate of riparian habitat loss has slowed significantly over the last 30 years. During this period, incidental take of habitat has been authorized primarily for urbanization, transportation, water management, and flood control, on the order of 10,000 to 20,000 acres. Several habitat conservation plans are being developed to allow for continued urbanization of the Sacramento Valley (Talley et al. 2006).

Approximately 50,000 acres of existing riparian habitat in the Central Valley, primarily in the Sacramento Valley, have been protected by Federal, State, and local agencies as well as private organizations. Within the study area, large parcels of suitable habitat for the valley elderberry longhorn beetle have been protected, along the American River Parkway. Restoration of more than 5,000 acres of habitat has been initiated throughout the beetle's range (Talley et al. 2006). Mitigation for previous Corps projects has planted within the American River Parkway through agreements with Sacramento County Parks. Additional lands are currently available for mitigation that may be required for this project.

Valley elderberry longhorn beetle is only found in close association with its host plant, elderberry shrubs (*Sambucus* spp.). Elderberry shrubs are found in or near riparian and oak woodland habitats. The valley elderberry longhorn beetle's life history is assumed to follow a sequence of events similar to those of related taxa. Female beetles deposit eggs in crevices in the bark of living elderberry shrubs. Presumably, the eggs hatch shortly after they are laid, and the larvae bore into the pith of the trunk or stem. When larvae are ready to pupate, they move through the pith of the plant, open an emergence hole through the bark, and return to the pith for pupation. Adults exit through the emergence holes and can sometimes be found on elderberry foliage, flowers, or stems or on adjacent vegetation. The entire life cycle of the valley elderberry longhorn beetle is thought to encompass 1 or 2 years, from the time eggs are laid and hatch until adults emerge and die (USFWS 1984).

The presence of exit holes in elderberry stems indicates previous valley elderberry longhorn beetle habitat use. Exit holes are cylindrical and approximately 0.25 inch in diameter. Exit holes can be found on stems that are 1 or more inches in diameter. The holes may be located on the stems from a few inches to about 9 to 10 feet above the ground (Barr 1991).

Factors Affecting Abundance

The valley elderberry longhorn beetle distribution decline is most likely related to the extensive loss of riparian forests in the Central Valley, which has reduced the amount of available habitat for the species, and has most likely decreased and fragmented the species' range (USFWS 1984).

Insecticide drift from cultivated fields and orchards adjacent to elderberry plants may affect valley elderberry longhorn beetle populations, if drift occurs at a time when adults are present on the shrubs (Barr 1991). Herbicide drift from agricultural fields and orchards can likewise affect the health of elderberry plants, thereby reducing their quantity and quality as valley elderberry longhorn beetle habitat.

The invasive Argentine ant (*Linepithema humile*) has been spreading in riparian habitats and may affect survival of the valley elderberry longhorn beetle. Argentine ants may predate valley elderberry longhorn beetle eggs although this interaction needs further exploration (Huxel 2000). The spread of invasive exotic plants (e.g., giant reed [*Arundo donax*] may also negatively affect the valley elderberry longhorn beetle by affecting supporting riparian habitats. The presence of giant reed promotes a more frequent fire cycle and homogenous plant community (Talley et al. 2006).

3.2.2 Vernal Pool Fairy Shrimp

Status and Distribution

The vernal pool fairy shrimp is listed as a threatened species under the ESA (59 FR 48136). Fairy shrimp are endemic to vernal pools in the Central Valley, coast ranges, and a limited number of sites in the Transverse Range and Santa Rosa Plateau of California. . The most accurate indication of the distribution and abundance of vernal pool fairy shrimp is the number of inhabited vernal pool complexes. There are 32 known populations of the vernal pool fairy shrimp, extending from the Stillwater Plain in Shasta County through the Central Valley to Pixley in Tulare County. In addition, the shrimp occur along the central Coast Range from northern Solano County to Pinnacles National Monument in San Benito County.

Critical habitat for the vernal pool fairy shrimp is designated in the vicinity of the study area on lands surrounding Mather Field. There is no critical habitat for vernal pool fairy shrimp in the study area.

Life History and Habitat Requirements

Vernal pool fairy shrimp live in vernal pools, an ephemeral freshwater habitat. None are known to occur in riverine waters, marine waters, or other permanent bodies of water. They are ecologically dependent on seasonal fluctuations in their habitat, such as absence or presence of water during specific times of the year, duration of inundation, and other environmental factors that include specific salinity, conductivity, dissolved solids, and pH levels. Water chemistry is one of the most important factors in determining the distribution of fairy shrimp (Belk 1977).

Fairy shrimp and tadpole shrimp play an important role in the community ecology of many ephemeral water bodies (Loring et al. 1988). They are fed upon by waterfowl and other vertebrates, such as western spadefoot toad (*Scaphiopus hammondi*) tadpoles (Ahl 1991).

Fairy shrimp have delicate elongate bodies, large stalked compound eyes, no carapace, and 11 pairs of swimming legs. They swim or glide gracefully upside down by means of complex beating movements of the legs that pass in a wavelike, anterior-to-posterior direction. Nearly all fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus. Female shrimp drop their eggs to the pool bottom or eggs remain in the brood sac until the female dies and sinks. The "resting" or "summer" eggs are capable of withstanding heat, cold, and prolonged desiccation. When the pools refill in the same or subsequent seasons some, but not all, of the eggs may hatch. The egg bank in the soil may be comprised of the eggs from several years of breeding (Donald 1983). The eggs hatch when the vernal pools fill with rainwater. The early stages of the fairy shrimp develop rapidly into adults. These non-dormant populations often disappear early in the season long before the vernal pools dry up.

Vernal pools form in regions with Mediterranean climates where shallow depressions fill with water during fall and winter rains and then evaporate in the spring (Collie and Lathrop 1976). Downward percolation is prevented by the presence of an impervious subsurface layer, such as a claypan, hardpan, or volcanic stratum (Holland 1976, 1988). Due to local topography and geology, the pools are usually clustered into pool complexes (Holland and Jain 1988). Pools within a complex typically are separated by distances on the order of meters and may form dense, interconnected mosaics of small pools or a more sparse scattering of larger pools. Temporary inundation makes vernal pools too wet during the wetted period for adjacent upland plant species adapted to drier soil conditions, while rapid drying during late spring makes pool basins unsuitable for typical marsh or aquatic species that require a more permanent source of water. However, many indigenous plant and aquatic invertebrate species have evolved to occupy the extreme environmental conditions found in vernal pool habitats.

Factors Affecting Abundance

Vernal pools are in danger due to a variety of human-caused activities, including urban development, water supply and flood control activities, and conversion of land to agricultural use. Changes in hydrologic pattern, overgrazing, and off-road vehicle use also imperil this aquatic habitat . Habitat loss occurs from direct destruction and modification of pools by filling, grading, discing, leveling, and other activities. Vernal pools can also be indirectly impacted when modifications of the surrounding uplands alter the vernal pool watershed (USFWS 1992b). Diversion of watershed runoff feeding the pools can result in premature pool dry-down before the life cycle of the fairy shrimp is complete. The fairy shrimp is also intolerant of flowing water that washes away the egg bank. Supplemental water from outside the natural watershed into vernal pools can change the habitat into a marsh-dominated or a permanent aquatic community that is unsuitable for the
vernal pool shrimp.

Other secondary impacts associated with urbanization include disposal of waste materials into habitat for the four species included in this final rule (Bauder 1986, 1987). Disposal of concrete, tires, refrigerators, sofas, and other trash adversely affects these animals by eliminating habitat, disrupting pool hydrology or, in some cases, through release of toxic substances. Dust and other forms of air or water pollution from commercial development or agriculture projects also may be deleterious to these animals. Introduction of the bullfrog (*Rana catesbeiana*) to areas inhabited by the vernal pool tadpole shrimp appears to increase the threat of predation facing this crustacean.

3.2.3 Vernal Pool Tadpole Shrimp

Status and Distribution

The vernal pool tadpole shrimp is listed as an endangered species under the ESA (59 FR 48136). They are endemic to vernal pools in the Central Valley, coast ranges, and a limited number of sites in the Transverse Range and Santa Rosa Plateau of California. The most accurate indication of the distribution and abundance of the vernal pool tadpole shrimp is the number of inhabited vernal pool complexes. There are 18 known populations of vernal pool tadpole shrimp in the Central Valley, ranging from east of Redding in Shasta County south to the San Luis National Wildlife Refuge in Merced County.

Critical habitat for the vernal pool tadpole shrimp is designated in the vicinity of the study area on lands surrounding Mather Field. There is no critical habitat for vernal pool fairy shrimp in the study area.

Life History and Habitat Requirements

The life history of the vernal pool tadpole shrimp is linked to the phenology of the vernal pool habitat. None are known to occur in riverine waters, marine waters, or other permanent bodies of water. After winter rainwater fills the pools, the populations are reestablished from diapaused eggs that lie dormant in the dry pool sediments (Ahl 1991). Tadpole shrimp are primarily benthic animals that swim with their legs down. They climb or scramble over objects, as well as plow along in bottom sediments. Their diet consists of organic detritus and living organisms, such as fairy shrimp and other invertebrates (Pennak 1989).

A female surviving to large size may lay up to six clutches of eggs, totaling about 861 eggs in her lifetime (Ahl 1991). The eggs are sticky and readily adhere to plant matter and sediment particles (Simovich and Fugate 1992). A portion of the eggs hatch immediately and the rest enter diapause and remain in the soil to hatch during later rainy seasons (Ahl 1991). Ahl (1991) found that eggs in one pool hatched within three weeks of inundation and maturated to sexually reproductive adults in another three to four weeks. Simovich and Fugate (1992) reported sexually mature adults occurred in another pool three to four weeks after the pools had been filled. The vernal pool tadpole shrimp matures slowly and is a long-lived species (Ahl 1991). Adults are often present and reproductive until the pools dry up in the spring (Ahl 1991; Simovich et al. 1992).

Factors Affecting Abundance

Vernal pools are in danger due to a variety of human-caused activities, including urban development, water supply and flood control activities, and conversion of land to agricultural use. Changes in hydrologic pattern, overgrazing, and off-road vehicle use also imperil this aquatic habitat . Habitat loss occurs from direct destruction and modification of pools by filling, grading, discing, leveling, and other activities. Vernal pools can also be indirectly impacted when modifications of the surrounding uplands alter the vernal pool watershed (USFWS 1992b). Diversion of watershed runoff feeding the pools can result in premature pool dry-down before the life cycle of the tadpole shrimp is complete. The tadpole shrimp is also intolerant of flowing water that washes away the egg bank. Supplemental water from outside the natural watershed into vernal pools can change the habitat into a marsh-dominated or a permanent aquatic community that is unsuitable for the vernal pool tadpole shrimp.

Other secondary impacts associated with urbanization include disposal of waste materials into habitat for the four species included in this final rule (Bauder 1986, 1987). Disposal of concrete, tires, refrigerators, sofas, and other trash adversely affects these animals by eliminating habitat, disrupting pool hydrology or, in some cases, through release of toxic substances. Dust and other forms of air or water pollution from commercial development or agriculture projects also may be deleterious to these animals. Introduction of the bullfrog (*Rana catesbeiana*) to areas inhabited by the vernal pool tadpole shrimp appears to increase the threat of predation facing this crustacean.

3.3 Fish

Six fish species' ESUs or Distinct Population Segments (DPSs) and critical habitats are addressed below. These include Sacramento River winter-run Chinook salmon ESU, Central Valley spring-run Chinook salmon ESU, Central Valley fall-/late fall–run Chinook salmon ESU, Central Valley steelhead DPS, delta smelt, and green sturgeon southern DPS.

3.3.1 Sacramento River Winter-Run Chinook Salmon Evolutionarily Significant Unit

Status and Distribution

The Sacramento River winter-run Chinook salmon ESU (*Oncorhynchus tshawytscha*) was listed as threatened under the Federal ESA on August 4, 1989 (NMFS 1989). NMFS subsequently upgraded the Federal listing to endangered on January 4, 1994 (NMFS 1994). NMFS designated critical habitat for Sacramento River winter-run Chinook salmon on June 16, 1993 (NMFS 1993a). The ESU includes all naturally spawned populations of winter-run Chinook in the Sacramento River and its tributaries, as well as populations from two artificial propagation programs, one at the Livingston Stone National Fish Hatchery and the other at Bodega Marine Laboratory (NMFS 2005a).

Prior to construction of Shasta Dam, winter-run Chinook salmon spawned in the upper reaches of the Sacramento River, the McCloud River, and the lower Pit River. Spawning is now restricted to approximately 44 miles of the mainstem Sacramento River, immediately downstream of Keswick Dam (Yoshiyama et al. 1998). The abundance of winter-run Chinook salmon in the Sacramento River before Shasta Dam was constructed, is unknown. Some biologists believe the run was relatively small, possibly consisting of a few thousand fish (Slater 1963). Others, relying on anecdotal accounts, believe the run could have numbered more than 200,000 fish (NMFS 1993b). During the mid-1960s, more than 20 years after the construction of Shasta Dam, the population exceeded 80,000 fish (USBR 1986). The population declined substantially during the 1970s and 1980s.

In 1988, winter-run Chinook salmon escapement was estimated at 696 adults. Escapement continued to decline, diminishing to an estimated 430 fish in 1989 and 211 fish in 1990 (CDFW 2013b). The rapid decline in escapement during the late 1980s and early 1990s prompted listing of the winter-run Chinook salmon as endangered under the California ESA and the Federal ESA. Escapement in 1991 was estimated to be 1,240 fish, indicating good survival of the 1988 class. NMFS data indicates that the population has increased during the late 1990s through 2001. In 1995, returning spawners numbered 1,337 fish and in 2012, returning adults were estimated to be 6,123 (CDFW 2013b). Despite increased efforts to maintain and enhance the population of winter-run Chinook salmon by various entities, in their final listing determination of June 28, 2005, NMFS again found "that the Sacramento River winter-run Chinook salmon ESU in total is in danger of extinction throughout all or a significant portion of its range" and concludes that the ESU continues to warrant listing as an endangered species under the Federal ESA (NMFS 2005a).

Life History

Winter-run Chinook salmon spend 1 to 3 years in the ocean. Adult winter-run Chinook salmon leave the ocean and migrate through the Delta into the Sacramento River from December through July with peak migration in March. Adults spawn from mid-April through August (Moyle 2002). Egg incubation continues through October. The primary spawning habitat in the Sacramento River is above the Red Bluff Diversion Dam (RBDD) at RM 243, although spawning has been observed downstream as far as RM 218 (NMFS 2001). Spawning success below RBDD may be limited primarily by warm water temperatures (Hallock and Fisher 1985; Yoshiyama et al. 1998).

Downstream movement of juvenile winter-run Chinook salmon begins in August, soon after fry emerge. The peak abundance of juveniles moving downstream at Red Bluff occurs in September and October (Vogel and Marine 1991). Juvenile Chinook salmon move downstream from spawning areas in response to many factors, which may include inherited behavior, habitat availability, flow, competition for space and food, and water temperature. The numbers of juveniles that move and the timing of movement are highly variable. Storm events and their resulting high flows and turbidity appear to trigger downstream movement of substantial numbers of juvenile Chinook salmon.

Winter-run Chinook salmon smolts (i.e., juveniles that are physiologically ready to enter seawater) may migrate through the Delta and San Francisco Bay to the ocean from November through May (Yoshiyama et al. 1998). The Sacramento River channel is the main migration route through the Delta. However, the Yolo Bypass also provides significant outmigration passage during higher flow events.

During winter in the Sacramento–San Joaquin system, juveniles rear on seasonally inundated floodplains. Sommer et al. (2001) found higher growth and survival rates of juvenile Chinook salmon reared on the Yolo Bypass floodplain, than those that reared in the mainstem Sacramento River.

Factors Affecting Abundance

One of the main factors in the decline of Chinook salmon is habitat loss and degradation. On the Sacramento River, Shasta Dam blocked access to historical spawning and rearing habitat. Other factors affecting abundance include the effects of reservoir operations on water temperature, harvesting and fishing pressure, entrainment in diversions, contaminants, predation by non-native species, and interaction with hatchery stock (Corps 2000b).

In the Sacramento River, operation of the Central Valley Project (CVP) and State Water Project (SWP) influences river flow. Low flows can reduce habitat area and adversely affect water quality. The resulting warm water temperatures and low dissolved oxygen levels can stress incubating eggs and rearing juvenile winter-run Chinook salmon. Low flow may affect migration of juveniles and adults through increased water temperature or reduced velocity that slows downstream movement of juveniles. Low flow, in combination with diversions, may result in higher entrainment losses at the State and Federal pumping plants in the south Delta (Corps 2000b).

In the Delta, flow drawn through the Delta Cross Channel (DCC) and Georgiana Slough transports some percentage of downstream migrating salmon into the central Delta. The number of juveniles entering the DCC and Georgiana Slough is assumed to be proportional to the flow volume diverted from the Sacramento River (CDFG 1987). Survival of juvenile Chinook salmon that are drawn into the central Delta is lower than survival of juvenile Chinook salmon that remain in the Sacramento River channel.

<u>Critical Habitat/Essential Fish Habitat</u>

Within the ARCF GRR study area, the Sacramento River and Sacramento Bypass is considered to be critical habitat for winter-run Chinook salmon. Critical habitat includes the water column, river bottom, and adjacent riparian zone which fry and juveniles use for rearing (NMFS 2006b). The conservation value of critical habitat in the study area is high because it supports both recruitment and survival of juveniles and adults (NMFS 2006a).

EFH is defined as those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity. EFH includes currently and historically accessible habitat. All reaches within the ARCF study area are considered to be essential fish habitat for winter-run Chinook salmon.

3.3.2 Central Valley Spring-Run Chinook Salmon Evolutionarily Significant Unit

<u>Status and Distribution</u>

The Central Valley spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*) was Federally listed as threatened on September 16, 1999 (NMFS 1999). Their threatened status was reaffirmed in NMFS's final listing determination issued on June 28, 2005 (NMFS 2005a). Critical habitat for Central Valley spring-run Chinook salmon was designated by NMFS on September 2, 2005 (NMFS 2005b). The ESU includes all naturally spawned spring-run Chinook salmon in the Sacramento River and its tributaries. Naturally spawned fish of hatchery origin in the Feather and Yuba Rivers as well as hatchery spawned fish in the Feather River are also included as a part of this ESU (NMFS 2005a).

Spring-run Chinook salmon may have once been the most abundant of Central Valley Chinook salmon (Mills and Fisher 1994), historically occupying the upstream reaches of all major river systems in the Central Valley where there were no natural barriers. Central Valley spring-run Chinook salmon are now restricted to the upper Sacramento River downstream of Keswick Dam; the Feather River downstream of Oroville Dam; the Yuba River downstream of Englebright Dam; several perennial tributaries of the Sacramento River (e.g., Deer, Mill, and Butte creeks); and the Delta.

The abundance of Central Valley spring-run Chinook salmon escapement, as measured by the number of adults returning to spawn from 1960 to 2013, averaged 10,236 adults for in-river natural spawners and 2,364 average adults returning to hatcheries (CDFW 2013b). Spring-run Chinook salmon spawn in the early fall and have interbred with fall-run Chinook salmon in the Sacramento and Feather Rivers. Genetically uncontaminated populations may exist in Deer Creek, Mill Creek, Butte Creek, and other eastside tributaries of the Sacramento River.

<u>Life History</u>

Adult spring-run Chinook salmon enter the mainstem Sacramento River from March through September, with the peak upstream migration occurring from May through June (Yoshiyama et al. 1998). Adults generally enter tributaries from the Sacramento River between mid-April and mid-June (Lindley et al. 2006 as cited in NMFS 2006b). Spring-run Chinook salmon are sexually immature during upstream migration, and adults hold in deep, cold pools near spawning habitat until spawning commences in late summer and fall. Spring-run Chinook salmon spawn in the upper reaches of the mainstem Sacramento River and tributary streams (USFWS 1995), with the largest tributary runs occurring in Butte, Deer, and Mill Creek's (Yoshiyama et al. 1998). Spawning typically begins in late August and may continue through October. Juveniles emerge in November and December in most locations but may emerge later when water temperature is cooler. Newly emerged fry remain in shallow, low-velocity edgewater (CDFG 1998).

Juvenile spring-run Chinook salmon typically spend up to one year rearing in fresh water before migrating to sea as yearlings, but some may migrate downstream as young-of-year juveniles. Rearing takes place in their natal streams, the mainstem of the Sacramento River, inundated floodplains (including the Sutter and Yolo bypasses), and the Delta. Based on observations in Butte Creek and the Sacramento River, young-of-year juveniles typically migrate from November through May. Yearling spring-run Chinook salmon migrate from October to March, with peak migration in November (Cramer and Demko 1997; Hill and Webber 1999). Downstream migration of yearlings typically coincides with the onset of the winter storm season, and migration may continue through March (CDFG 1998).

<u>Factors Affecting Abundance</u>

Main factors in the decline of spring-run Chinook salmon populations are habitat loss and degradation. Dams have blocked access to historical spawning and rearing habitat. Other factors affecting abundance of spring-run Chinook salmon include harvest, entrainment in diversions, contaminants, predation by non-native species, and interbreeding with fall-run Chinook salmon and hatchery stocks (Corps 2000b).

In the Sacramento River and its major tributaries, operation of the CVP and SWP controls river flow. Low flows limit habitat area and adversely affect water quality, such as warm water temperature and low dissolved oxygen that stress incubating eggs and rearing juveniles. Low flow may affect migration of juveniles and adults through inadequate water depth to support passage, or through reduced velocity that slows the downstream movement of juveniles. Low flow, in combination with diversions, may result in higher entrainment losses (Corps 2000b).

In the Delta, flow drawn through the DCC and Georgiana Slough transports some portion of downstream migrants into the central Delta. The number of juveniles entering the DCC and Georgiana Slough is assumed to be proportional to the flow volume diverted from the Sacramento River (CDFG 1987). Survival of juvenile Chinook salmon that are drawn into the central Delta is lower than survival of juvenile Chinook salmon that remain in the Sacramento River channel.

Critical Habitat/Essential Fish Habitat

Critical habitat for spring-run Chinook salmon includes all river channels and sloughs within the ARCF GRR study area on the Sacramento River and on the American River from the confluence to the Watt Avenue bridge. (NMFS 2006b). Critical habitat includes the stream channels and the lateral extent as defined by the ordinary high-water line or bank-full elevation. Primary constituent elements (PCEs) of critical habitat in the study area include: (1) freshwater rearing sites that have adequate water quality and quantity, floodplain connectivity, and natural cover that supports juvenile growth and mobility, and (2) freshwater migration corridors that support adequate water quantity and quality as well as natural cover to provide food and migration pathways for juveniles as well as adults. (NMFS 2005e, 2006b). The conservation value of critical habitat in the study area is high because it supports both recruitment and survival of juveniles and adults (NMFS 2006a).

EFH is defined as those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity. EFH includes currently and historically accessible habitat. All reaches within the ARCF study area are considered to be EFH for spring-run Chinook salmon.

3.3.3 Central Valley Fall-/Late Fall–Run Chinook Salmon Evolutionarily Significant Unit

Status and Distribution

The Central Valley fall-/late fall–run Chinook salmon ESU (*Oncorhynchus tshawytscha*) is not listed under the Federal ESA. On March 9, 1998, NMFS issued a proposed rule to list fall-run Chinook salmon as threatened (NMFS 1998a). However, on September 16, 1999, NMFS determined that the species did not warrant listing (NMFS 1999). On April 15, 2004, NMFS classified Central Valley fall-/late fall–run Chinook salmon as a species of concern (NMFS 2004). However, EFH is designated for this species.

The Central Valley fall-/late fall–run Chinook salmon ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin river basins and their tributaries. Central Valley fall-/late fall–run Chinook salmon are currently the most abundant and widespread salmon runs in California (Mills et al. 1997), representing about 80% of the total Chinook salmon produced in the Sacramento River drainage (Kjelson et al. 1982). The most abundant spawning populations of fall-/late fall–run Chinook salmon occur in the Sacramento, Feather, Yuba, and American rivers (Mills and Fisher 1994). Fall-run Chinook salmon in the Sacramento, Feather, and American rivers have a relatively large hatchery component, from 1952 to 2013 the average was 57,508 fish. The average escapement in-river on the Sacramento and San Joaquin system from 1960 to 2013 was 264,475 (CDFW 2013b).

Life History

Adult fall-run Chinook salmon migrate into the Sacramento River and its tributaries from June through December in mature condition and spawn from late September through December, soon after arriving at their spawning grounds (Yoshiyama et al. 1998). The spawning peak occurs in October and November. Emergence occurs from December through March, and juveniles migrate downstream to the ocean soon after emerging, rearing in fresh water for only a few months. Smolt outmigration typically occurs from March through July (Yoshiyama et al. 1998).

Late fall–run Chinook salmon migrate upstream before they are sexually mature, and hold near spawning grounds for 1 to 3 months before spawning. Upstream migration takes place from October through April and spawning occurs from late January through April, with peak spawning in February and March (Yoshiyama et al. 1998). Fry emerge from April through June. Juvenile late fall–run Chinook salmon rear in their natal streams during the summer, and in some streams they remain throughout the year. Smolt outmigration can occur from November through May (Yoshiyama et al. 1998).

Factors Affecting Abundance

Factors affecting abundance of fall-/late fall–run Chinook salmon are similar to factors affecting abundance of winter- and spring-run Chinook salmon, i.e., habitat loss and degradation. Fall-run Chinook salmon, however, typically use spawning habitat farther downstream than the spawning habitat used by spring- and winter-run Chinook salmon. The effect of dams on spawning habitat area for fall-run Chinook salmon is not as severe as for other runs, although access to substantial spawning habitat area has been blocked by dams.

Critical Habitat/Essential Fish Habitat

Critical habitat is not designated for fall-/late fall–run Chinook salmon, however EFH is designated for this species. EFH is defined as those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity. EFH includes currently and historically accessible habitat. All reaches within the ARCF GRR study area are considered to be EFH for fall-/late fall-run Chinook salmon.

3.3.4 Central Valley Steelhead Distinct Population Segment

Status and Distribution

The Central Valley steelhead (*Oncorhynchus mykiss*) DPS was Federally listed as threatened on March 19, 1998 (NMFS 1998b). The threatened status of Central Valley steelhead was reaffirmed in NMFS's final listing determination on January 5, 2006 (NMFS 2006a); at the same time NMFS also adopted the term DPS, in place of ESU, to describe Central Valley steelhead and other population segments of this species. NMFS originally designated critical habitat for Central Valley steelhead on February 16, 2000 (NMFS 2000). However, following a lawsuit (*National Association of Home Builders et al. v. Donald L. Evans, Secretary of Commerce, et al.*), NMFS decided to rescind the listing and re-evaluate how to classify critical habitat for several DPSs of steelhead.

Critical habitat for Central Valley steelhead was re-designated by NMFS on September 2, 2005 (NMFS 2005b). The DPS includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries, excluding steelhead from San Francisco and San Pablo Bays and their tributaries. Artificially propagated fish from the Coleman and Feather River hatcheries are included in the DPS (NMFS 2006a).

Steelhead ranged throughout the tributaries of the Sacramento and San Joaquin rivers prior to dam construction, water development, and watershed perturbation dating from the 19th and 20th centuries. Wild stocks are now mostly confined to the upper Sacramento River downstream of Keswick Dam; upper Sacramento River tributaries such as Deer, Mill, and Antelope creeks; and the Yuba River downstream of Englebright Dam. Populations may also exist in Big Chico and Butte Creeks and a few wild steelhead are produced in the American and Feather rivers (McEwan and Jackson 1996). The abundance of naturally reproducing Central Valley steelhead, as measured by the number of adults returning to spawn, is largely unknown. Natural escapement in 1995 was estimated to be about 1,000 adults each for Mill and Deer creeks and the Yuba River (S. P. Cramer and Associates 1995). Hatchery returns have averaged around 10,000 adults (Mills and Fisher 1994). The most recent annual estimate of adults spawning upstream of RBDD is less than 2,000 fish (NMFS 2006a).

Life History

Central Valley steelhead have one of the most complex life histories of any salmonid species, exhibiting both anadromous and freshwater resident life histories. Freshwater residents typically are referred to as rainbow trout, and those exhibiting an anadromous life history are called steelhead (NMFS 1999). Steelhead exhibit highly variable life history patterns throughout their range but are broadly categorized into winter and summer reproductive ecotypes. Winter steelhead are the most widespread reproductive ecotype and the only type currently present in Central Valley streams (McEwan and Jackson 1996). Winter steelhead become sexually mature in the ocean, enter spawning streams in summer, fall or winter, and spawn a few months later in winter or late spring (Meehan and Bjornn 1991; Behnke 1992).

In the Sacramento River, adult winter steelhead migrate upstream during most months of the year, beginning in July, peaking in September, and continuing through February or March (Hallock 1987). Spawning occurs primarily from January through March, but may begin as early as late December and may extend through April (Hallock 1987). Individual steelhead may spawn more than once, returning to the ocean between each spawning migration.

Juvenile steelhead rear a minimum of one and typically two or more years in fresh water before migrating to the ocean as smolts. Juvenile migration to the ocean generally occurs from December through August. The peak months of juvenile migration are January to May (McEwan 2001). The importance of main channel and floodplain habitats to steelhead in the lower Sacramento River and upper Delta is not well understood. Steelhead smolts have been found in the Yolo Bypass during the period of winter and spring inundation (Sommer 2002), but the importance of this and other floodplain areas in the lower Sacramento River and upper Delta is not yet clear.

Factors Affecting Abundance

The decline in steelhead populations is attributable to changes in habitat quality and quantity. The availability of steelhead habitat in the Central Valley has been reduced by as much as 95% or more due to barriers created by dams (NMFS 1996a). Populations have been most severely affected by dams blocking access to the headwaters of all major tributaries; consequently, most runs are maintained through artificial production. The decline of naturally produced Central Valley steelhead has been more precipitous than that of hatchery stocks. Populations in the range’s southern portion have experienced the most severe declines (NMFS 1996b). Other factors contributing to the decline of steelhead in the Central Valley are mining, agriculture, urbanization, logging, harvest, hatchery influences, flow management (including reservoir operations), hydropower generation, and water diversion and extraction (NMFS 1996a).

Critical Habitat/Essential Fish Habitat

Habitat for endangered or threatened anadromous fish is designated as critical habitat under the ESA and as EFH under the MSA. EFH has been designated for Chinook salmon, but not for steelhead. Critical habitat for Central Valley steelhead includes the stream channels and the lateral extent as defined by the ordinary high-waterline or bank-full elevation in the designated stream reaches of the Sacramento and American River, NEMDC and Dry/Robla creek portions of the ARCF GRR. Primary constituent elements of critical habitat are as described for spring-run Chinook salmon (NMFS 2006b).

3.3.5 Delta Smelt

Status and Distribution

Delta smelt (*Hypomesus transpacificus*) was Federally listed as threatened on March 5, 1993 (USFWS 1993) and critical habitat was designated on December 19, 1994 (USFWS 1994). Population trends and abundance of delta smelt are poorly understood due to their short life span (1 year). Based on data from 21 years of monthly sampling in Suisun Marsh, delta smelt appear to be experiencing long-term declines (Matern et al. 2002). Summer tow-net and fall/mid-water trawl data show fluctuating annual abundance from 1991 through 1996, with an increasing trend in the late 1990s, followed by an overall decline in abundance since 1999 (Bryant and Souza 2004).

Life History

Delta smelt are endemic to the Sacramento–San Joaquin estuary and are found seasonally in Suisun Bay and Suisun Marsh. They typically are found in shallow water (less than 10 feet) where salinity ranges from 2 to 7 parts per thousand (ppt), although they have been observed at salinities between 0 and 18.4 ppt. Delta smelt have relatively low fecundity and most live for 1 year. They feed on planktonic copepods, cladocerans, amphipods, and insect larva (Moyle 2002).

Delta smelt are semi-anadromous. During their spawning migration, adults move into the freshwater channels and sloughs of the Delta between December and January. Spawning occurs between January and July, with peak spawning from April through mid-May (Moyle 2002). Spawning locations in the Delta have not been identified and are inferred from larval catches (Bennett 2005). Larval fish have been observed in Montezuma Slough; Suisun Slough in Suisun Marsh; the Napa River estuary; the Sacramento River above Rio Vista; and Cache, Lindsey, Georgiana, Prospect, Beaver, Hog, Sycamore, and Barker sloughs (Wang 1986, Moyle 2002, Stillwater Sciences 2006, and USFWS 1996). Spawning was also observed in the Sacramento River up to Garcia Bend (RM 51) during drought conditions, as a result of increased saltwater intrusion that moved delta smelt spawning and rearing farther inland (Wang and Brown 1993).

Laboratory experiments have found eggs to be adhesive, demersal, and usually attached to substrate composed of gravel, sand, or other submerged material (Moyle 2002, Wang 1991). Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later. Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay near the bottom. As their fins and swim bladder develop, they move higher into the water column and are transported downstream to the open waters of the estuary (Moyle 2002).

Factors Affecting Abundance

Diversions and Delta inflow and outflow may affect survival of delta smelt. In water exported at the South Delta CVP and SWP export facilities, estimates of delta smelt entrainment suggest a population decline in the early 1980s, mirroring the decline indicated by mid-water trawl, summer tow-net, Kodiak trawl, and beach seine data (Bennett 2005). Diversions and upstream storage, including operation of the CVP and SWP, control Delta inflow and outflow during most months. Reduced Delta flow may inhibit or slow movement of larvae and juveniles to estuarine rearing habitat and into deeper and narrower channels of the Delta, resulting in lower prey availability and increased mortality from predators (Moyle 2002). Low Delta flow also may increase entrainment in diversions, including entrainment at the CVP and SWP export pumps (Moyle 2002). Additional factors affecting delta smelt abundance include extremely high river outflow that increases entrainment at export facilities, changes in prey abundance and composition, predation by nonnative species, toxic substances, disease, and loss of genetic integrity through interbreeding with the introduced Wagasaki smelt (Moyle 2002; CDFG 2000; Bennett 2005).

Critical Habitat/Essential Fish Habitat

Critical habitat for delta smelt consists of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the contiguous waters in the Delta (USFWS 1994). Critical habitat for delta smelt is designated in the following California counties: Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo (USFWS 2003). Critical habitat in the ARCF GRR study area includes the Sacramento River up to the I Street Bridge and the Yolo Bypass just above Interstate 80 at the railroad tracks. Primary constituent elements of critical habitat determined to be essential to the conservation of the species include: physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration (USFWS 2006a).

3.3.6 Green Sturgeon Southern Distinct Population Segment

Status and Distribution

On January 23, 2003, NMFS determined that green sturgeon (*Acipenser medirostris*) are comprised of two populations, a northern and a southern DPS (NMFS 2003). The northern DPS includes populations extending from the Eel River northward, and the southern DPS includes populations south of the Eel River to the Sacramento River. The Sacramento River supports the southernmost spawning population of green sturgeon (Moyle 2002). On April 6, 2005, NMFS determined that the northern DPS does not warrant listing under the ESA, but it remains on the Species of Concern List (NMFS 2005c). On April 7, 2006, NMFS determined that the southern DPS of green sturgeon was threatened under the Federal ESA (NMFS 2006c). On October 9, 2009, NMFS (74 CFR 52300) designated critical habitat for the green sturgeon southern DPS throughout most of its occupied range.

Green sturgeon were classified as a Class 1 Species of Special Concern by CDFG in 1995 (Moyle et al. 1995). Class 1 Species of Special Concern are those that conform to the state definitions of threatened or endangered and could qualify for addition to the official list. On March 20, 2006, emergency green sturgeon regulations were put into effect by CDFG requiring a year-round zero bag limit of green sturgeon in all areas of the state (CDFG 2006).

Life History

The green sturgeon is anadromous, but it is the most marine-oriented of the sturgeon species and has been found in near shore marine waters from Mexico to the Bering Sea (NMFS 2005c). The southern DPS has a single spawning population in the Sacramento River (NMFS 2005d) and more recently spawning has been observed in the lower Feather River, a tributary of the Sacramento River (Seesholtz et al. 2012). Adults typically migrate upstream into rivers between late February and late July. Spawning occurs from March to July, with peak spawning from mid-April to mid-June. Green sturgeon are believed to spawn every 3 to 5 years, although recent evidence indicates that spawning may be as frequent as every 2 years (NMFS 2005c). Little is known about the specific spawning habitat preferences of green sturgeon. Adult green sturgeon are believed to broadcast their eggs in deep, fast water over large cobble substrate, where the eggs settle into the interstitial spaces (Moyle 2002). Spawning is generally associated with water temperatures from 46 to 57 degrees Fahrenheit (°F). In the Central Valley, spawning occurs in the Sacramento River upstream of Hamilton City, perhaps as far upstream as Keswick Dam (Adams et al. 2002) and the lower Feather River (Seesholtz et al. 2012).

Green sturgeon eggs hatch in approximately 8 days at 55°F (Moyle 2002). Larvae begin feeding 10 days after hatching. Metamorphosis to the juvenile stage is complete within 45 days of hatching. Juveniles spend 1 to 4 years in fresh and estuarine waters and migrate to salt water at lengths of 300 to 750 millimeters (mm) (NMFS 2005c).

Little is known about movements, habitat use, and feeding habits of green sturgeon. Green sturgeon have been salvaged at the state and Federal fish collection facilities in every month, indicating that they are present in the Delta year-round. Juveniles and adults are reported to feed on benthic invertebrates, including shrimp and amphipods, and small fish (NMFS 2005c).

<u>Factors Affecting Abundance</u>

The historical decline of the southern DPS of green sturgeon has been largely attributed to the reduction of spawning habitat area. Keswick and Shasta Dams on the Sacramento River and Oroville Dam on the Feather River are impassable barriers that prevent green sturgeon from accessing what were likely historical spawning grounds upstream of these dams. Other potential migration barriers or impediments include the Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, the Delta Cross Channel, and Shanghai Bench and Sunset Pumps on the Feather River. Other factors that have been identified as potential threats to green sturgeon are reductions in freshwater outflow in the Delta during larval dispersal and rearing, high water temperatures during spawning and incubation, entrainment by water diversions, contaminants, predation and other impacts by introduced species, and poaching (NMFS 2005c).

<u>Critical Habitat/Essential Fish Habitat</u>

There is no EFH designated for green sturgeon. Designated critical habitat for the southern DPS of green sturgeon includes the Sacramento River downstream of Keswick Dam, the Feather River downstream of Oroville Dam, and the Yuba River downstream of Daguerre Dam; portions of Sutter and Yolo Bypasses; the legal Delta, excluding Five Mile Slough, Seven Mile Slough, Snodgrass Slough, Tom Paine Slough and Trapper Slough; and San Francisco, San Pablo, and Suisun bays. Freshwater habitat of green sturgeon of the southern DPS varies in function, depending on location within the Sacramento River watershed. Spawning areas currently are limited to accessible reaches of the Sacramento River upstream of Hamilton City and downstream of Keswick Dam (CDFG 2002) and portions of the Feather River (Seesholtz et al. 2012). Preferred spawning habitats are thought to contain large cobble in deep and cool pools with turbulent water (CDFG 2002; Moyle 2002; Adams et al. 2002). Sufficient flows are needed to sufficiently oxygenate and limit disease and fungal infection of recently laid eggs (Deng et al. 2002). Within the Sacramento River, spawning appears to be triggered by large increases in water flow during spawning (Brown and Michniuk 2007).

3.4 Amphibians

Two protected amphibian species were identified in the USFWS database records: the California red-legged frog (*Rana draytonii*) and the California tiger salamander (*Ambystoma californiense*) Amphibians are generally associated with smaller creeks, lentic habitats, and/or vernal pools. These aquatic habitats are generally not found along the ARCF reaches or in adjacent areas. Additionally, there are no known occurrences of these species in the action area. No suitable habitat for the salamander is present in the action area, and the action area is outside of the frog's extant range. Therefore, these listed amphibians are not considered further in this BA.

3.5 Reptiles

Two protected reptile species were identified in USFWS database records: the Alameda whipsnake (*Masticophis lateralis euryxanthus*) and giant garter snake (*Thamnophis gigas*). The range of the Alameda whipsnake is limited to Contra Costa and Alameda counties, which is not within the ARCF study area; therefore, Alameda whipsnake is dismissed and not discussed further in this BA.

3.5.1 Giant Garter Snake

Status and Distribution

The giant garter snake (*Thamnophis gigas*) is Federally listed as a threatened species under the ESA. Currently, this species is only known from 13 isolated population clusters within the Central Valley, from Chico to an area just southwest of Fresno (USFWS 1997). Giant garter snake populations that occur within the ARCF study area are within and adjacent to the Sacramento Bypass, which includes both small canals and rice fields. Additionally GGS is known to occur in the NEMDC north of the pump station at the Dry Creek north levee, however this is north of the ARCF GRR action area. SAFCA's Borrow Site 2 is located north of Dry Creek, so there is some potential for impacts to GGS in the NEMDC area.

Life History

The giant garter snake inhabits agricultural wetlands and associated waterways, including irrigation and drainage canals, rice fields, marshes, sloughs, ponds, low- gradient streams, and adjacent uplands. They have also been observed to use revetment as cover (Wylie et al. 2002). Giant garter snakes are believed to be most numerous in rice-growing regions (USFWS 1999b). Giant garter snakes are typically absent from the larger rivers; wetlands with sand, gravel, or rock substrates; and riparian areas lacking suitable basking sites or suitable prey populations (Hansen and Brode 1980; Brode 1988; USFWS 1999b). The giant garter snake hibernates from October to March in abandoned burrows of small mammals located above prevailing flood elevations (Fisher et al. 1994), and breeds during March and April.

Factors Affecting Abundance

Giant garter snakes have been reduced in distribution and abundance due to habitat loss and degradation throughout the Central Valley. Several factors may degrade habitat for giant garter snakes, including upstream watershed modifications, water storage and diversion projects, and urban and agricultural development. Contamination from agricultural runoff may also have detrimental effects. On-going agricultural practices such as tilling, grading, harvesting and operation of other equipment may also result in mortality and increased rates of predation. Clearing and maintenance of irrigation canals and draining of rice fields may also result in mortality and degradation of habitat (USFWS 1999b).

3.6 Birds

3.6.1 Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is was Federally listed as threatened in October 2014. Nesting western yellow-billed cuckoos no longer occur on the Sacramento River south of Colusa as the river has been channelized and riprapped from that point into the Sacramento-San Joaquin River Delta. However, nesting western yellow-billed cuckoo do occur south of the Sacramento area, and north of the Sacramento area, so there is some potential for migrant individuals to use the riparian habitats along the American River Parkway as they move between nesting habitat areas. As a result, this species is discussed in greater detail below.

Prior to construction activities, surveys would be conducted within the study area to determine where potential nest sites occur. The surveys would be conducted annually in close proximity to construction locations and within one-half mile of any anticipated construction. If any special status bird species are found, coordination with the resource agencies would occur and appropriate avoidance and minimization measures would be established prior to the start of construction.

Status and Distribution

Over the last 100 years, western cuckoo population declined dramatically due to extensive loss of suitable breeding habitat, primarily riparian forests and associated bottomlands dominated by willow (Salix spp.), cottonwood (Populus spp.), or mesquite (Prosopis spp.) (Gaines and Laymon 1984, Laymon and Halterman 1987, Hughes 1999). Once considered a common breeder in California, by 1940 the yellow-billed cuckoo suffered severe population reduction (Grinnell and Miller 1944) and by 1987 was estimated to occupy only 30 percent of its historical range (Laymon and Halterman 1987). California statewide surveys conducted in 1977 (Gaines and Laymon 1984), 1986/1987 (Laymon and Halterman

1987), and 1999 (Halterman et. al 2001) found yellow-billed cuckoo populations were concentrated mostly along the Sacramento River from Red Bluff to Colusa, along the South Fork of the Kern River, and portions of the Lower Colorado River. Population estimates on the Sacramento and Kern Rivers from the 1999 surveys were similar to those of the 1986/1987 surveys, but lower when compared to the 1977 survey. The Lower Colorado River population appeared to suffer severe declines in the 12 years from the 1986/87 to the 1999 surveys.

In 2001, USFWS determined that western yellow-billed cuckoos represent a Distinct Population Segment (DPS), and as such became a candidate for protective listing under the Endangered Species Act (USFWS 2001). In 2002, the listing was determined to be warranted but precluded by higher priority listing actions (due to limited resources) (USFWS 2002). In 2013, USFWS formally proposed that the Western DPS be listed as Threatened under the Endangered Species Act. On October 3, 2014, the proposed rule became effective and finalized the USFWS determination for listing the western yellow-billed cuckoo, but not its critical habitat.

Life History

Yellow-billed cuckoos are among the latest-arriving Neotropical migrants. They arrive on their breeding grounds in Arizona and California by June (Hughes 1999). Diet during the breeding season consists primarily of large insects such as grasshoppers, katydids, caterpillars, praying mantids, and cicadas; also tree frogs and small lizards (Hamilton and Hamilton 1965, Laymon 1980, Laymon et al. 1997). Nesting usually occurs between late June and late July, but can begin as early as late May and continue until late September (Hughes 1999). Nests consist of a loose platform of twigs, which are built by both sexes and take one to two days to build (Hughes 1999), though occasionally the nest of another species is used (Jay 1911, Bent 1940, Payne 2005). Clutch size is 1 to 5 (Payne 2005), though up to 8 eggs have been found in one nest due to more than one female laying in the nest (Bent 1940). Eggs are generally laid daily until clutch completion (Jay 1911), and incubation begins once the first egg is laid, lasting 9 to 11 days (Hughes 1999). Young hatch asynchronously and are fed mostly large insects (Laymon and Halterman 1985, Laymon et al. 1997, Halterman et al. 2009) similar to the adult diet. Young fledge after 5 to 9 days (6 days average), but may be dependent on adults for at least three weeks (Laymon and Halterman 1985).

Fall migration is thought to begin in late August, with most birds gone by mid-September (Hughes 1999); however on the Lower Colorado River some individuals appear to begin migrating in early August (McNeil et al. 2011). Their non-breeding range is believed to be the western side of the Andes (Hughes 1999), though little information exists on migration routes and non-breeding range in South America where they can be confused with the endemic pearly-breasted cuckoo (C. euleri), their closest relative (Payne 2005).

Factors Affecting Abundance

Habitat losses associated with manmade flood control and water management features that alter watercourse hydrology have contributed to the decline of the species. The natural processes that sustained riparian habitat in western North America have greatly diminished. Loss and degradation of habitat has occurred as a result of livestock overgrazing and encroachment from agriculture. These losses are exacerbated by the conversion of native habitat to predominantly nonnative vegetation. Habitat losses result in additional effects such as increased predation and reduced dispersal potential. These effects are associated with small and widely separated habitat patches. These threats are particularly persistent where small habitat patches are within proximity to human-altered landscapes, especially agricultural fields, resulting in the potential for pesticides to poison individual western yellow-billed cuckoos and reduce their prey base.

4.0 Environmental Baseline

This section describes the physical conditions and general vegetation, wildlife, and fisheries resources present within the ARCF action area. These conditions are first presented generally throughout the ARCF action area and then site specific SRA is analyzed as well as affected species in the ARCF action area. The environmental baseline provides information necessary to determine if the proposed action would jeopardize the continued existence of species being considered, and if the project can support long-term survival of these species in the action area.

The ARCF action area includes the mainstem Sacramento River from Freeport (RM 46) in the Delta upstream to the American River confluence (RM 60). The region also includes the lower American River from the confluence with the Sacramento River upstream to RM 11, NEMDC, Arcade Creek, Dry/Robla Creeks and Magpie Creek.

Downstream from the American River confluence, the Sacramento River is moderately sinuous (average sinuosity of 1.3), with the channel confined on both sides by man-made levees enhanced by decades of man-made additions. The channel in this reach is of uniform width, is not able to migrate, and is typically narrower and deeper relative to the upstream reach due to scour caused by the concentration of shear forces acting against the channel bed (Brice 1977). Channel migration is similarly limited along the lower American River because of man-made levees and regulated flows from Folsom Dam.

The natural banks and adjacent floodplains of both rivers are composed of silt- to gravel-sized particles with poor to high permeability. Historically, the flow regimes caused the deposition of a gradient of coarser to finer material, and longitudinal fining directed downstream (sand to bay muds). The deposition of these alluvial soils historically accumulated to form extensive natural levees and splays along the rivers, 5 to 20 feet above the floodplain for as far as 10 miles from the channel (Thompson 1961). The present day channels consist of fine-grained cohesive banks that erode due to natural processes as well as high flow events (Corps 2012).

Seasonal high flows enter the adjacent Yolo Bypass from this reach of the Sacramento River via the Sacramento Bypass (RM 63). Tidal influence emanating from Suisun Bay extends up the Sacramento River for 80 miles to Verona, with greater tidal variations occurring downstream during low river stages in summer and fall.

NEMDC is an approximately 13.3-mile, human-made, partially leveed drainage channel that provides drainage from Sankey Road and connects streams of the American Basin (Dry, Robla, and Arcade Creeks) to the American River. South of the confluence with Arcade Creek, the east and west levees of NEMDC are dominated by wild oats grasslands, while the channel is characterized by Fremont cottonwood forest, with smaller amounts of valley oak woodland, smart-weed cocklebur patches, and perennial rye grass fields.

The approximately 16.2-mile-long channel of Arcade Creek extends east-to-west from Orangevale to the American River, via NEMDC. The north and south levees are dominated by wild oats grasslands. Valley oak woodland is the main riparian vegetation type along Arcade Creek, but Fremont cottonwood forest occurs in small patches along the easternmost reach of Arcade Creek near NEMDC. Hardstem bulrush marsh is found within Arcade Creek near Norwood Avenue while water primrose wetlands are predominant within the channel of Arcade Creek from approximately the confluence with NEMDC to Norwood Avenue. East of Norwood Avenue, the creek channel becomes narrower, and dominated by a shaded canopy of valley oak woodland.

The environmental baseline in the ARCF GRR action area also includes the sites completed under the WRDA 1996 and WRDA 1999 authorizations for the project. The WRDA 1996 construction included installing slurry walls in the American River levees to address seepage and slope stability concerns. The WRDA 1999 construction included shape and slope improvements to specific reaches of the American River levee system, and some segments of the Sacramento River levees. Consultation has occurred on these sites throughout the construction period on an as-needed basis to ensure compliance with the ESA. The original project construction was coordinated with USFWS as the American River Watershed (Common Features) Project, Sacramento County, California. The Biological Opinions for these sites are on file with USFWS under Reference # 1-1-99-F-0078.

4.1 Vegetation

The ARCF study area consists of primarily riparian forest, valley oak woodland, riparian scrub-shrub habitat, and typically non-native annual grassland. Scrub-shrub generally refers to areas where the woody riparian canopy is composed of young trees or shrubs less than 20 feet high. Species that are typically found in riparian forest, valley oak woodland, and scrub habitats include cottonwood, several willow species, sycamore valley oak, black walnut, Oregon ash, white alder, boxelder, blue elderberry, buttonbush, Himalaya blackberry, wild grape, and poison oak. Understory vegetation may consist of an herbaceous layer of sedges, rushes, grasses, and forbs.

Riparian forest typically has a dominant overstory of cottonwood, California sycamore, black walnut, black willow, or valley oak. Dominant species found in the sub canopy may also include alder, ash and box elder. Layers of climbing vegetation make up part of the subcanopy, with wild grape being a major component, but wild cucumber and clematis vines are also found in riparian communities.

Several species of invasive non-native trees, shrubs and vines may be present in some riparian locations, predominantly red sesbania, Himalayan blackberry, tamarix, false bamboo, tree-of-heaven, eucalyptus, and ivy.

The herbaceous ruderal groundcover, primarily nonnative annual grassland, is found on most levees along the Sacramento River. It occurs on the levees and also within gaps in the riparian habitats. Plant species include wild oats, soft chess, ripgut brome, red brome, wild barley, Bermuda grass, and foxtail fescue. Common forbs include broadleaf filaree, red stem filaree, turkey mullein, clovers, and many others. The majority of these plants are not native to the project area.

4.1.1 Historical Human Resource Use and Current Riparian Vegetation

Historical precipitation and runoff patterns resulted in the Sacramento River being bordered by up to 500,000 acres of riparian forest, with valley oak woodland covering the higher river terraces (Katibah 1984). However, human activities of the 1800s and 1900s have substantially altered the hydrologic and fluvial geomorphic processes that create and maintain riparian forests within the Sacramento basin, resulting in both marked and subtle effects on riparian communities. Riparian recruitment and establishment models (Mahoney and Rood 1998; Bradley and Smith 1986) and empirical field studies (Scott et al. 1997, 1999) emphasize that hydrologic and fluvial processes play a central role in controlling the elevational and lateral extent of riparian plant species. These processes are especially important for pioneer species that establish in elevations close to the active channel, such as cottonwood and willows (*Salix* spp.). Failure of cottonwood recruitment and establishment is attributed to flow alterations by upstream dams (Roberts et al. 2001) and to isolation of the historic floodplain from the river channel. In addition, many of these formerly wide riparian corridors are now narrow and interrupted by levees and weirs. Finally, draining of wetlands, conversion of floodplains to agricultural fields, and intentional and unplanned introduction of exotic plant species have altered the composition and associated habitat functions of many of the riparian communities that are able to survive under current conditions.

4.1.2 Site-Specific Analysis of Riparian Vegetation

Analysis of total linear feet (lf) of SRA was conducted using Google Earth Pro for the reaches only associated with bank protection on the American and Sacramento Rivers in the ARCF action area (Table 8). However, site specific conditions at proposed bank protection sites will evaluate SRA habitat values using the SAM method of analysis to determine impacts and onsite compensation value based on actual designs. The East Side Tributaries were not evaluated because no bank erosion protection is planned. It should be noted however that there is minimal, if any, SRA associated with the tributaries in the reaches where construction is proposed, except Arcade Creek. Approximately 8 acres of trees along the Sacramento River would be removed to construct the new 1,500 foot Sacramento Weir. Additionally, in the area proposed to be incorporated into the Sacramento Bypass, there is approximately 236 acres of newly planted nut orchard trees as of summer 2015. In order to construct the widened bypass, these trees would be removed.

Identification of individual reaches in the ARCF action area can be seen in Figure 2. American River North (ARN) reaches A through I includes the north side of the American River and the East Side Tributaries. American River South (ARS) reaches A through G includes the south side of the American River and the east side of the Sacramento River.

Table 8. Summary of Reach-Specific SRA Analysis.

American River		Sacramento River	
Reach	**Linear Feet (lf) of SRA**	**Reach**	**Linear Feet (lf) of SRA**
ARN A	19,000	D	9,200
ARS A	6,850	E	8,850
ARS B	875	F	21,100
ARS C	3,800	G	11,150
Total	30,525	Total	50,300

4.2 American River Hydraulic Baseline

The American River levee system was originally intended to convey a discharge of 115,000 cfs. When the Joint Federal Project (JFP) is completed at Folsom Dam, in combination with levee repairs currently being completed under the Common Features Project (and other authorities) and the dam 3.5 foot raise, the intent is for the river to be able to convey a discharge of 160,000 cfs, assuming that the levees do not fail from one or more of the potential failure modes (i.e., seepage, stability, insufficient height, or erosion).

In addition, modifications of Folsom Dam operations will shift the way floods are released into the lower river from Folsom Dam. Specifically, frequent flood events, that is, floods which occur say once in every ten to twenty-five years, will have a larger peak discharge compared to those under current dam operations.

4.2.1 Folsom Dam Operations

In 2017, the Folsom Joint Federal Project (JFP) auxiliary spillway at Folsom Dam will be completed and a new water control manual will be adopted. This includes a 400,000 acre-feet to 600,000 acre-feet (400/600) variable flood space operation that takes incidental storage space in upstream reservoirs into consideration when determining flood storage requirements at Folsom Dam during the flood season. The JFP will allow dam operators to release larger quantities of water at lower reservoir stages and more efficiently utilize flood space in the reservoir.

While the JFP and new water control manual are not in place, these projects will be in operation prior to any construction occurring on the ARCF project. As a result, including the operation of the JFP as a part of the baseline condition of this project is a reasonable assumption for the ARCF GRR. Therefore, the ARCF GRR assesses the impacts associated with the increase in water within the Yolo Bypass that results from the widening of the Sacramento Weir and Bypass. Additional changes in flows from the operation of the JFP will be addressed in the forthcoming Folsom Dam Water Control Manual Update consultation. However, these flows are represented throughout this BA as a part of the Future Without Project Condition.

Table 9 lists a sample of the current and future peak discharges for a range of flood events. It is anticipated that the values will be updated as part of the Folsom Water Control Manual Update evaluation.

Table 9. Comparison of Peak Discharges in the American River between Current and Future Events.

	Current Conditions	Future Conditions
50% (1/2) ACE (2-year)	30,200	25,200
10% (1/10) ACE (10-year)	43,100	71,700
4% (1/25) ACE (25-year)	99,700	115,000
2% (1/50) ACE (50-year)	115,000	115,000
1% (1/100) ACE (100-year)	145,000	115,000
0.5% (1/200) ACE (200-year)	320,000	160,000

4.2.2 American River Erosion Susceptibility

The Lower American River, Erosion Susceptibility Analysis for Infrequent Flood Events, evaluated the potential for erosion of grass-covered levees and overbanks in response to different stream discharges resulting from releases of various magnitudes from Folsom Dam (Ayers, 2004). This study concluded that the river system is degrading under present operating conditions because the lower American River is starved of sediments by Folsom Dam and Nimbus Dam. Hardpan has been reached in the channel bottom as far downstream as Guy West Bridge (RM 7.0), and this hardpan is slowing further degradation. With the river starved for sediment and unable to further scour its channel the river is now eroding laterally to satisfy its need for sediment. Erosion of the riverbank is occurring even at low flow conditions of 7,000 cfs, which was the peak flow from the 2003 runoff season. Ongoing erosion has scarred the channel banks leaving them susceptible to further erosion, especially during high flow events. Lateral erosion is further reducing the amount of berm separating the main channel from the levee. The loss of vegetation on the berm and bank is leaving bare soil, which is more susceptible to erosion at a lower velocity than if the berm or bank was covered with vegetation.

Figure 19 shows the velocities for a discharge of 115,000 cfs, which average about 6 to 8 feet per second in the channel with maximum velocities ranging up to about 12 feet per second. Figure 20 shows the velocities for a discharge of 160,000 cfs which average about 6 to 9 feet per second in the channel with maximum velocities ranging up to about 13 feet per second. Of concern in both of these figures are the proximities of the relatively high velocities to the levees along the Lower American River. Additionally, the range of the computed velocities is of concern since the magnitude of the velocities is great enough to erode many of the relatively fine grained material present in the channel lining. The results of the analysis indicate that the large discharge events are capable of eroding the material typically found along the Lower American River channel.

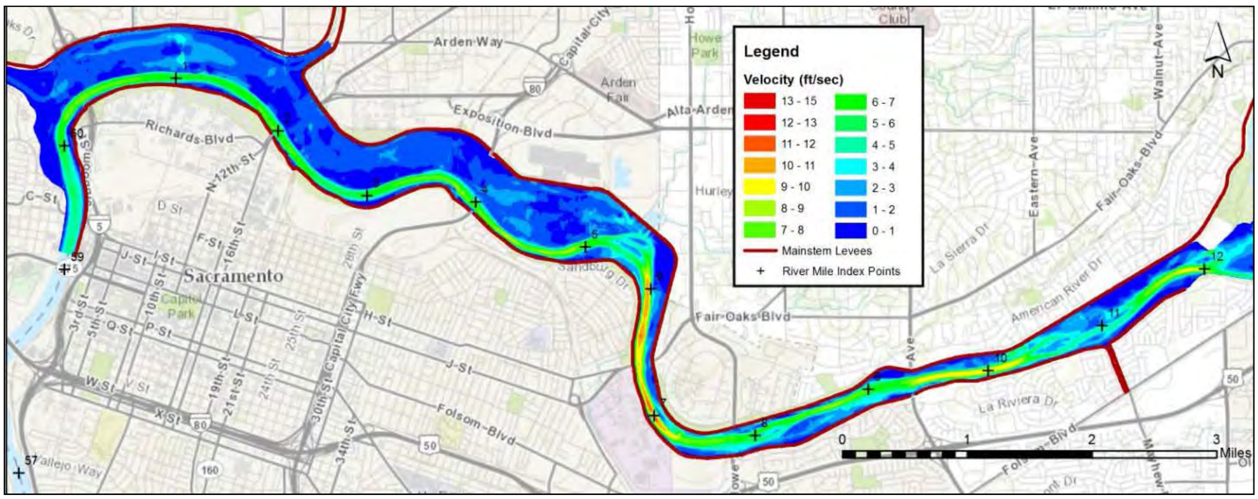


Figure 19. Velocities in the Lower American River at 115,000 cfs.

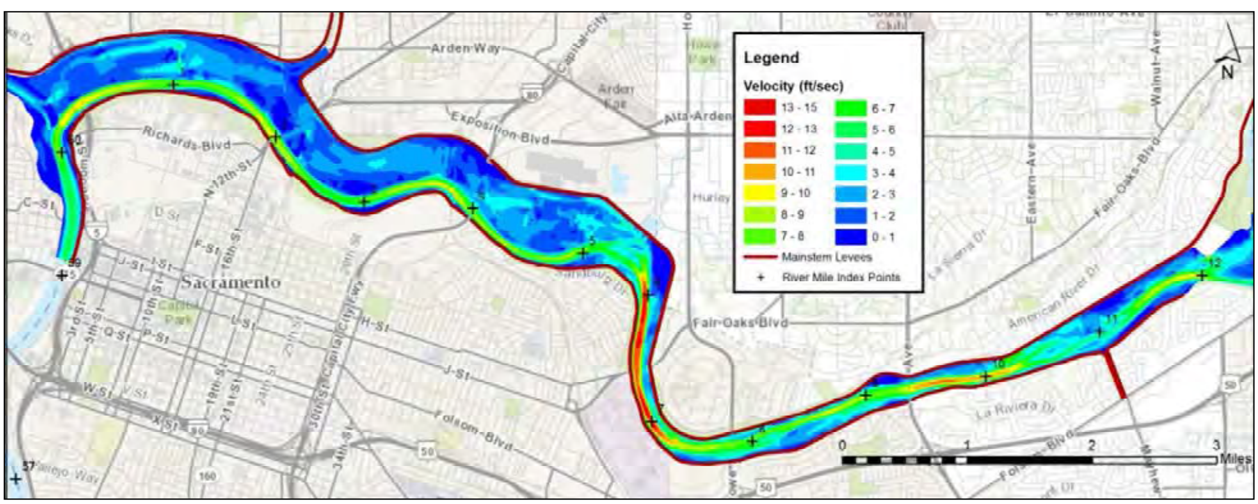


Figure 20. Velocities in the Lower American River at 160,000 cfs.

Figure 21 shows velocity contours in the area where erosion is greatest, between RM 6 and RM 7.5. As can be seen in Figure 21, velocities reach 11 feet per second for flows of 115,000 cfs, and get as high as 14 feet per second for 160,000 cfs. The study concluded that a flow of 145,000 cfs could cause damage at most of the study's identified priority sites, and could cause a levee failure to occur for at least one of the sites (Ayers, 2004). This reach of river represents the worst conditions regarding velocity (11 to 14 feet per second). Downstream and upstream of this reach, velocities in general for the same peak releases average in the 6 to 9 feet per second range.

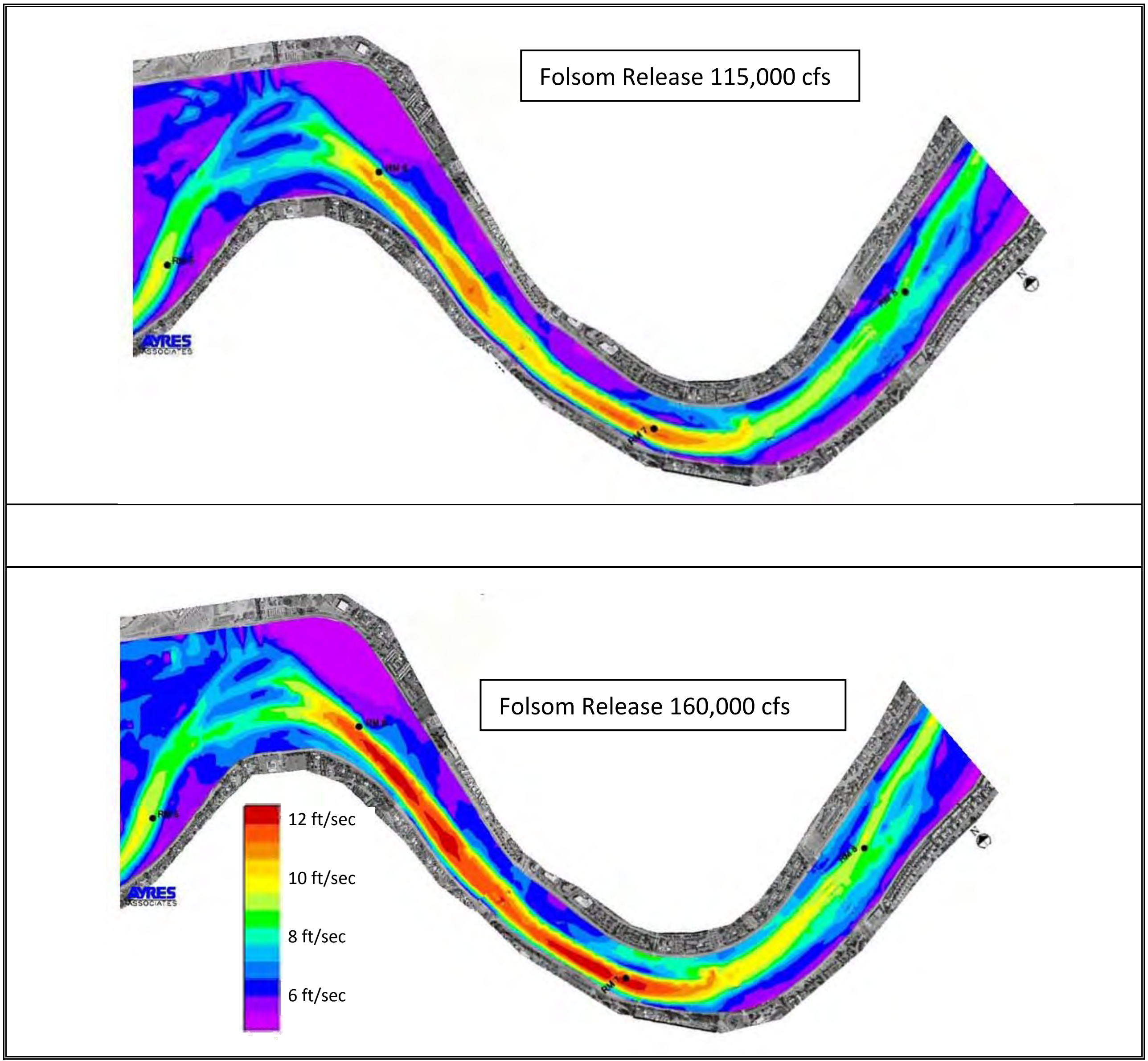


Figure 21. American River Velocity Contours.

Bare soil can withstand approximately 1.5 to 2.5 feet per second. Soil with good turf cover can withstand between 3.5 to 8 feet per second. The conditions of grass cover along the American River are not good and erosion occurs at velocities much less than the 11 to 14 feet per second in the RM 6 to RM 7.5 reach. This is illustrated by the fact that emergency erosion repairs have needed to occur as far downstream as near Highway 160 (RM 1.8) and as far upstream as between Watt Avenue and the Mayhew Drain (RM 10.2).

4.3 Affected Species in the Action Area

4.3.1 Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle is listed as a threatened species under the ESA (USFWS 1980). The valley elderberry longhorn beetle's range extends from southern Shasta County to Fresno County (Talley et al. 2006). Along the eastern edge of the species' range, adult beetles have been found in the foothills of the Sierra Nevada at elevations up to 2,220 feet, and beetle exit holes have been located on elderberry plants at elevations up to 2,940 feet. Along the western edge of the species' range, adult beetles have been found on the eastern slopes of the Coast Ranges at elevations of up to 500 feet, and beetle exit holes have been detected on elderberry plants at elevations up to 730 feet (Barr 1991).

Valley elderberry longhorn beetle is only found in close association with its host plant, elderberry (Sambucus spp.). Elderberry plants are found in or near riparian and oak woodland habitats. The valley elderberry longhorn beetle's life history is assumed to follow a sequence of events similar to those of related taxa. Female beetles deposit eggs in crevices in the bark of living elderberry plants. Presumably, the eggs hatch shortly after they are laid, and the larvae bore into the pith of the trunk or stem. When larvae are ready to pupate, they move through the pith of the plant, open an emergence hole through the bark, and return to the pith for pupation. Adults exit through the emergence holes and can sometimes be found on elderberry foliage, flowers, or stems or on adjacent vegetation. The entire life cycle of the valley elderberry longhorn beetle is thought to encompass 2 years, from the time eggs are laid and hatch until adults emerge and die (USFWS 1984).

The presence of exit holes in elderberry stems indicates previous valley elderberry longhorn beetle habitat use. Exit holes are cylindrical and approximately 0.25 inch in diameter. Exit holes can be found on stems that are 1 or more inches in diameter. The holes may be located on the stems from a few inches to about 9 to 10 feet above the ground (Barr 1991).

The valley elderberry longhorn beetle distribution decline is most likely related to the extensive loss of riparian forests in the Central Valley, which has reduced the amount of available habitat for the species, and has most likely decreased and fragmented the species' range (USFWS 1984). Insecticide drift from cultivated fields and orchards adjacent to elderberry plants may affect valley elderberry longhorn beetle populations, if drift occurs at a time when adults are present on the shrubs (Barr 1991). Herbicide drift from agricultural fields and orchards can likewise affect the health of elderberry plants, thereby reducing their quantity and quality as valley elderberry longhorn beetle habitat.

The invasive Argentine ant (*Linepithema humile*) has been spreading in riparian habitats and may affect survival of the valley elderberry longhorn beetle. Argentine ants may predate valley elderberry longhorn beetle eggs although this interaction needs further exploration (Huxel, 2000). The spread of invasive exotic plants (e.g., giant reed [*Arundo donax*] may also negatively affect the valley elderberry longhorn beetle by affecting supporting riparian habitats. The presence of giant reed promotes a more frequent fire cycle and homogenous plant community (Talley et al. 2006).

Critical habitat for the valley elderberry longhorn beetle occurs in two locations near the City of Sacramento (USFWS 1980). One area is enclosed by the Western Pacific railroad tracks and Highway 160, approximately one-half mile north of the American River near its confluence with the Sacramento River. The second site is located along the south bank of the American River at Goethe Park, just upstream of RM 13.

VELB are known to occur throughout the ARCF GRR study area. The Corps conducted surveys in 2011 of the levee systems within the action area. The survey area consisted of the levee structures and 15 feet on both the waterside and landside; where access was available. The survey located elderberry clusters, however, actual shrubs, stem size, nor exit hole presence were determined. The surveys found the greatest amount of clusters on the south side of the American River and determined that both basins contain shrubs. All shrubs are considered to be in a riparian zone. Within the East Side Tributaries surveys were conducted identical to the American and Sacramento River. The only area where shrubs were located was along Arcade Creek, which contained two clusters of shrubs.

The American River Parkway has been the focus of a number of mitigation efforts from the confluence of the American and Sacramento Rivers (mitigation site 0.9, located at river mile [RM] 0.9 on the right side of the American River) up to Lake Natoma (Sailor Bar mitigation site located at RM 21 on the right side of the American River), elderberry mitigation sites create connectivity for potential translocation of valley elderberry longhorn beetles.

Additional VELB habitat within the Parkway has been created as part of previous Corps construction efforts, including:

- Site 0.9 on the right bank of American River at RM 0.9.
- Cal Expo: three distinct mitigation sites located between RM 3 and RM 4 on the right side of the American River.
- Site 11.5: elderberry mitigation site located near RM 11.5 on the right side of the American River.

- Mayhew: elderberry mitigation site located near RM 11 on the left side of the American River.
- River Bend Park: multiple mitigation sites located near RM 14 on the on the left side of the American River.
- Sailor Bar: mitigation site located near RM 21 on the right side of the American River.

These sites are currently being monitored and maintained by the Corps with annual reports provided to USFWS. Both the critical habitat are located in areas Operated and Maintained by the American River Flood Control District. The mitigation sites are maintained by SAFCA. Habitat maps of the American River Parkway showing locations of elderberry shrubs are included as Appendix F of the BA. Existing mitigation sites in the Parkway are identified in the maps in Appendix G of the BA.

Additional sites established by other agencies also exist along both sides of the American River, increasing connectivity to existing areas of critical habitat for the VELB. Additionally, future plans of restoration and mitigation could increase connectivity in large areas such as Woodlake, Bushy Lake, and Rossmoor. Smaller sites along the American River, including restoration efforts within the ARCF GRR construction footprint, would increase connectivity between these larger sites and the existing habitat within the American River Parkway. These additional sites would be assessed during the design phase of the ARCF GRR project for viability of future compensation efforts associated with this action.

4.3.2 Chinook Salmon and Steelhead

Four distinct runs of Chinook salmon occur in the ARCF action area: winter-run, spring-run, fall-run, and late fall–run. The runs are named after the season of adult migration, with each run having a distinct combination of adult migration, spawning, juvenile residency, and smolt migration periods. In general, fall- and late fall-run Chinook salmon spawn soon after entering their natal streams, while spring- and winter-run Chinook salmon typically hold in their natal streams for up to several months before spawning. Central Valley Steelhead also occurs in the ARCF action area. Immigration of adult steelhead in the Sacramento and American River's peaks in late September and October (Moyle 2002). The steelhead spawning season typically stretches from December through April. After several months, fry emerge from the gravel and begin to feed. Juveniles rear in fresh water from 1 to 4 years (usually 2 years), then migrate to the ocean as smolts in the spring (March through June).

During higher winter flow events in the East Side Tributaries there is suitable habitat in NEMDC, Arcade Creek and Dry/Robla Creek for the presence of fall/late-fall salmon. Central Valley steelhead are expected to occur in NEMDC as adults, migrating upstream to their spawning habitat, and as juveniles and smolts, rearing and migrating toward the ocean. Central Valley steelhead would not typically occur in Arcade Creek or Robla Creek, as these streams regularly lacks water quality conditions for spawning. NEMDC includes critical habitat for Central Valley steelhead, which uses this locations for juvenile rearing, juvenile migration, and adult migration (NMFS 2014). There is no critical fish habitat designation for Arcade and Robla Creeks.

During the intermittent years when the Sacramento Bypass is flooded in the winter and spring all four runs of juvenile Chinook salmon and steelhead can potentially use the floodplain for rearing and migration.

4.3.3 Green Sturgeon

Green sturgeon are known to occur in the lower reaches of large rivers, including the Sacramento River (Moyle 2002) and more recently spawning has been observed in the lower Feather River, a tributary of the Sacramento River (Seesholtz et al. 2012). Adults of this species tend to be associated with marine environments more than the more common white sturgeon, although spawning populations have been identified in the Sacramento and Klamath Rivers (Corps 1993). Juvenile rearing (natal stream to estuary) can occur year round in the Sacramento River action area.

Critical habitat for the green sturgeon extends into the American River upstream to the Highway 160 bridge where there is a potential to encounter adults and/or rearing juvenile green sturgeon. The Sacramento Bypass, when flooded, can support juvenile green sturgeon during downstream migration and rearing.

4.3.4 Delta Smelt

Adult delta smelt begin spawning migration into the upper Delta in December or January. Migration may continue over several months. Spawning occurs between January and July, with peak spawning during April through mid-May (Moyle 2002). Spawning occurs along the channel edges in the upper Delta, including the Sacramento River above Rio Vista, Cache Slough, Lindsey Slough, and Barker Slough. Spawning has been observed in the Sacramento River up to Garcia Bend below the confluence of the American River on the Sacramento River action area during drought conditions, possibly attributable to adult movement farther inland in response to saltwater intrusion (Wang and Brown 1993). The typical pattern is for delta smelt to inhabit the oligohaline to freshwater portion of the estuary for much of the year until late winter and early spring, when many migrate upstream to spawn (Sommer et al. 2011). There is evidence that some may not migrate to spawn. After hatching, their larvae and post-larvae subsequently migrate downstream in spring towards the brackish portion of the estuary (Dege and Brown 2004; Sommer and Mejia 2013).

Key progress in our understanding of delta smelt is that they are strongly associated with turbid water (Feyrer et al. 2007). Their results showed that, during fall, delta smelt are only present at locations where Secchi depth is less than 1 meter. This finding is consistent with Grimaldo et al. (2009), who found that delta smelt were not present in upstream areas when turbidities were less than about 12 NTU

(Sommer and Mejia 2013). It is likely that the lack of turbidity in the American River would be unsuitable for delta smelt.

The general pattern is that delta smelt cannot tolerate temperatures higher than 25 °C (Swanson et al. 2000). Hence, the 25 °C is used as a general guideline to assess the upper limits for delta smelt habitat (Wagner et al. 2011; Cloern et al. 2011). Downstream of the Delta, the smallest channel where adults and juveniles have been reported is Spring Branch Slough in Suisun Marsh, which averages about 15-m wide (Meng et al. 1994; Matern et al. 2002; Sommer and Mejia 2013). Due to higher temperatures and lack of suitable channel width the East Side Tributaries would not be suitable habitat for the delta smelt.

The northern-most reach of delta smelt critical habitat in the study area includes the Sacramento River up to the I Street Bridge on the east side and on the west side the critical habitat extends up the Yolo Bypass to the Union Pacific Railroad tracks just below the Sacramento Bypass along the I-80 corridor.

4.3.5 Giant Garter Snake

The giant garter snake inhabits agricultural wetlands and other waterways such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley. Because of the direct loss of natural habitat, the giant garter snake relies heavily on rice fields in the Sacramento Valley, but also uses managed marsh areas in Federal National Wildlife Refuges and State Wildlife Areas. Habitat loss and fragmentation, flood control activities, changes in agricultural and land management practices, predation from introduced species, parasites, water pollution, and continuing threats are the main causes for the decline of this species.

Rice fields and their adjacent irrigation and drainage canals serve an important role as aquatic habitat for giant garter snake as is the case adjacent to the Sacramento Bypass. The land proposed to be incorporated into the Sacramento Bypass is currently agricultural fields producing row crops and nut orchards. The associated drainage ditches and farm canals in this area are considered aquatic GGS habitat.

Habitat elements for GGS do occur along the east side of the NEMDC and other waterways of the east side tributaries, however, due to current habitat conditions, such as close proximity to urban development, high levels of human disturbance, scarcity of upland habitat, and riparian vegetation along the banks of most channel reaches, giant garter snakes are unlikely to occur in the Arcade, Dry/Robla, and Magpie Creek and the southern portion of NEMDC below Dry/Robla Creek. Large waterways, such as the Sacramento and American Rivers, do not provide suitable habitat for giant garter snake.

4.3.6 Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp lives in vernal pools and swales containing clear to turbid water and grassy bottoms in unplowed grasslands. The shrimp is ecologically dependent on seasonal fluctuations in its habitat, such as presence or absence of water during specific times of the year, duration of water, temperature, and quantities of dissolved oxygen (USFWS 1992b).

There are 32 known populations of the vernal pool fairy shrimp, extending from the Stillwater Plain in Shasta County through the Central Valley to Pixley in Tulare County. In addition, the shrimp occur along the central Coast Range from northern Solano County to Pinnacles National Monument in San Benito County. Critical habitat is designated for a number of sub-populations of fairy shrimp throughout California. The closest critical habitat to the action area is a sub-population of vernal pool fairy shrimp in vernal pools near Mather Field in south-eastern Sacramento County. In the action area, vernal pools are known to occur near Magpie Creek, and there are recorded occurrences of vernal pool fairy shrimp in the CNDDB from 1995 (CNDDB 2015).

Vernal pool habitat is known to occur near Magpie Creek. Alongside the Magpie Creek Diversion Canal, there are some lands which could support vernal pools or vernal pool fairy shrimp that would be impacted by project construction. At this time, a wetland delineation has not been conducted to verify the occurrence of vernal pools; however, a wetland delineation would occur prior to project construction. Since the ARCF GRR is adopting the design of the 2004 Magpie Creek Flood Control Project, the impacts to vernal pools at this time were assessed based on that project's consultation. The proposed project would result in 0.25-acre of indirect effects to vernal pools/swales of potentially suitable vernal pool fairy shrimp habitat.

Seasonal wetlands, which may provide suitable habitat for vernal pool invertebrates, occur in the vicinity of the NSS project's Robla woodland mitigation site A, however any vernal pools in this area would be avoided by these activities. With the implementation of at 250-foot buffer between vernal pools and construction activities there would be no direct or indirect impacts from activities at Robla woodland mitigation site A. As a result, any mitigation efforts at the Robla woodland mitigation site would are not likely to adversely affect vernal pool fairy shrimp.

4.3.7 Vernal Pool Tadpole Shrimp

The vernal pool tadpole shrimp lives in vernal pools and swales containing clear to highly turbid water. The shrimp is ecologically dependent on seasonal fluctuations in its habitat, such as presence or absence of water during specific times of the year, duration of water, temperature, and quantities of dissolved oxygen (USFWS 1992b).

There are 18 known populations of vernal pool tadpole shrimp in the Central Valley, ranging from east of Redding in Shasta County south to the San Luis National Wildlife Refuge in Merced County. In the action area, vernal pools are known to occur near Magpie Creek, and there are recorded occurrences of vernal pool tadpole shrimp in the CNDDB from 1998 (CNDDB 2015).

Vernal pool habitat is known to occur near Magpie Creek. Alongside the Magpie Creek Diversion Canal, there are some lands which could support vernal pools or vernal pool tadpole shrimp that would be impacted by project construction. At this time, a wetland delineation has not been conducted to verify the occurrence of vernal pools; however, a wetland delineation would occur prior to project construction. Since the ARCF GRR is adopting the design of the 2004 Magpie Creek Flood Control Project, the impacts to vernal pools at this time were assessed based on that project's consultation. The proposed project would result in 0.25-acre of indirect effects to vernal pools/swales of potentially suitable vernal pool tadpole shrimp habitat.

Seasonal wetlands, which may provide suitable habitat for vernal pool invertebrates, occur in the vicinity of the NSS project's Robla woodland mitigation site A, however any vernal pools in this area would be avoided by these activities. With the implementation of at 250-foot buffer between vernal pools and construction activities there would be no direct or indirect impacts from activities at Robla woodland mitigation site A. As a result, any mitigation efforts at the Robla woodland mitigation site would are not likely to adversely affect vernal pool tadpole shrimp.

4.3.8 Western Yellow-Billed Cuckoo

Western yellow-billed cuckoo is Federally listed as threatened. The cuckoo is typically found in riparian forests with dense deciduous trees and shrubs. Over the last 100 years, western cuckoo population declined dramatically due to extensive loss of suitable breeding habitat, primarily riparian forests and associated bottomlands dominated by willow (Salix spp.), cottonwood (Populus spp.), or mesquite (Prosopis spp.) (Gaines and Laymon 1984, Laymon and Halterman 1987, Hughes 1999, Halterman et al. 2001). Once considered a common breeder in California, by 1940 the Yellow-billed Cuckoo suffered severe population reduction and by 1987 was estimated to occupy only 30 percent of its historical range (Laymon and Halterman 1987).

Nesting usually occurs between late June and late July, but can begin as early as late May and continue until late September (Hughes 1999). Nests consist of a loose platform of twigs, which are built by both sexes and take one to two days to build (Hughes 1999), though occasionally the nest of another species is used (Jay 1911, Bent 1940, Payne 2005). There are no recent CNDDB occurrences in the vicinity of the action area, but migrant individuals are likely to pass through the area in transit to breeding sites along the Sacramento River north of Colusa. Cuckoos are unlikely to nest in the study area, although potential dispersal and foraging habitat is present in the American River Parkway and along the Sacramento River.

5.0 Effects of the Proposed Action

5.1 Invertebrates

5.1.1 Valley Elderberry Longhorn Beetle

Effects to valley elderberry longhorn beetle may occur if elderberry shrubs are incidentally damaged by construction personnel or equipment. Impacts may also occur if elderberry shrubs need to be transplanted because they are located in areas that cannot be avoided by construction activities. During the design phase of the project, a site-specific assessment would occur in coordination with County Parks, project stakeholders, and the Services to determine which erosion protection measure is appropriate for each location in the Parkway. This assessment would take into account hydraulic conditions as well as environmental conditions of the site and would avoid and minimize impacts to riparian habitat and elderberry shrubs to the maximum extent practicable within the framework of the proposed project. Impacts that cannot be avoided or minimized would be mitigated, as described in Section 2.5 above.

Potential impacts due to damage or transplantation include direct mortality of beetles and/or disruption of their lifecycle. Since the project would occur over a 10 year period and construction would occur during beetle flight season, there could be direct mortality caused by construction activities. Elderberry shrubs that cannot be avoided would be transplanted between November and mid-February when the plants are doormat. Transplanting procedures will comply with the Conservation Guidelines for the Valley Elderberry Longhorn Beetle, USFWS, 9 July 1999.

Along the American River portion of the project, there is approximately 65 acres of riparian habitat that would be impacted, which includes elderberry shrubs. In this 65 acres, approximately 250 shrubs would be transplanted within the American River Parkway outside of the 15 foot vegetation free zone. The habitat maps in Appendix F show the locations of elderberry shrubs within the Parkway in 2013. Impacts to shrubs would be limited to approximately 40-feet waterward of the levee in most places. While impacts to these 250 shrubs would likely result in adverse effects to VELB, the majority of the shrubs in the Parkway, including the mitigation and restoration sites delineated on the maps in Appendix G, would not be impacted by the project. The majority of the impacts to VELB would occur on the stretch of the American River between Howe and Watt Avenues. Without implementation of compensation within this reach, connectivity of VELB habitat could be adversely impacted by the proposed measures.

Seedlings and native plants could be planted on top of the constructed trench to create similar connectivity as the existing conditions, or on the protected berms above bank protection sites. However, temporal loss of habitat may occur due to transplantation of elderberry shrubs. With transplants, new shrubs, and associated natives installed on the surface of the launchable rock trenches between Howe and Watt Avenues, and other compensation proposed in Section 2.5, connectivity for the beetle would be similar to the existing condition. Although compensation measures include restoration and creation of habitat, mitigation plantings would likely require one or more years to become large enough to provide supporting habitat. Furthermore, associated riparian habitats may take 25 years or longer to reach their full value.

Along the Sacramento River reach of the project, there is approximately 110 acres of riparian habitat that would be impacted, which includes elderberry shrubs. In this 110 acres, approximately 13 elderberry shrubs would be transplanted between November and mid-February. These shrubs would be transplanted to the River Bend Park mitigation site within the American River Parkway, or a new site coordinated with County Parks during the design phase of the project. Additionally, there is some potential for shrubs to be transplanted on site, where space is available, or to potential future mitigation sites in the Sacramento River corridor. Connectivity for the beetle could be affected by the reduction in shrubs if on-site compensation is not possible; however, impacts along this reach of the project are limited to the top half of the levee, which would be degraded in order to construct the slurry wall. The majority of the shrubs in this reach would likely not be located on the levee prism and would remain in place and provide sufficient connectivity.

For the NSS project, elderberry shrubs were not observed along Arcade Creek, NEMDC, or Borrow Site 2 during field surveys. Encroachment removal along Robla Creek would be limited to trimming back residential landscaping from a fence line and would have no potential for adverse impact to any elderberry shrubs, if present nearby. Elderberry shrubs could be present adjacent to potential woodland mitigation sites, including along Robla Creek. However, tree mitigation efforts would occur on open grassland areas and avoid disturbance of elderberry shrubs that may be nearby. Buffers would be established around elderberry shrubs in these areas as described in Section 2.5 above and would be maintained during all encroachment removal and mitigation installation activities. Further, implementation of the avoidance and minimization measures listed in Section 2.5 above would avoid the potential for direct and indirect effects on elderberry shrubs through the establishment of appropriate buffers.

Elderberry surveys done in 2011 by the Corps looked at the project area including the levee itself and 15 feet landside and 15 feet waterside. Only the locations of the shrubs were surveyed in order to get an idea of the magnitude of potential impacts. In order to determine affects to the beetle, detail elderberry shrub surveys from previous projects within the American River Parkway are being used as a representative sample for this project. The previous surveys were completed for other ARCF Projects along the American River Parkway within the project vicinity. These representative samples take into effect all project-related impacts to elderberry shrubs that would require mitigation, including incidental trimming of full stems for the purposes of providing access for project activities. The representative sample calculations are as follows; each shrub contains 13 stems measuring between 1 and 3 inches with no exit holes; 5 stems between 3 and 5 inches with .02 exit holes; and 2 stems greater than 5 inches with .07 exit holes. All shrubs are assumed to be in riparian habitat. Tables 10 and 11 include calculations of stems that would be affected with the implementation of this project and proposed compensation.

Table 10. American River Elderberry Shrub Effects and Proposed Compensation.

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios[1,2]	Elderberry Plantings	Associated Native Planting	Associated Native Ratios
non-riparian	greater than or = 1" & less than or = 3"	No	0	1	0	0	1
		yes	0	2	0	0	2
non-riparian	greater than 3" & less than 5"	No	0	2	0	0	1
		yes	0	4	0	0	2
non-riparian	greater than or = 5"	No	0	3	0	0	1
		yes	0	6	0	0	2
riparian	greater than or = 1" & less than or = 3"	No	1,998	2	3,996	3,996	1
		yes	0	4	0	0	2
riparian	greater than 3" & less than 5"	No	790	3	2,370	2,370	1
		yes	16	6	96	192	2
riparian	greater than or = 5"	No	312	4	1,248	1,248	1
		yes	23	8	184	368	2
TOTAL			**3,139**		**7,894**	**8,174**	
				Calculations:	natives-elderberries	280	
				basins or credits	1,578.8	28	
				total basins or credits=	1,606.8		
					2,892,240		
				total acres need for compensation	66.39669421		

1 Affected elderberry plant minimization ratios based on location, stem diameter, and presence of exit holes

2 Multiply No. of stems by this for planting counts

Table 11. Sacramento River Elderberry Shrub Effects and Proposed Compensation.

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios[1,2]	Elderberry Plantings	Associated Native Plantings	Associated Native ratios
non-riparian	greater than or = 1" & less than or = 3"	No	0	1	0	0	1
		yes	0	2	0	0	2
non-riparian	greater than 3" & less than 5"	No	0	2	0	0	1
		yes	0	4	0	0	2
non-riparian	greater than or = 5"	No	0	3	0	0	1
		yes	0	6	0	0	2
riparian	greater than or = 1" & less than or = 3"	No	104	2	208	208	1
		yes	0	4	0	0	2
riparian	greater than 3" & less than 5"	No	40	3	120	120	1
		yes	1	6	6	12	2
riparian	greater than or = 5"	No	16	4	64	64	1
		yes	2	8	16	32	2
TOTAL			**163**		**414**	**436**	
				Calculations:	natives-elderberries	22	
				basins or credits	82.8	2.2	
				total basins or credits=	85		
					153000		
				total acres need for compensation	3.512396694		

1 Affected elderberry plant minimization ratios based on location, stem diameter, and presence of exit holes
2 Multiply No. of stems by this for planting counts

Operation and Maintenance

As part of long-term O&M, elderberry shrubs will be trimmed by the three levee maintenance districts. Table 12 describes the maximum amount of elderberry acreage that will be trimmed each year as a result of O&M. Trimming consists of cutting overhanging branches along the levee slopes on both the landside and waterside. Some shrubs may be located adjacent to the levee with branches hanging over the levee maintenance road. Up to a third of a shrub will be trimmed in a single season. Trimming will occur between November 1 and March 15. Loss of habitat will be offset through the development of a conservation area as described in the conservation measures below. Each year the local maintaining authority will document the amount of valley elderberry longhorn beetle habitat that they have trimmed and report that number to the Corps to ensure compliance with this biological opinion. If the local maintaining agency has a need to exceed the amount of valley elderberry longhorn beetle habitat which needs to be trimmed or affected due to routine maintenance then they will request the Corps reinitiate consultation on this biological opinion for those actions.

Table 12. O&M Elderberry Shrub Effects and Compensation.

O&M Agency	Annual Acreage Trimmed[1]	Life of Project Acreage[2]
American River Flood Control District	0.5 acre	25 acres
Maintenance Area 9	0.2 acre	10 acres
City of Sacramento	0.1 acre	5 acres

[1] Acreage was estimated based on a measurement of 0.009-acre per every 1/3[rd] of a shrub trimmed.
[2] Life of project is estimated to be 50 years.

5.1.2 Vernal Pool Fairy Shrimp

Effects to vernal pool fairy shrimp associated with the ARCF GRR's proposed Magpie Creek measures were addressed in the 2004 Biological Opinion for the Magpie Creek Flood Control Project (Appendix E).

For the NSS project, seasonal wetland habitat is present in annual grassland north of Robla Creek, including in the eastern portion of Robla woodland mitigation site A. Although riparian planting activities would not directly affect the seasonal wetland habitat, these activities could indirectly affect potentially suitable habitat for vernal pool invertebrates in this area by altering hydrology and/or degrading water quality. These effects could result in temporary loss of individuals, but the population could persist if the habitat is restored to its prior condition. However, implementation of the avoidance and minimization measures listed in Section 2.5 above would avoid and minimize the potential for indirect effects on suitable habitat for vernal pool invertebrates through the establishment of appropriate buffers.

5.1.3 Vernal Pool Tadpole Shrimp

Effects to vernal pool tadpole shrimp associated with the ARCF GRR's proposed Magpie Creek measures were addressed in the 2004 Biological Opinion for the Magpie Creek Flood Control Project (Appendix E).

For the NSS project, seasonal wetland habitat is present in annual grassland north of Robla Creek, including in the eastern portion of Robla woodland mitigation site A. Although riparian planting activities would not directly affect the seasonal wetland habitat, these activities could indirectly affect potentially suitable habitat for vernal pool invertebrates in this area by altering hydrology and/or degrading water quality. These effects could result in temporary loss of individuals, but the population could persist if the habitat is restored to its prior condition. However, implementation of the avoidance and minimization measures listed in Section 2.5 above would avoid and minimize the potential for indirect effects on suitable habitat for vernal pool invertebrates through the establishment of appropriate buffers.

5.2 Fish Species

The assessment of effects on fish considers the potential occurrence of protected species and life stages relative to the location, magnitude, timing, frequency, and duration of project actions. Species habitat attributes potentially affected by project implementation include spawning habitat area and quality, rearing habitat area and quality, migration habitat conditions, and water quality.

Short-term construction related effects on fish species include effects on individuals (e.g., displacement, disruption of essential behaviors, mortality) and immediate, short-term effects on habitat. These short-term effects are evaluated qualitatively and generally mitigated through the use of construction BMPs and limitations on construction windows.

Long-term effects typically last months or years, and generally involve physical alteration of the bank and riparian vegetation adjacent to the water's edge, with consequent impacts upon SRA cover, nearshore cover, and shallow water habitat (Fris and DeHaven 1993).

The operation and maintenance of the bank protection sites would include allowing the vegetation to grow to maturity and provide SRA habitat. There would be no sediment removal or clearing of vegetation along the planted bench after construction. The following statements will be added to the O&M manual once construction is completed to ensure sustainability of the created habitat. Therefore, affects from O&M activities would not be affect listed fish species and are not discussed in detail below.

Trees, either preserved or planted, on the berm within the project footprint of the bank protection site shall not be removed as part of normal maintenance as long as they remain healthy. As unhealthy trees are removed or fall over, any subsequent cavities in the rock must be filled in a timely manner with rock material equal to the surrounding repair. Leave the fallen trees in place.

Mitigation plantings installed on this site shall be left in a natural state. Following successful establishment of the habitat, no additional maintenance such as irrigation or mowing shall be required as a part of normal maintenance.

Soil placed on/in rock as a part of the original repair and all associated vegetation (grasses & woody shrubs/trees) within the footprint of the bank protection site does not require replacement as a part of normal maintenance. In other words if the soil is washed out it does not need to be replaced and re-vegetated.

During typical summer-fall conditions, focus fish species which include salmon, steelhead, green sturgeon, and delta smelt are generally absent in the Sacramento and Yolo Bypass. During winter-spring conditions, assuming inundation, the Yolo Bypass provides a large amount of available floodplain habitat for migration and rearing. Under the "worst case scenario" assumptions, project actions along the Sacramento Bypass levee reach would result in the removal of all trees and vegetation; due to the abundance of floodplain habitat during increased inundation with the widening of the Sacramento Bypass, it is highly unlikely that the loss of these shoreline habitat features would impact overall habitat that would be available and most likely utilized by salmon, steelhead, green sturgeon, and delta smelt in the Sacramento Bypass during winter-spring conditions.

5.2.1 Sacramento River Winter-Run Chinook Salmon

Potential project effects from the actions are described below for each life stage and its habitat. Effects on designated critical habitat are addressed via description of habitat effects for each applicable species.

Construction-Related Effects

Adult Migration

Construction activities may affect but are not likely to adversely affect winter-run adults because construction will avoid the primary migration period (December through July), will be restricted to the channel edge, and will include implementation of the avoidance and minimization measures described in Section 2.5. The work windows for all listed fish species that could be impacted by the project are shown on Table 13 below.

Spawning

Winter-run Chinook salmon do not spawn in the ARCF GRR action area. Therefore, the project will have no effect on winter-run Chinook salmon spawning or spawning habitat.

Juvenile Rearing and Migration

Rearing and emigrating juveniles and smolts may be found in the action area during the fall, winter, and spring. The abundance of juvenile winter-run Chinook salmon moving downstream peaks at Red Bluff in September and October and continues until mid March in drier years (Vogel and Marine 1991). Downstream migration may be triggered by storm events and the resulting high flow and turbidity, although the relative importance of various outmigration cues remains unclear.

Implementation of the bank erosion protection measures may result in adverse effects to juvenile and smolt winter-run Chinook salmon and their critical habitat. Construction activities that increase noise, turbidity, and suspended sediment may disrupt feeding or temporarily displace fish from preferred habitat. Rearing or outmigrating salmon may not be able to readily move away from nearshore areas that are directly affected by construction activities such as placement of rock revetment; these effects could result in stress, injury, or mortality. Take of juvenile or smolt winter-run Chinook salmon could therefore occur via mortality or injury during construction activity, or by the impairment of essential behaviors such as feeding or escape from predators. Substantial increases in suspended sediment could temporarily bury substrates that support benthic macroinvertebrates, an important food source for juvenile salmonids. However, due to the limited duration and spatial extent of project actions, effects on salmonid feeding are expected to be minimal. In addition, spills or leakage of gasoline, lubricants, or other petroleum products from construction equipment or storage containers could result in physiological impairment or mortality to rearing or outmigrating salmon in the vicinity of the project sites. With implementation of best management practices, the impacts due to spills should be minimal.

Restricting in-water activities to the August 1 through November 30 work window (beginning on July 1 for sites upstream of RM 60) and implementing the avoidance and minimization measures described in Section 2.5 will minimize, but may affect and is likely to adversely affect potential construction-related effects on juveniles and smolts.

Table 13. Assumed Life Stage Timing and Distribution of Special Status Fish Species.

Life Stage	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Late Fall–Run Chinook Salmon													
Adult Migration	SF Bay to Upper Sac River and Tributaries	■	■	■	■						■	■	■
Spawning	Upper Sacramento River and Tributaries	■	■	■	■								
Egg Incubation	Upper Sacramento River and Tributaries	■	■	■	■	■							
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■	■	■	■	■
Smolt Outmigration	Sacramento River and tributaries, Delta	■	■	■	■	■						■	■
Juvenile Movement and Rearing	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■	■	■	■	■
Fall-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries						■	■	■	■	■	■	■
Spawning[1]	Upper Sacramento River and Tributaries									■	■	■	■
Egg Incubation[1]	Upper Sacramento River and Tributaries	■	■								■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■								■	■
Smolt Outmigration	Sacramento River and tributaries, Delta			■	■	■	■	■					
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay		■	■	■	■	■						
Spring-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries			■	■	■	■	■	■	■			
Spawning	Upper Sacramento River and Tributaries								■	■	■		
Egg Incubation	Upper Sacramento River and Tributaries								■	■	■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■	■	■	■	■
Smolt Outmigration	Sacramento River and tributaries, Delta	■	■	■	■	■	■					■	■
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay	■	■	■								■	■
Winter-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River	■	■	■	■	■	■						■
Spawning	Upper Sacramento River				■	■	■	■	■				
Egg Incubation	Upper Sacramento River				■	■	■	■	■	■	■		
Juvenile Rearing (Natal Stream)	Upper Sacramento River to SF Bay	■	■	■	■	■		■	■	■	■	■	■
Smolt Outmigration	Sacramento River and tributaries, Delta	■	■	■						■	■	■	■
Juvenile Movement and Rearing	Upper Sacramento River to SF Bay	■	■	■	■	■	■	■	■	■	■	■	■
Central Valley Steelhead													
Adult Migration	SF Bay to Upper Sacramento River and Tributaries	■	■					■	■	■	■	■	■
Spawning	Upper Sacramento River and Tributaries	■	■	■	■								■
Egg Incubation	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■				■
Juvenile Rearing	Upper Sacramento River and Tributaries to SF Bay	■	■	■	■	■	■	■	■	■	■	■	■
Smolt Outmigration	Sacramento River and tributaries, Delta	■	■	■	■	■							■

Life Stage	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay												
Delta Smelt													
Adult Migration	Delta												
Spawning	Delta, Suisun Marsh												
Larval and Early Juvenile Rearing	Delta, Suisun Marsh												
Estuarine Rearing: Juveniles/Adults	Lower Delta, Suisun Bay												
Green Sturgeon													
Adult Migration	Delta to Upper Sacramento River and Tributaries												
Spawning	Upper Sacramento River and Tributaries												
Egg Incubation	Upper Sacramento River and Tributaries												
Juvenile Movement and Rearing	Sacramento River and Tributaries to SF Bay												

Notes: SF Bay = San Francisco Bay.
[1] Spawning and incubation occurs from October to February in the Feather, American, and Mokelumne Rivers
Sources: Brown 1991; Wang and Brown 1993; U.S. Fish and Wildlife Service 1996; McEwan 2001; Moyle 2002; Hallock 1989; U.S. Army Corps of Engineers 2006.

Long-Term Effects

The ARCF GRR action area does not support spawning habitat for winter-run Chinook salmon, therefore the projects long-term effects will have no effect to spawning habitat.

Winter-run Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River Standard Assessment Methodology (SAM) and American River SAM analysis reach over the lifetime of the project (Appendix B). Figures 22 through 24 below show the long term condition changes at a typical bank protection site over 10 years. Chinook salmon should exhibit a positive response by year 5. Short term habitat deficits are expected within the recommended recovery period for Chinook salmon. The maximum habitat deficit identified is -1,291 ft for the juvenile migration life stage of Spring-run Chinook salmon in the fall of year 11. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions.

Winter-run Chinook salmon are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Winter-run Chinook salmon should exhibit a negative response by year 1. The maximum habitat deficit identified is -188 ft for the juvenile migration life stage of Winter-run Chinook salmon in the spring of year 2. Short term and long term habitat deficits will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir.

Figure 22. Bank Protection Site R4 in Planting Year 2001 on the American River.

Figure 23. Bank Protection Site 4R in 2005

Figure 24. Bank Protection Site 4R in 2010.

5.2.2 Central Valley Spring-Run Chinook Salmon

Potential project effects for spring-run Chinook salmon are described below for each life stage and its habitat, including effects on designated critical habitat.

<u>Construction-Related Effects</u>

Adult Migration

Adult spring-run Chinook salmon migrate up the Sacramento River from March through September although most individuals have entered tributary streams by mid-June and will not be affected by construction activities. Therefore, potential for construction-related ARCF GRR project effects will be similar to that described for winter-run Chinook salmon.

Spawning

Spring-run Chinook salmon do not spawn in the ARCF GRR action area. Therefore, the project will have no effect on spring-run Chinook salmon spawning or spawning habitat.

Juvenile Rearing and Migration

Similar to winter-run Chinook salmon, spring-run Chinook salmon typically spend up to 1 year rearing in fresh water before migrating to sea. Therefore, potential for construction-related effects will be similar to that described for winter-run Chinook salmon above.

Restricting in-water activities to the August 1 through November 30 work window and implementing the avoidance and minimization measures described in Section 2.5 will minimize, but may affect and is likely to adversely affect potential construction-related effects on juveniles and smolts.

<u>Long-Term Effects</u>

The ARCF GRR area does not support spawning habitat for spring-run Chinook salmon, therefore the projects long-term effects will have no effect to spawning habitat.

Spring-run Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River SAM and American River analysis reaches over the lifetime of the project (Appendix B). Figures 22 through 24 show the long term condition changes at a typical bank protection site over 10 years. Spring-run Chinook salmon should exhibit a positive response by year 5. Short term habitat deficits are expected within the recommended recovery period for spring-run Chinook salmon. The maximum habitat deficit identified is -1,440 feet for the juvenile migration life stage of spring-run Chinook salmon in the summer of year 10. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions. For juvenile spring-run Chinook salmon, the bank protection measures will generally provide long-term increases in bank shading at project sites. The plantings of native grasses and willows are designed to benefit juvenile Chinook salmon by increasing the availability (habitat area) and quality (shallow water and instream cover) of nearshore aquatic habitat and SRA relative to current conditions. Long term effects may affect but are not likely to adversely affect critical habitat for spring-run Chinook salmon juvenile rearing and migration.

Spring–run Chinook salmon are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a negative response by year 1. The maximum habitat deficit identified is -188 feet for the juvenile migration life stage of spring-run Chinook salmon in the spring of year 2. Short term and long term habitat deficits will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir.

5.2.3 Central Valley Steelhead

Potential project effects for steelhead are described below for the relevant life stages and their habitat, including effects on designated critical habitat.

Construction-Related Effects

The levees along NEMDC are devoid of any tall vegetation or instream woody material and subsequently, construction activities would be approximately 100 feet from the east levee toe, outside of the wetted channel. As a result, the NSS levee improvements would not result in construction-related effects to steelhead.

Adult Migration

In the Sacramento River, adult steelhead migrate upstream during most months of the year, beginning in July, peaking in September, and continuing through February or March. Adults use the river channel in the action area as a migration pathway to upstream spawning habitat, and may also use deep pools with instream cover as resting and holding habitat. The potential for construction-related effects on migrating adult steelhead would be similar to that described above for adult winter-run Chinook salmon with the determination being that the construction-related activities may affect but are not likely to adversely affect adult migration.

Spawning

Within the ARCF GRR action area, potential spawning habitat is present in the American River, NEMDC, and Dry/Robla Creek. Steelhead spawn in late winter and late spring outside of the August 1-November 30 construction window; therefore, construction-related effects may affect but are not likely to adversely affect steelhead spawning or their spawning habitat.

Juvenile Rearing and Migration

Central Valley steelhead rear year-round in the cool upstream reaches of the mainstem Sacramento River and its major tributaries. Juveniles and smolts are most likely to be present in the action area during their downstream migration to the ocean, which may begin as early as December and peaks from January to May. The importance of main channel and floodplain habitats in the lower Sacramento River to rearing steelhead is becoming more understood.

Steelhead smolts have been found in the Yolo Bypass during the period of winter and spring inundation (Sommer 2002). Sommer et al. (2001) found that Juvenile Chinook salmon that reared within a large, engineered floodplain of the Sacramento River (the Yolo Bypass) had higher rates of growth and survival than fish that reared in the main-stem river channel during their migration. For purposes of this analysis, rearing juvenile steelhead are assumed to use nearshore and off-channel habitat in the action area. The potential for construction-related effects on steelhead juveniles and smolts and their habitat will therefore be similar to that described above for winter-run Chinook salmon which may affect and is likely to adversely affect.

Long-Term Effects

Steelhead are expected to show a long term positive response to project actions in the Sacramento River SAM and American River SAM analysis reaches over the lifetime of the project (Appendix B). Figures 22 through 24 show the long term condition changes at a typical bank protection site over 10 years. Steelhead should exhibit a positive response by year 5. Short term habitat deficits are expected within the recommended recovery period for Steelhead. The maximum habitat deficit identified is -1,330 ft for the juvenile migration life stage of Steelhead in the fall of year 11. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions.

Steelhead are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Steelhead should exhibit a negative response by year 1. The maximum habitat deficit identified is -174 ft for the juvenile migration life stage in the spring of year 2. Short term and long term habitat deficits will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir.

The NSS project would result in long-term indirect effects on steelhead through modification of riparian and aquatic habitat, including channel bed and bank substrate. Additionally, SRA habitat would be impacted through the removal of approximately 5 trees. These impacts would be unlikely to adversely affect steelhead with the implementation of the measures described in Section 2.5 above.

5.2.4 Delta Smelt

Primary Constituent Elements

In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation (50 CFR 424.12[b]). The Service is required to list the known primary constituent elements together with a description of any critical habitat that is proposed. Such physical and biological features (i.e., primary constituent elements) include, but are not limited to, the following:

- Space for individual and population growth, and for normal behavior;
- Food, water, air, light, minerals, or other nutritional or physiological requirements;
- Cover or shelter;
- Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and
- Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The primary constituent elements essential to the conservation of the delta smelt are physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration (NMFS 1994a).

Spawning Habitat

Delta smelt adults seek shallow, fresh or slightly brackish backwater sloughs and edgewaters for spawning. To ensure egg hatching and larval viability, spawning areas also must provide suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (e.g., submerged tree roots and branches and emergent vegetation). Specific areas that have been identified as important delta smelt spawning habitat include Barker, Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore sloughs and the Sacramento River in the Delta, and tributaries of northern Suisun Bay. The spawning season varies from year to year and may start as early as December and extend until July (NMFS 1994a).

Larval and Juvenile Transport

To ensure that delta smelt larvae are transported from the area where they are hatched to shallow, productive rearing or nursery habitat, the Sacramento and San Joaquin Rivers and their tributary channels must be protected from physical disturbance (e.g., sand and gravel mining, diking, dredging, and levee or bank protection and maintenance) and flow disruption (e.g., water diversions that result in entrainment and in-channel barriers or tidal gates). Adequate river flow is necessary to transport larvae from upstream spawning areas to rearing habitat in Suisun Bay. Additionally, river flow must be adequate to prevent interception of larval transport by the State and Federal water projects and smaller agricultural diversions in the Delta. To ensure that suitable rearing habitat is available in Suisun Bay, the 2 ppt isohaline must be located westward of the Sacramento-San Joaquin River confluence during the period when larvae or juveniles are being transported, according to the historical salinity conditions which vary according to water-year type. Reverse flows that maintain larvae upstream in deep-channel regions of low productivity and expose them to entrainment interfere with these transport requirements. Suitable water quality must be provided so that maturation is not impaired by pollutant concentrations. The specific geographic area important for larval transport is confined to waters contained within the legal boundary of the Delta, Suisun Bay, and Montezuma Slough and its tributaries. The specific season when habitat conditions identified above are important for successful larval transport varies from year to year, depending on when peak spawning occurs and on the water-year type. The Service identified situations in the biological opinion for the delta smelt (1994) where additional flows might be required in the July-August period to protect delta smelt that were present in the south and central Delta from being entrained in the State and Federal project pumps, and to avoid jeopardy to the species. The long-term biological opinion on CVP-SWP operations will identify situations where additional flows may be required after the February through June period identified by EPA for its water quality standards to protect delta smelt in the south and central Delta (USFWS 1994).

Rearing Habitat

Maintenance of the 2 ppt isohaline according to the historical salinity conditions described above and suitable water quality (low concentrations of pollutants) within the Estuary is necessary to provide delta smelt larvae and juveniles a shallow, protective, food-rich environment in which to mature to adulthood. This placement of the 2 ppt isohaline also serves to protect larval, juvenile, and adult delta smelt from entrainment in the State and Federal water projects. An area extending eastward from Carquinez Strait, including Suisun Bay, Grizzly Bay, Honker Bay, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three Mile Slough, and south along the San Joaquin River including Big Break, defines the specific geographic area critical to the maintenance of suitable rearing habitat. Three Mile Slough represents the approximate location of the most upstream extent of tidal excursion when the historical salinity conditions described above are implemented. Protection of rearing habitat conditions may be required from the beginning of February through the summer (USFWS 1994).

Adult Migration

Adult delta smelt must be provided unrestricted access to suitable spawning habitat in a period that may extend from December to July. Adequate flow and suitable water quality may need to be maintained to attract migrating adults in the Sacramento and San Joaquin River channels and their associated tributaries, including Cache and Montezuma sloughs and their tributaries. These areas also should be protected from physical disturbance and flow disruption during migratory periods (USFWS 1994).

Construction-Related Effects

Delta smelt in the Sacramento River have been documented upstream as far as the city of Sacramento (RM 60) (Moyle 2002), and may be present throughout their life cycle. Potential project effects are described below for relevant life stages and their habitats, including effects on designated critical habitat.

Adult Migration

Adult Delta smelt migrate upstream between December and January and spawn between January and July, with a peak in spawning activity between April and mid-May (Moyle 2002). Potential construction-related effects to physical habitat, water, river flow, and salinity concentrations for migrating adult Delta Smelt will be avoided or minimized by restricting in water construction activities on the Sacramento River to the August 1 through November 30 work window allowing for unrestricted access to suitable and important spawning habitat. If there is any change in effect due to construction constraints outside the work window, consultation will be initiated. Construction-related effects may affect but are not likely to adversely affect adult migration.

Spawning

Potential spawning habitat includes shallow channel edge waters in the Delta and Sacramento River. Specific areas that have been identified below the ARCF GRR project area as important delta smelt spawning habitat include Barker, Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore sloughs and the Sacramento River in the Delta, and tributaries of northern Suisun Bay. As a result, potential construction-related effects to delta smelt physical habitat would include disruption of spawning activities, disturbance or mortality of eggs and newly hatched larvae, alteration of spawning and incubation habitat, and loss of shallow water habitat for spawning.

The erosion repair is likely to somewhat reduce the sediment supply for riverine reaches directly downstream because the erosion repair is holding the bank or levee in place. However, from a system sediment prospective, the bank material we are protecting in the project reaches is not a major source of sediment compared to the upstream reaches of the Sacramento, Feather, and especially the Yuba River systems. All of the available sediment in the American River watershed is being contained behind

Folsom Dam. The site specific designs will be constrained from allowing any velocity increases outside the erosion repair site (Schlunegger 2014).

In response to a USFWS request for more data on July 23, 2014, the Corps conducted an analysis of existing shallow water habitat in the ARCF GRR project area, and the effect of the proposed project on that habitat. The results of this analysis are included as Appendix C to this report. This analysis was based on a cross section geometry with the assumption that the sediment or sand will be converted to rock revetment. The conclusion of the analysis was that approximately 14 acres of shallow water habitat would be permanently lost as a result of implementation of the ARCF GRR with 46 acres of spawning habitat being affected by a long-term change in substrate from sand to rock. The footprint could be minimized as site-specific designs are developed during the PED phase of the project and will be further coordinated with USFWS at that time. Compensation would involve the purchase of 42 credits of shallow water habitat replacement and 32 credits to compensate for the permanent change in spawning substrate at a USFWS-approved mitigation bank.

Construction-related effects on delta smelt spawning and incubation will be minimized by restricting in-water construction activities on the Sacramento River and Sacramento Weir and Bypass to the August 1 through November 30 work window, thereby avoiding the seasons when spawning is most likely to occur, however construction activities may affect and is likely to adversely affect delta smelt spawning habitat.

Juvenile Rearing and Migration

Juvenile delta smelt may be subject to disturbance or displacement caused by construction activities that would alter physical habitat, water, and river flow in the form of increased noise, turbidity, and suspended sediment. Delta smelt may not be readily able to move away from channel or nearshore areas that are directly affected by construction activities (i.e., removal or placement of instream woody material, placement of rock revetment). Larvae may be disrupted during summer months as they migrate downstream to rear in the Delta. Incidental take of delta smelt may occur from direct mortality or injury during a construction activity, or by the impairment of essential behavior patterns (i.e., feeding, escape from predators). Salinity concentrations would not be affected by the construction activity. Construction-related effects on delta smelt rearing and migration will be minimized by restricting in-water construction activities on the Sacramento River to the August 1 through November 30 work window, thereby avoiding the seasons when these life stages are most likely to occur. Construction-related activities may affect and is likely to adversely affect juvenile rearing and migration.

Long-Term Effects

Non-native species may exploit the warmer water temperature in the shallow bench habitat created as an on-site mitigation feature and prey on delta smelt eggs and larvae; however, bench habitat would most likely not bring in more predatory fish that don't already exist in the project area. A 2013 long-term aquatic monitoring program draft report by FishBio for the Corps noted that Black bass (largemouth and smallmouth bass) have the highest probability of habitat occupancy at both Sacramento River Bank Protection Project (SRBPP) sites with bench features and sites with no bench features. Unlike previous years, when highest bass abundance was typically associated with wetland trench designs (not included in the suite of monitored sites in 2013), the highest likelihood of encountering black bass was observed at no bench and bench sites, in particular those near rivermile 70, well above the project area (Corps 2013b). Proposed planting of emergent vegetation will enhance habitat complexity by providing cover and incubation habitat, especially during high winter and spring flows.

5.2.5 Green Sturgeon

Potential project effects are described below for each life stage of green sturgeon and its habitat. An accurate assessment of potential project effects on green sturgeon and its habitat is difficult due to the limited information available on distribution, seasonal abundance, habitat preferences, and other life history requirements of this species.

Construction-Related Effects

Adult Migration

Adult green sturgeon are believed to move upstream through the Sacramento River ARCF action area from February through late July (NMFS 2005c). Construction activities occurring outside of these time periods are not likely to affect migrating green sturgeon adults. Construction activities during July, however, may have adverse impacts on any adult green sturgeon that are still migrating upstream. Because construction activities will largely avoid the peak migration period, will be restricted to the channel edge, and will implement the avoidance and minimization measures described in Section 2.5, construction-related activities may affect but are not likely to adversely affect adult migration.

Spawning

Spawning migrations of Green Sturgeon typically occur during the months of March through June (Thomas et al. 2013). The Sacramento River downstream of Knights Landing (RM 90) is not believed to have suitable spawning habitat for green sturgeon, primarily due to lack of suitable coarse bottom substrate such as large cobbles (Corps 2012). Therefore, the ARCF GRR project will have no affect on spawning green sturgeon or their habitat.

Juvenile Rearing and Migration

Based on general knowledge of green sturgeon life history, larvae may occur in the Sacramento River and Delta shortly after spawning, from February through late July (peak spawning from April through June) (Emmett et al. 1991 as cited in Moyle 2002). Restricting in-water construction activities to the August 1 through November 30 work window and implementing the avoidance and minimization measures described in Section 2.5, will minimize potential impacts of in-water construction activities on green sturgeon larvae. However, if larvae or juveniles are present during construction, in-water activities could result in localized displacement and possible injury or mortality to individuals that do not readily move away from the channel or nearshore areas. Project actions associated with bank protection measures may increase sediment, silt, and pollutants, which may affect and is likely to adversely affect rearing habitat or reduce food production, such as aquatic invertebrates, for larval and juvenile green sturgeon.

Widening of the weir and bypass will increase the entrainment and stranding exposure and rates of juveniles. When the weir is overtopping and water is flowing down the bypass, adult fish are attracted to the flow and follow it upstream in an attempt to reach their holding and spawning habitat. Widening the weir and bypass would increase the amount of water going over the weir and increase the attraction rate of sturgeon, salmon, and steelhead. Without fish passage in place, the stranding rates of these fish would increase. This is significant, especially for sturgeon. Population viability modeling, funded in part by the Corps, concluded that without the fish rescue that took place, the loss of the green sturgeon stranded behind the Fremont and Tisdale weirs in 2011 would have significantly reduced the viability the species and increased their extinction risk (Thomas, et. al, 2013). We believe that because of its location and design, the Sacramento weir poses a similar risk and widening the weir would add to the effect. Given that green sturgeon are long-lived species that have the strongest upstream migration and cohort replacement rates during wet water years and especially after high river flow conditions, the effect of the stranding occurring only two to three times over a 50 year period could adversely impact juvenile green sturgeon.

Long-Term Effects

SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species. SAM values for green sturgeon generally indicate a negative response or no response to typical onsite mitigative features. Green sturgeon are expected to show long term negative response to project actions in the Sacramento River SAM analysis reach for several life stages at all seasonal habitat conditions over the lifetime of the project. Project actions in the American River SAM analysis reach will also mimic SRBPP repair site onsite mitigative features. SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species; green sturgeon will exhibit a negative response for juvenile rearing in the summer/fall to these onsite mitigative features. However, during the winter/spring green sturgeon juvenile rearing life stages will exhibit a positive response to these onsite mitigative features. Green Sturgeon are expected to show a long term positive response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project for the fry and juvenile rearing life stages in the winter/spring/summer/fall of year 1 (See Appendix B of the ARCF GRR BA for a more detailed analysis).

Long-term changes in nearshore habitat are expected to have negligible effects on adult green sturgeon because adult sturgeon use deep, mid-channel habitat during migration. If juvenile green sturgeon use nearshore areas of the Sacramento River as foraging habitat or refuge from predators, the general long-term effects of bank protection on nearshore habitat values may affect, and is likely to adversely affect rearing juvenile green sturgeon critical habitat.

5.3 Giant Garter Snake

Much of the project area is unlikely to provide GGS aquatic habitat because it consists of larger rivers and flood control features, often surrounded by riparian vegetation and steep banks. GGS have not been documented in the east side tributaries (CDFW 2014), and historical habitat conditions are thought to have limited dispersal of the species east of NEMDC (E. Hansen, pers. comm., 2015). Based on these factors and current habitat conditions, such as close proximity to urban development, high levels of human disturbance, scarcity of upland habitat, and riparian vegetation along the banks of most channel reaches, GGS are unlikely to occur in the east side tributaries and the southern portion of NEMDC. Therefore, all proposed project elements that would occur in these areas are unlikely to directly or indirectly impact GGS or adversely affect habitat occupied by the species.

The quality of habitat for GGS improves along NEDMC north of Dry Creek, where aquatic habitat is more extensive, very little riparian vegetation is present, urban development is less extensive, and large areas of open grasslands are present landside of the levees. GGS are known to occur in rice fields, associated canals, and managed marshes in the Natomas Basin. Additionally, the Sacramento Bypass is considered GGS habitat.

<u>Short-Term Effects</u>

There is the potential for short-term effects to GGS upland habitat during construction of the Sacramento Bypass widening. Construction activities could disturb GGS due to vibration, noise, and dust. During construction, equipment could possibility harm or kill a snake if the snakes are present. In addition to these short-term construction related effects, there would be temporary impacts to approximately 25 acres of aquatic GGS habitat and 50 acres of upland habitat from the relocation of the Sacramento Bypass levee toe drain. To minimize potential impacts to GGS, the avoidance and minimization measures discussed in Section 2.5 above would be implemented. These short-term effects are anticipated to occur over a single construction season and would return to the pre-existing conditions once completed. If construction were to occur in GGS habitat areas for more than one construction season, then additional mitigation would be required in accordance with the measures discussed in Section 2.5 above.

Based on habitat conditions and known occurrences of giant garter snake, NSS project's Borrow Site 2 is located immediately east of NEMDC and supports suitable upland habitat for GGS. If GGS are present during borrow activities, these activities would result in direct and indirect effects to this species. Approximately 5.5 acres of GGS upland habitat would be impacted by the borrow activities. Ground disturbing activities at Borrow Site 2, where uplands adjacent to suitable aquatic habitat would be disturbed, could result in direct displacement, injury, or death of snakes if the habitat is used for basking, hibernating, or aestivating. Indirect effects could occur if snakes are displaced from occupied habitat or disturbed by nearby construction activities. Displacement and disturbance resulting from human activity, construction noise, and equipment vibrations could affect the ability of snakes to conduct essential life history functions, such as dispersal, movement, or foraging, and could result in increased competition for food and space and vulnerability to predation.

However, all project-related impacts at Borrow Site 2 would occur within one active season and, therefore, are considered temporary. Borrow Site 2 would be restored/enhanced and re-graded to a condition that exceeds the pre-project condition by lowering the land surface closer to the low flow channel elevation and through establishment of a more diverse mosaic of aquatic and wetland habitat components. Additionally, with the implementation of the proposed avoidance and minimization measures discussed in Section 2.5, the use of Borrow Site 2 may affect, but is not likely to adversely affect GGS.

Table 14. Impacts to Giant Garter Snake Habitat.

Location	**Area of Impact (acres) / Impact Type**
NEMDC/NSS Borrow Site 2	5.5 acres / Temporary Upland
Sacramento Bypass Drainage Ditches/Irrigation Canals	15 acres / Permanent Aquatic 30 acres / Permanent Upland
Sacramento Bypass Levee Toe Drain	25 acres / Temporary Aquatic 50 acres / Temporary Upland
Total Impacts to GGS Habitat	**Permanent Aquatic - 15 acres** **Permanent Upland – 30 acres** **Temporary Aquatic – 25 acres** **Temporary Upland – 55.5 acres**

Long-Term Effects

GGS habitat at the NSS Borrow Site 2 would be restored to pre-project conditions, resulting in no long-term loss of upland GGS habitat in this portion of the project area. The Borrow Site will be planted to create freshwater marsh and seasonal wetland habitat, which will provide mitigation for potential unavoidable impacts to jurisdictional wetland habitat occurring during the North Sacramento

Streams Levee Improvement Project. Upland areas disturbed during borrow activities will be seeded with native perennial grasses.

In the Sacramento Bypass, there would be a permanent loss of approximately 15 acres of GGS aquatic habitat from the removal of the drainage ditches and farm canals in the extended Bypass area and approximately 30 acres of associated upland habitat. Compensation would occur through the purchase of credits at a USFWS-approved mitigation bank. This compensation would be in accordance with the ratios established in Section 2.5.

Additionally, since the land within the expanded bypass area would be removed from agricultural production and added to the wildlife area, there is the potential for wetlands to form in this area, which could improve the habitat conditions of the area long term. Long-term adverse impacts could result from O&M activities. These activities include mowing, rodent control, and grouting any new rodent holes that form in the new levee. Additionally, driving near habitat could disturb GGS due to vibration, noise, and dust. Maintenance activities would occur during the GGS active season to reduce impacts to the snake. Overall, these activities are considered less than significant, because they are short term activities and because O&M reduces the potential impacts associated with future levee repairs.

Operation of the expanded Sacramento Weir and Bypass was described in Section 2.2.6 above, and would result in an increase of water surface elevation of approximately 0.5-foot on the levee slopes on either side of the Yolo Bypass. However, when this increase would occur, during a 200-year flood event, the Yolo Bypass levees already contain water up to a 21 foot depth. As a result, GGS burrows would likely already be saturated before the additional water associated with the widened Sacramento Bypass is a factor. The additional 0.5-foot resulting from this action would not significantly change the timing or duration of this flooding and would not result in further impacts to GGS habitat. As a result, operation of the widened Sacramento Weir and Bypass may affect, but is not likely to adversely impact the GGS.

5.4 Western Yellow-Billed Cuckoo

The project area is unlikely to support western yellow-billed cuckoo nesting habitat. However, migrant individuals are likely to pass through the area in transit to breeding sites along the Sacramento River north of Colusa. Overall, cuckoos are unlikely to occur in the action area, although potential dispersal and foraging habitat is present in the American River Parkway and along the Sacramento River.

Short-Term Effects

Prior to construction, surveys would be conducted to determine the presence of cuckoos within the project area in accordance with any required USFWS survey protocols and permits at the time of construction. If cuckoos are determined to be present, there is the potential for short term, temporary impacts during construction from dust, noise, and vibration. However, since construction would occur in the summer months when the cuckoo is nesting (June 1 through September 30), and cuckoos are unlikely to be nesting in the study area, these effects would not adversely effect the species. If cuckoos are determined to the present prior to construction, the Corps would reinitiate consultation in order to coordinate the appropriate avoidance and minimization measures that should be implemented in order to reduce impacts to the cuckoo.

Long-Term Effects

Potential long-term effects to the cuckoo could result from the loss of 65 acres of riparian habitat in the footprint of the rock trench sites within the American River Parkway. For the American River, impacts to trees would be the width of the launchable rock trenches (currently proposed at approximately 40-feet wide) for a total of approximately 65 acres. This habitat is suitable for the yellow-billed cuckoo due to the significant width of the riparian corridor along the American River Parkway, ranging from approximately 75 feet in some of the more narrow stretches to over 1,000 feet in other locations. The Corps would compensate for riparian vegetation removed as a result of construction within the Parkway and on-site to the maximum extent practicable. There would remain a significant temporal loss of riparian habitat for the cuckoo during their migration, however in time it is anticipated that with the implementation of the compensation proposed by the Corps, the riparian corridor would recover and would provide a suitable level of habitat for the cuckoo long-term.

Additionally, approximately 70 acres of riparian habitat would be impacted along the Sacramento River; however the Sacramento River's riparian corridor is very narrow (approximately 100 feet wide in most locations) and would not likely provide quality habitat for the cuckoo, who require a minimum of 20 hectares of riparian corridor to nest. However, they are expected to use this area as a migration corridor. Impacts to riparian vegetation along the Sacramento River could remove approximately a 60-foot wide segment of the 100-foot wide riparian corridor. However, with the implementation of on-site mitigative features associated with the construction of the bank protection, as described in Section 2.2.3, the project would add an additional 25-foot wide corridor of SRA/riparian vegetation along the river bank. The result would be a remaining impact of approximately 35 feet of riparian corridor loss, or approximately 40 acres. This remaining impact would be compensated either through the creation of off-site mitigation near the Sacramento River, or through the purchase of credits from a USFWS-approved mitigation bank. With the implementation of compensation for the loss of riparian habitat, the long-term effect of the removal of riparian vegetation along the Sacramento and American Rivers may affect, but is not likely to adversely affect the western yellow-billed cuckoo.

5.5 Ongoing Project Actions

As described in Section 2.5, in-water construction work will be completed during established work windows for salmonids and delta smelt. Maintenance activities may occur year-round in the dry areas. Effects from on-going activities (e.g., maintenance) are expected to be similar to effects described in Section 5.2, although the effects' magnitudes will be less.

5.6 Effects on the Environmental Baseline

Effects of the proposed action include reductions in nearshore aquatic and riparian habitat that is used by aquatic and terrestrial species. Placement of revetment on earthen banks alters natural fluvial processes that sustain high-value nearshore and floodplain habitats in alluvial river systems.

5.7 Effects on Essential Elements of Critical Habitat

The project actions may adversely modify designated critical habitat for the valley elderberry longhorn beetle, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and green sturgeon. Any project action within the Sacramento River waterway from the confluence of the American River downstream to Freeport RM 46 may also affect designated critical habitat for delta smelt (USFWS 2003). Potential impacts of the project actions on critical habitat for listed species are discussed separately for each species in the effects analysis discussion above (Sections 5.1 to 5.3).

5.8 Cumulative Effects

5.8.1 ESA Cumulative Effects Analysis

The ESA requires the action agency, NMFS, and USFWS to evaluate the cumulative effects of the proposed actions on listed species and designated critical habitat, and to consider cumulative effects in formulating Biological Opinions (USFWS and NMFS 2002c). The ESA defines cumulative effects as "those effects of future State or private actions, not involving Federal activities that are reasonably certain to occur within the action area" of the proposed action subject to consultation (USFWS and NMFS 2002b). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Federal ESA. For the purposes of this BA, the area of cumulative effects analysis is defined as the Sacramento River watershed.

A number of other commercial and private activities, including hatchery operations, timber harvest, recreation, as well as urban and rural development, could potentially affect listed species in the Sacramento River basin. Levee maintenance activities by state agencies and local reclamation districts are likely to continue, although any effects on listed species will be addressed through Section 10 of the ESA. Ongoing non-federal activities that affect listed salmonids, green sturgeon, delta smelt, valley elderberry longhorn beetle, giant garter snake and their habitat, will likely continue in the short-term, at intensities similar to those of recent years. However, some activities associated with the State's proposed Central Valley Flood Protection Plan or state or local efforts to implement the ETL could result in increased effects on listed species. The extent and pace of those activities are not yet known.

Cumulative effects may also include non-federal rock revetment projects. Some non-federal rock revetment projects carried out by State or local agencies (e.g., reclamation districts) that do not fill wetlands or occur above the ordinary high water line will not need Section 404 (Clean Water Act) permits from the Corps and resulting Section 7 (ESA) consultation, but any effects on listed species should be addressed through Section 10 of the ESA. These types of actions are possible at many locations throughout the ARCF action area and could contribute to cumulative impacts to waters of the U.S. These impacts could include similar effects to those associated with the ARCF proposed bank protection measure, including loss of Delta smelt shallow water and spawning habitat, loss of green sturgeon benthic habitat, loss of SRA habitat, and loss of riparian habitat along the Sacramento and American River corridors. Without appropriate mitigation, these effects would contribute to an adverse effect on these species. However, since the ARCF project is proposing to restore impacted SRA and riparaian habitat and compensate for any permanent loss of in-water habitat, the ARCF project would not be expected to combine to create an adverse cumulative effect with these actions.

Potential cumulative effects on fish may include any continuing or future non-federal diversions of water that may entrain adult or larval fish or that may incrementally decrease outflows, thus changing the position of habitat for these species. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses and power production. Several new diversions are in various stages of action. The introduction of exotic species may also occur under numerous circumstances. Exotic species can displace native species that provide food for larval fish.

Potential cumulative effects on all species addressed in this BA could include: wave action in the water channel caused by boats that may degrade riparian and wetland habitat and erode banks; dumping of domestic and industrial garbage; land uses that result in increased discharges of pesticides, herbicides, oil, and other contaminants; and conversion of riparian areas for urban development. In addition, routine vegetation clearing and mowing associated with agricultural practices may affect or remove habitat for the valley elderberry longhorn beetle and giant garter snake.

5.8.2 Federal Cumulative Effects Analysis

While cumulative effects analyses in ESA consultations are specifically to address non-federal actions as explained above, the following cumulative analysis of Federal actions is being provided to inform the agencies of federal actions affecting listed species in the general local area. The Corps has initiated consultation with USFWS and NMFS on four different Federal actions which could create a cumulative effect on listed species in the Sacramento area. These four projects include the West Sacramento Project, the Southport Early Implementation Project, the American River Common Features Project (including the North Sacramento Streams project), and the Sacramento River Bank Protection Project (SRBPP).

The purpose of the West Sacramento Project is to investigate and determine the extent of Federal interest in plans that reduce flood risk to the City of West Sacramento. The proposed alternative for this project consists of levee improvements to 50 miles of existing levees surrounding the city and extending down along the Sacramento Deep Water Ship Channel to address identified seepage, stability, and erosion concerns through the construction of slurry walls and bank protection. In addition, the project proposes to set back the Sacramento River levee in the Southport area of West Sacramento. The West Sacramento Project includes the geographic area and project features that are also being considered in the Southport Early Implementation Project. The Southport Early Implementation Project is being proposed by the West Sacramento Area Flood Control Agency and the State of California to provide 200-year protection consistent with the State's goal for urbanized areas, as well as to provide opportunities for ecosystem restoration and public recreation. The Southport Early Implementation Project's proposed alternative includes the Sacramento River setback levee in the Southport area of West Sacramento. The Southport project is planned to begin construction in 2015.

The SRBPP was authorized to protect the existing levees and flood control facilities of the SRFCP. The SRBPP is a long-range program of bank protection authorized by the Flood Control Act of 1960. The SRBPP directs the Corps to provide bank protection along the Sacramento River and its tributaries, including that portion of the lower American River bordered by Federal flood control project levees. Beginning in 1996, erosion control projects at five sites covering almost two miles of the south and north banks of the lower American River have been implemented. Additional sites at RM 149 and 56.7 on the Sacramento River totaling one-half mile have been constructed since 2001. During 2005 through 2007, 29 critical sites totaling approximately 16,000 linear feet were constructed under the Declaration of Flood Emergency by Governor Schwarzenegger. This is an ongoing project, and additional sites requiring maintenance will continue to be identified indefinitely until the remaining authority of approximately 24,000 linear feet is exhausted over the next 3 years. WRDA 2007 authorized an additional 80,000 linear feet of bank. For implementation of the 80,000 additional linear feet of bank protection, the Corps has submitted a biological assessment and initiated formal consultation with NMFS and USFWS.

Potential cumulative impacts from the combination of these projects to each of the listed species included in this consultation are below. The construction periods and related effects from these projects could all occur simultaneously. For the ARCF and West Sacramento projects, this means that similar construction-related effects such as rock placement or tree removal could be occurring at the same time for the stretch of the projects from the I Street Bridge to the Stone Locks. During preconstruction engineering and design, the Corps designs will avoid impacts to special status species, where possible, or otherwise minimize effects to each of these species including designs to have negligible effects on velocities. There may be localized effects; the change in bank composition to rock may result in short term slight increase of velocities, but installation of vegetation on site would result in a much greater long-term reduction of velocities. The site would be designed to ensure that any increase in velocity does not extend downstream of the sites. Additionally, the two projects would coordinate to ensure that construction sites are offset from each other (i.e., sites directly across the Sacramento River from each other where there is bank protection being installed, specifically from the I-Street Bridge downstream to the Barge canal, would not be constructed in the same construction season). These are also different styles of bank protection. The West Sacramento side has some berm between the levee and the channel, and therefore it is really a "bank" fix, while the ARCF side has levee toe underwater and includes rock berm.

Valley Elderberry Longhorn Beetle

Concurrent construction of multiple projects over the next 10 to 15 years within the Sacramento Metropolitan area would likely cause mortality to beetles due to construction operations. Construction activities for the multiple projects would occur each year during the flight season of beetles. Since construction activities would be adjacent to known VELB locations it is likely that some mortality may occur. No designated critical habitat would be affected with the construction of any of the projects.

Shrubs within the each project footprint would be transplanted to areas in close proximately to the current locations. Additionally, compensation would be located within the vicinity of impacted shrubs. Transplanting of shrubs and planting of seedlings and natives within the project vicinity would provide connectivity for the beetle within the American River Parkway. Connectivity is a primary cause of the beetle decline and an important element in the recovery and sustainability for the beetle. Habitat maps of the Parkway that show individual shrub locations are included in Appendix F. Appendix G includes maps of the Corps' existing compensation sites within the Parkway. The Corps would coordinate with County Parks to determine appropriate locations for newly established elderberry mitigation sites within the Parkway, with connectivity being one of the goals in site selection. The transplanting of shrubs and compensation within the same area as the potential impacts would result in effects to the beetle but not result in jeopardy to the valley elderberry longhorn beetle.

Salmon, Steelhead, and Sturgeon

The proposed projects could adversely modify critical habitat or contribute to the loss or degradation of sensitive habitats for listed species such as the Sacramento River winter-run Chinook salmon, Central Valley steelhead, Central Valley spring-run Chinook salmon, and green sturgeon in the greater project vicinity. However, with site specific erosion repair designs, retention of SRA through vegetation variances, and the installation of riparian plantings and instream large woody material, the proposed projects are expected to increase habitat values over time by increasing the amount of riparian habitat, SRA cover, and floodplain habitat available to listed fish over a broad range of flows.

The erosion repair activities of these combined projects would likely reduce the sediment supply for riverine reaches directly downstream because the erosion repair is holding the bank or levee in place. However, from a system sediment perspective, the bank material we are protecting in the project reaches is not a major source of sediment compared to the upstream reaches of the Sacramento, Feather, and especially the Yuba River systems. All of the available sediment in the American River watershed is being contained behind Folsom Dam. The site specific designs will be constrained from allowing any velocity increases outside the erosion repair site (Schlunegger 2014).

Site specific designs such as setback levees, IWM, and shallow bank slopes within the SRBPP, Common Features, West Sacramento, and Southport EIP projects would be incorporated to address erosion repair while including features for increasing habitat for listed fish. The levee setback component of the Southport EIP and West Sacramento projects would result in the restoration of historical Sacramento River floodplain in the project areas, with a diverse mosaic of seasonal floodplain, wetland, riparian, and upland habitat. The goals of the offset area restoration designs are to increase river-floodplain connectivity, restore ecologically functional floodplain habitat, and meet the flood risk–reduction objectives of the projects. Based on the SAM, establishing connectivity of the floodplain to the river will result in large and rapid gains in habitat quantity and quality that will fully compensate for initial habitat deficits on the existing levee and result in significant long-term species benefits (improved growth and survival) relative to existing conditions. Although not addressed by the SAM, these benefits will be enhanced over time by revegetation of the floodplain and development of a diverse mosaic of wetland, riparian and upland plant communities that will further improve the habitat and ecosystem functions of the restored floodplain. In addition to increasing the amount of structural cover available to fish along the shoreline, the installation of IWM is also expected to promote sediment deposition on the rock bench as observed at locations where similar designs have been used to address the compensation needs of listed fish species. Project actions are unlikely to result in long-term habitat losses to Sacramento River winter-run Chinook salmon, Central Valley steelhead, Central Valley spring-run Chinook salmon, and green sturgeon.

The American River Common Features and West Sacramento Projects would have initial cover losses due to project actions but will be partially offset by installing riparian plantings and native grasses along the lower slopes. These features will increase the availability of high quality shallow water habitat for juvenile Chinook salmon and steelhead, and possibly juvenile green sturgeon during the annual high-flow period (late fall, winter, and spring). Because of the vegetation variance that the Corps will be seeking, tree removal would be limited to no more than the upper one-half of the waterside of the levees therefore leaving the lower one-half or more of the trees in place on the Sacramento River within the study area. SRA would not be compromised, thus maximizing existing SRA values in the study area. The establishment and growth of planted riparian vegetation is expected to increase habitat values over time by increasing the extent of overhead cover available to listed fish species.

<u>Delta Smelt</u>

The proposed projects, with the implementation of site specific designs and purchase of credits at a USFWS-approved mitigation bank, would provide long-term net benefits to delta smelt as explained above in for the other fish species. However, there are four specific significant threats to the delta smelt that have been identified by the USFWS: direct entrainments by State and Federal water export facilities, summer and fall increases in salinity, summer and fall increases in water clarity, or effects from introduced species (USFWS 2015). Bank protection has also been identified as a significant threat to delta smelt shallow water habitat for spawning, incubation, and rearing within the Sacramento River portion of the ARCF project area.

Implementation of the various projects would not affect direct entrainments by State and Federal water export facilities. The ARCF project would release of more water down the Sacramento Bypass into the Yolo Bypass during high water events. The excess water that would normally be moving downriver through the Sacramento area would enter the system farther down in the Delta area. Since adult delta smelt are moving up the system to spawn at this time this would not affect entrainment in the water export facilities.

Summer and fall increases in salinity is driven more by low flow drought years and water releases in the Sacramento tributaries then site specific designs for erosion protection in the project areas. Summer and fall increases in water clarity are associated with, among other factors, invasive non-native clam species and non-native plant species, which are generally located down in the Delta below the project areas, that are filtering out vital chlorophyll and plankton that would normally increase turbidity which helps the delta smelt avoid predators. However, as mentioned above, the erosion repair component of the ARCF, West Sacramento, and SRBPP would likely reduce the sediment supply for riverine reaches directly downstream because the erosion repair is holding the bank or levee in place. However, as explained above, from a system sediment perspective, the bank material we are protecting in the project reaches is not a major source of sediment compared to the upstream reaches of the Sacramento, Feather, and especially the Yuba River systems.

Increases of bank substrate size over sand and sediment resulting in reductions in instream habitat are assumed to reduce the availability and suitability of habitat for spawning, incubation, and rearing. As a result, potential cumulative effects include disruption of spawning activities, disturbance or mortality of eggs and newly hatched larvae. A permanent loss of approximately 14 acres with an additional 46 affected acres of sandy shallow water spawning and incubation habitat in the ARCF GRR project area would result from sand to rock conversion and would eliminate areas for successful egg deposition and survival due to the change in preferred substrate. However, the ARCF project would mitigate for the loss of shallow water habitat through the purchase of credits at a USFWS-approved mitigation bank. As a result, the cumulative impact of these projects may affect, but is not likely to adversely affect the Delta Smelt.

Giant Garter Snake

The giant garter snake could be affected by multiple projects being constructed within the Sacramento Metropolitan area over the next 10 to 15 years. Primarily habitat loss would occur on the West Sacramento side of the Sacramento River adjacent to the Sacramento Bypass and the West Sacramento and Southport construction areas. Short term impacts would occur for a single construction season along haul routes and within borrow sites. To minimize potential impacts to snakes work within giant garter snake habitat would be conducted between May 1 and October 1 when snakes are active and can move out of the construction area. Snake mortality could occur during construction along haul routes, however, the snakes are mobile and would likely move out of the way from construction equipment. There would be a permanent loss of a few irrigation canals in the Sacramento Bypass and some existing wetlands adjacent to the levees in the West Sacramento study area.

Western Yellow-Billed Cuckoo

Concurrent construction of the ARCF, West Sacramento, and SRBPP projects over the next 10 to 15 years within the Sacramento Metropolitan area could result in adverse effects to Western yellow-billed cuckoo through the removal of trees within the riparian corridors. Construction activities for the multiple projects would occur each year during nesting season, which could disrupt nesting birds, if present. However, the cuckoo is not known to nest in the Sacramento River or its tributaries below Colusa, therefore the tree removal would not effect Western yellow-billed cuckoo nesting habitat. Additionally, any tree removal would likely occur outside of the nesting season. No designated critical habitat would be affected with the construction of any of the projects.

Prior to construction, each project would be required to conduct surveys to determine the presence of the cuckoo. Nesting birds are not expected to be present, but migrating cuckoos could use riparian habitat in these reaches as they pass through the area. If cuckoos are found during surveys, additional measures would be proposed by each of the projects, which may include biological monitoring.

Planting of seedlings and native trees within the project vicinity would mitigate for the loss of trees within the riparian corridor and would likely improve the habitat in the area long-term by filling gaps in the riparian canopy. While the short term impact would be significant, over time these compensation measures within the same area as the potential impacts would result in less than significant effects to the cuckoo. Since the cuckoo is not likely to be nesting within the area, and while the cumulative impact to the riparian corridor from tree removal would be significant, there still remains a significant amount of trees that could be used by the cuckoo, particularly in the American River Parkway, as described in Section 5.9.5 above. As a result, the cumulative effect from these projects may affect, but is not likely to adversely affect the yellow-billed cuckoo.

5.9 Conclusion and Effects Determination for Listed Species

5.9.1 Valley Elderberry Longhorn Beetle

The project construction would result in the transplanting of a maximum of 270 elderberry shrubs during the 13 year construction timeframe. Compensation for the transplanting of the shrubs would be on-site where possible and within the same region when off-site. The replacement plantings would result in habitat connectivity for the beetle within the project area. In consideration of this information, the project actions are unlikely to result in long-term habitat losses to valley elderberry longhorn beetle, as long as the applicable mitigation and compensation measures are implemented. However, ARCF GRR project actions may adversely affect valley elderberry longhorn beetles due to potential take during construction.

Additionally, approximately 90 shrubs could be trimmed each year by the maintaining agencies for O&M activities. The trimming are not expected to reduce the habitat overall for the beetle as the shrubs would remain in the existing location. The maintaining agencies would purchase credits in a mitigation bank to offset any potential affects that may occur due to trimming.

5.9.2 Fish

Anadromous Fish Species

The ARCF GRR is expected to result in adverse short-term, construction- and O&M-related effects on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, southern DPS North American green sturgeon, and their designated critical habitat. Project effects may include localized incidental take due to disturbance, displacement, or impairment of feeding or other essential behaviors of adult and juvenile salmon, steelhead, and green sturgeon during construction and operations and maintenance (O&M) activities. Injury or mortality of juvenile salmonids, and green sturgeon, could occur, if individuals are unable to readily move away from channel or nearshore areas directly affected by construction activities. Accidental discharge of toxic substances during construction could cause physiological impairment or mortality of listed fish and other aquatic species at or immediately downstream of project sites. Other potential stressors include noise, suspended sediment, turbidity, and sediment deposition generated during in-water construction activities. These effects could also occur in areas downstream of project sites, because noise and sediment may be propagated downstream. Restricting in-water activities to the August 1 through November 30 work window, and implementing BMPs, will minimize the potential for adverse effects.

Long-term project effects on the habitat of listed fish species include instream and overhead cover, and substrate conditions along the seasonal low- and high-flow shorelines of the erosion sites. Implementation of the project will result in temporary losses of instream structure and riparian vegetation along the summer-fall and winter-spring shorelines and will also limit long-term fluvial functioning necessary for the development and renewal of SRA habitat in the future.

Initial cover losses due to project actions will be partially offset by installing riparian plantings and native grasses along the lower slopes. These features will increase the availability of high quality shallow water habitat for juvenile Chinook salmon and steelhead, and possibly juvenile green sturgeon during the annual high-flow period (late fall, winter, and spring). Because we will not be removing any trees on the lower one-third of the waterside of the levees in the Sacramento River area, SRA will not be compromised thus maximizing existing SRA values in the action area. The establishment and growth of planted riparian vegetation is expected to increase habitat values over time by increasing the extent of overhead cover available to listed fish species.

These features will increase the availability of high quality shallow water habitat for juvenile Chinook salmon and steelhead, incubating delta smelt, and possibly juvenile green sturgeon during the annual high-flow period (late fall, winter, and spring). Because we will not be removing any trees on the lower one-third of the waterside of the levees in the Sacramento River area, SRA will not be compromised thus maximizing existing SRA values in the action area. The establishment and growth of planted riparian vegetation is expected to increase habitat values over time by increasing the extent of overhead cover available to listed fish species.

In consideration of the above information, the project actions are not likely to result in long-term habitat losses to Sacramento River winter-run Chinook salmon, Central Valley steelhead, Central Valley spring-run Chinook salmon, delta smelt, and green sturgeon as long as the applicable mitigation and compensation measures are implemented. This conclusion is based on the Corps' commitment to: (1) minimize temporary habitat losses through the incorporation of on-site mitigation features (e.g., vegetated riparian and wetland benches, riparian plantings, and no planned tree removal) in the project area measures; and (2) implementation of off-site habitat compensation measures (e.g., riparian planting, rock removal) prior to or concurrent with project construction. However, project actions may adversely affect these focus species due to: (1) incidental take during construction and; (2) fragmentation of existing natural bank habitats due to the placement of revetment; and (3) the potential loss of long-term fluvial functioning necessary for the development and renewal of shaded riverine aquatic habitat.

Determinations

Section 7 of the Endangered Species Act requires that Federal agencies ensure, in consultation with the U.S. Fish and Wildlife Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. Effects to critical habitat are discussed for each fish species in Section 5.2. Based on those assessments, project actions:

- May affect, likely to adversely affect designated critical habitat for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Green sturgeon;
- May affect, likely to adversely affect designated critical habitat for delta smelt within the ARCF GRR project area which includes the Sacramento River upstream to approximately RM 60 (U.S. Fish and Wildlife Service 2003a).

5.9.3 Giant Garter Snake

To minimize the potential for adverse effects on GGS in the Sacramento Bypass, GGS habitat will be designated as an environmentally sensitive area delineated with signs or fencing, and if possible, avoided by all construction personnel. Additional measures and habitat compensation as outlined in Section 2.5.3 will also be implemented to avoid and minimize potential temporary effects to GGS during construction. There would be approximately 15 acres of GGS aquatic habitat permanently removed due to removal of the drainage canals within the widened bypass. Compensation for this loss would occur in accordance with the measures discussed in Section 2.5.3. Temporary effects during construction would disturb approximately 30 acres of upland GGS habitat for one construction season. Compensation for these temporary impacts would occur in accordance with the measures discussed in Section 2.5.3.

In consideration of the above information, the project actions are unlikely to result in long-term habitat losses to the giant garter snake, as long as the applicable mitigation and compensation measures are implemented. However, even with on-site mitigation and off-site compensation, the project actions may adversely affect giant garter snakes due to: (1) take during construction and O&M activities; and (2) habitat fragmentation. Ground disturbing activities at NSS Borrow Site 2 could result in direct displacement, injury, or death of snakes. These effects, which could affect the ability of snakes to conduct essential life history functions, such as dispersal, movement, or foraging, would be temporary (occurring during one active season). Construction activities could temporarily degrade aquatic habitat, but the overall result of implementing the proposed site restoration at Borrow Site 2 would be an enhancement of habitat quality.

5.9.4 Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

Approximately 0.25-acre of vernal pool habitat has the potential to be indirectly impacted by project construction near Magpie Creek. The Corps proposes to either purchase 1 acre of credits at a mitigation bank, or compensate for the loss of 1 acre of habit through enhancement of the habitat in the 79 acres of land being acquired under this project as a flood overflow area. The project actions are unlikely to result in long-term habitat losses to the vernal pool fairy shrimp and vernal pool tadpole shrimp, with the implementation of the mitigation and compensation measures proposed. As a result, the project actions may affect, but are not likely to adversely affect the vernal pool fairy shrimp and vernal pool tadpole shrimp.

5.9.5 Western Yellow-billed Cuckoo

Potential long-term effects to the cuckoo could result from the loss of 175 acres of riparian habitat. However, this long term effect would be significantly reduced with the receipt of a vegetation variance and implementation of the SWIF. There would remain a significant temporal loss of riparian habitat for the cuckoo during their migration, however in time it is anticipated that the riparian corridor would recover with the implementation of the compensation proposed by the Corps. While the removal of trees from the construction footprint is a significant effect, the majority of the trees within the cuckoo's migration corridor would not be impacted by construction activities, particularly within the American River Parkway. In the Parkway, the maximum footprint of impact would be 65 feet from the levee toe, while portions of the Parkway include a corridor of150 to 500 feet wide. As a result, the long-term effect of the removal of riparian vegetation may affect, but is not likely to adversely affect the western yellow-billed cuckoo.

5.10 Effects of the Proposed Action on Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.S.C. 180 et seq.), requires that Essential Fish Habitat (EFH) be identified and described in Federal fishery management plans. Federal action agencies must consult with NMFS on any activity that they fund, permit, or carry out that may adversely affect EFH. NMFS is required to provide EFH conservation and enhancement recommendations to the Federal action agencies.

EFH of Pacific salmon pursuant to Section 305 (b) (2) of the MSA appropriate determinations for EFH as either; (1) will not adversely effect, or (2) may adversely affect. Important components of EFH for Chinook salmon spawning, rearing, and migration include:

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
- Freshwater rearing sites with:
    a) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    b) Water quality and forage supporting juvenile development; and
    c) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
- Estuarine areas free of obstruction and excessive predation with:
    a) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
    b) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
    c) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

The ARCF GRR includes habitat on the Sacramento River, American River, and the Sacramento Bypass that have been designated as EFH for Chinook salmon, a major contributor to Pacific Coast salmon fisheries. The Pacific Coast salmon fishery EFH extends along the Pacific Coast from Washington to Point Conception in California. Freshwater EFH includes all habitats currently and historically accessible to salmon and is based on descriptions of habitat used by coho and Chinook salmon. The EFH excludes areas above naturally occurring barriers such as waterfalls, which have been present for several hundred years, and impassible dams identified on large rivers (NMFS 1997). The following analysis of EFH does not include effects to the fish species, just the species habitat as defined in the MSA. Results for the effects of EFH for winter-run, spring-run, and fall/late-fall-run Chinook salmon in the ARCF GRR action area were based on the SAM analysis detailed in Appendix B.

5.10.1 Effects of the Proposed Action on EFH

Site specific project designs were unavailable for the ARCF GRR project reach at the time of this SAM analysis. The following data sources were used to characterize SAM habitat conditions (as defined by bank slope, floodplain availability, substrate size, instream structure, aquatic vegetation, and overhanging shade) within the ARCF GRR project area under existing or pre-project conditions:

- The Corps' Sacramento River revetment database – This database was used to stratify the project reach into subreaches that encompass relatively uniform bank conditions based on their general physical characteristics (USACE 2007). This database was used to characterize existing habitat conditions within individual subreaches where more recent data were unavailable.
- Aerial images of the ARCF GRR project reach (Google™ Earth), provided current and historical images of bank conditions that were used to address gaps or uncertainties related to existing cover characteristics within individual subreaches.

The SAM employs six habitat variables to characterize near-shore and floodplain habitats of the winter-run, spring-run, and fall/late-fall-run Chinook species:

- Bank slope—average bank slope of each average seasonal water surface elevation;
- Floodplain availability—ratio of wetted channel and floodplain area during the 2-year flood, to the wetted channel area during average winter and spring flows;
- Bank substrate size—the median particle diameter of the bank (i.e., D50) along each average seasonal water surface elevation;
- Instream structure—percent of shoreline coverage of instream woody material along each average seasonal water surface elevation;
- Aquatic vegetation—percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
- Overhanging shade—percent of the shoreline coverage of shade along each average seasonal water surface elevation.

Sacramento River SAM EFH Analysis

The Sacramento River SAM analysis reach includes the entire left bank (east side) of the Sacramento River from the American River confluence to approximately 4,020 linear feet (lf) below the Freeport Bridge.

Short Term

Short term construction activities may adversely affect Chinook EFH. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions most positively associated with fry and juvenile rearing and migration.

Long Term

Long term construction actions will not adversely affect EFH on the Sacramento River portion of the ARCF GRR action area. EFH is expected to show a long term positive response to project actions in the Sacramento River SAM analysis reach over the lifetime of the project. Positive EFH response would be most likely associated with long term growth of SRA (overhanging shade) and aquatic vegetation.

American River SAM EFH Analysis

The American River SAM analysis (ARN A-B and ARS A-C) reaches include portions of the right and left bank of the American River from Goethe Park to the confluence of the Sacramento. It also includes portions of NEMDC, Arcade Creek, Magpie Creek, and Dry/Robla Creek.

Short Term

Short term construction activities may adversely affect Chinook EFH. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions most positively associated with fry and juvenile rearing and migration.

Long Term

Long term construction actions will not adversely affect EFH on the Sacramento River portion of the ARCF GRR action area. EFH is expected to show a long term positive response to project actions in the American River SAM (Appendix B) analysis reach over the lifetime of the project. Positive EFH response would be most likely associated with long term growth of SRA (overhanging shade) and aquatic vegetation.

Sacramento Bypass SAM EFH Analysis

The Sacramento Bypass SAM analysis reach includes the right bank (north side) of the Sacramento Bypass levee in its entirety from the confluence of the Sacramento River to its termination at the Yolo Bypass.

Short Term

Short term construction activities may adversely affect Chinook EFH. Short term habitat deficits will result from the initial loss of aquatic vegetation and over hanging shade at the portion of the Sacramento Bypass associated with the removal of the SRA habitat to allow expansion of the Sacramento Bypass Weir. There is no planned vegetation removal for the levee widening.

Long Term

Chinook salmon are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a negative response by year 1. The maximum habitat deficit identified is -188 ft for the juvenile migration life stage of spring-run and winter-run Chinook salmon in the spring of year 2. Long term habitat deficits would be associated with the permanent removal of SRA habitat for the expansion of the weir portion of the project not the levee portion.

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Appendix A

Species Lists

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 141222022932

Current as of: December 22, 2014

Quad Lists

CLARKSBURG (497A)

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Branchinecta lynchi

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris

green sturgeon (T) (NMFS)

Hypomesus transpacificus

Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Rana draytonii

California red-legged frog (T)

Reptiles

Thamnophis gigas

giant garter snake (T)

Birds

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (T)

RIO LINDA (512B)
Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

SACRAMENTO EAST (512C)
Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
Critical habitat, valley elderberry longhorn beetle (X)
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus mykiss
- Central Valley steelhead (T) (NMFS)
- Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
- Central Valley spring-run chinook salmon (T) (NMFS)
- Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
- winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
- California tiger salamander, central population (T)

Rana draytonii
- California red-legged frog (T)

Reptiles

Thamnophis gigas
- giant garter snake (T)

Birds

Coccyzus americanus occidentalis
- Western yellow-billed cuckoo (T)

SACRAMENTO WEST (513D)
Listed Species

Invertebrates

Branchinecta lynchi
- vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
- valley elderberry longhorn beetle (T)

Lepidurus packardi
- vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
- green sturgeon (T) (NMFS)

Hypomesus transpacificus
- Critical habitat, delta smelt (X)
- delta smelt (T)

Oncorhynchus mykiss
- Central Valley steelhead (T) (NMFS)
- Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
- Central Valley spring-run chinook salmon (T) (NMFS)
- Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
- Critical habitat, winter-run chinook salmon (X) (NMFS)
- winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
- California tiger salamander, central population (T)

Rana draytonii

California red-legged frog (T)

Reptiles

Thamnophis gigas

giant garter snake (T)

Birds

Coccyzus americanus occidentalis

Western yellow-billed cuckoo (T)

Vireo bellii pusillus

Least Bell's vireo (E)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be March 22, 2015.

Appendix B

American River Common Features GRR SAM Analysis

American River Common Features General Reevaluation Report

Standard Assessment Methodology Analysis

July 2015

Contents

1.0 Introduction

This document provides the background data and assumptions for the Standard Assessment Methodology (SAM) effects analysis of the American River Common Features General Reevaluation Report (ARCF GRR) project on the following focus fish species (Table 1).

Table 1. ARCF GRR Project Focus Fish Species.

Species/ESUs	Federal Status
Chinook salmon (*Oncorhynchus tshawytscha*)	
Central Valley spring-run ESU	Threatened
Central Valley fall-run ESU	Species of concern
Central Valley late fall-run ESU	Species of concern
Sacramento River winter-run ESU	Endangered
Central Valley steelhead DPS (*Oncorhynchus mykiss*)	Threatened
green sturgeon (*Acipenser medirostris*)	Threatened

1.1 Background

The U.S. Army Corps of Engineers (Corps) initiated formal Section 7 consultation with the National Marine Fisheries Service (NMFS) for the ARCF GRR on June 27, 2014. The original SAM analysis included in the Section 7 consultation for the ARCF GRR was determined to be insufficient in detail. Through internal discussions and interagency coordination with the NMFS, a revised set of parameters was developed to better assess the project's impact on focus fish species and their habitat. This report documents and provides justification for the revised SAM analysis and should replace the analysis included in the original Biological Assessment (BA) Appendix B.

1.2 SAM Modeling Approach

Long-term effects of the ARCF GRR project on focus fish species and their habitat were estimated using the SAM. The SAM computations were performed using the SAM Electronic Calculation Template (ECT) Version 4.0 (April 2012) developed by the Corps and Stillwater Sciences, in consultation with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife Service (CDFW), and California Department of Water Resources (DWR), academic contributions from the University of California at Davis and Humboldt State University, and peer reviewed by sixteen professionals in fish biology, river geomorphology, environmental sciences, and engineering (USACE 2012). The SAM allows agencies to quantitatively assess the potential effects of bank protection and stream restoration projects to ensure that these activities do not jeopardize Chinook salmon, steelhead, and green sturgeon, or destroy or adversely modify their critical habitat. The

SAM can also determine suitable compensation for habitat loss, by evaluating the benefits of certain design features (e.g., planted emergent vegetation) to target fish species.

The SAM employs six habitat variables to characterize near-shore and floodplain habitats of listed fish species:

- *bank slope*—average bank slope of each average seasonal water surface elevation;
- *floodplain availability—ratio of wetted channel and floodplain area during the 2-year flood, to the wetted channel area during average winter and spring flows;*
- *bank substrate size—the median particle diameter of the bank (i.e., D50) along each average seasonal water surface elevation;*
- *instream structure*—percent of shoreline coverage of instream woody material along each average seasonal water surface elevation;
- *aquatic vegetation*—percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
- *overhanging shade*—percent of the shoreline coverage of shade along each average seasonal water surface elevation.

The SAM does not directly model changes in the above variables. Instead, habitat changes are estimated separately by the user and entered into an input data file to an electronic calculation template (ECT) developed within an MS Access database to track species responses to project actions over time. Changes in habitat variables may be fixed in time, such as installation of revetment at a particular slope and substrate size. In other circumstances, habitat evolution over time may be represented by more gradual changes in variables such as changes in floodplain inundation due to meander migration or changes in shade due to growth of planted vegetation. Typically, habitat evolution modeling is restricted to shade estimates from riparian growth models, but the SAM accommodates any number of other habitat modeling approaches such as meander migration modeling or large woody debris recruitment modeling.

Once a particular time series of habitat variable estimates is developed and entered into an ECT input file fish responses are calculated using previously developed relationships between habitat variables and species/life stage responses (USACE 2012). The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with- or without-project), the ECT uses these relationships to determine the responses of individual species and life stages to the measured or predicted values of each variable, for each season and target year; the ECT then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear distance or area of bank to which it applies; the product is then integrated through time, generating a weighted species response index (WRI expressed as ft or ft^2) in each year of the analysis. The WRI provides a common metric that can be used to quantify habitat values over time, compare project designs to existing conditions, and evaluate the effectiveness of on-site and off-site habitat compensation actions.

2.0 Habitat Analysis

Following procedures described in the SAM (USACE 2012), construction activities at each site were translated into habitat variables for pre-project and with project conditions in each of four seasons using available data sources. The relevant habitat conditions to encode the conceptual response models for the focus fish species from the present to the future (t = 0, 1, 5, 15, 25, and 50 yrs), and under pre-project and with-project conditions are described below. Revisions to the original SAM analysis are summarized in the discussion.

2.1 Project Description

The ARCF GRR project tentatively selected plan – Alternative 2 – Sacramento Bypass and Improve Levees, involves the construction of fix-in-place levee remediation measures along the Sacramento River, American River, and north side tributaries as well as widening of the Sacramento Weir and Bypass. Proposed repair actions for each waterway are presented below (Table 2). This SDAM analysis groups project actions into 4 SAM reaches based on hydrologic connectivity: American River North (ARN_AB), American River South (ARS_ABC), Sacramento River South (ARS_DEFG), and the Sacramento Bypass (SBP).

2.1.1 Sacramento River

The levees along the Sacramento River under Alternative 2 would be improved to address identified seepage, stability, erosion, and a minimal amount of height concerns. Most height concerns along the Sacramento River would be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass.

2.1.2 American River

Levees along the American River under Alternative 2 require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed for the American River levees: (1) bank protection, and (2) launchable rock trench. Both of these measures are described in detail in the BA.

2.1.3 East Side Tributaries

Natomas East Main Drain Canal (NEMDC) requires improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A conventional open trench cutoff wall would be constructed at these locations to address the seepage and stability problems. The NEMDC east levee also has height issues which will be addressed with construction of a new floodwall. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown for construction.

We will be doing no in-water work on NEMDC under the Alternative 2 scenario and after consultation with NMFS, NEMDC was left out of the SAM analyses.

2.1.4 Sacramento Weir and Bypass

Under Alternative 2, the width of the Sacramento Weir and Bypass would be roughly doubled to accommodate increased bypass flows. The expanded Sacramento Weir and Bypass would generally result in an additional 25,000 cfs flow during high water conditions. The frequency of water diversion is expected to be the same, which is to use the current Sacramento Weir operation based on a stream gage at the I Street Bridge (Schlunegger 2014). Under normal flow conditions the Sacramento Weir and Bypass would be operating at pre-existing conditions described in detail in the ARCF GRR biological assessment (USACE 2014). Implementation of this action would result in the degradation of the existing north levee of the Sacramento Bypass and construction of a new levee approximately 1,500 feet to the north. The existing Sacramento Weir would be expanded to match the wider bypass. At this time, it is not known whether the new segment of weir would be constructed consistent with the 1916 design described above, or whether it would be designed to be a gravity-type weir. The new north levee of the bypass would be designed to be consistent with the existing Sacramento Bypass north levee, however, it would also include a 300-foot-wide seepage berm on the landside with a system of relief wells.

Table 2. ARCF GRR Project Alternative 2 – Proposed Remediation Measures by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench	---
Sacramento River	Cutoff Wall	Cutoff Wall	Bank Protection	Sacramento Bypass and Weir Widening, Levee Raise
NEMDC	Cutoff Wall	Cutoff Wall	---	Floodwall
Arcade Creek	Cutoff Wall	Cutoff Wall	---	Floodwall
Dry/Robla Creeks	---	---	---	Floodwall
Magpie Creek[2]	---	---	---	Floodwall, Levee Raise

[1]American River seepage, stability, and overtopping measures were addressed in the American River Common Features, WRDA 1996 and 1999 construction projects.
[2]In addition to the Floodwall, Magpie Creek will include construction of a new levee along Raley Boulevard south of the creek, and construction of a detention basin on both sides of Raley Boulevard. In addition, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

2.1.5 Construction Schedule

The ARCF GRR project reach will be implemented in increments. The timing of each project reach (Table 3) is based on the proposed schedule provided in the Biological Assessment: American River Common Features General Reevaluation Report (USACE 2014).

Table 3. Tentative Construction Schedule for the Recommended Plan.

PRIORITY	WATERWAY	REACH[1]	YEAR OF PROJECT CONSTRUCTION												
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Sacramento River	ARS F													
2	Sacramento River	ARS E													
3	American River	ARS A													
4	Sacramento River	ARS G													
5	Sacramento River	ARS D													
6	American River	ARS B													
7	American River	ARN A													
8	American River	ARS C													
9	American River	ARN B													
10	Sacramento Weir & Bypass	--													
11	Arcade Creek	ARN D													
12	NEMDC	ARN F													
13	Arcade Creek	ARN E													
14	NEMDC	ARN C													
15	Dry/Robla Creek	ARN G													
16	Magpie Creek	ARN I													

2.1.6 Vegetation on Levees

Compliance with Engineering Technical Letter 1110-2-571 (ETL) vegetation requires implementation of a vegetation-free zone within 15 ft of the waterside and landside toes of a levee. The levees along the Sacramento and American rivers were often set close to the river which has resulted in limited riparian vegetation in the project reach. The Corps is seeking a variance from the ETL vegetation requirements along the Sacramento River and American River portions of this project. This SAM analysis assumes that a Vegetation Variance Request (VVR) was assumed to be in place for the Sacramento and American River reaches. The Corps will obtain an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The Corps will be complying with the ETL on the American River via a System Wide Implementation Framework (SWIF). The VVR is not assumed to apply to the SBP.

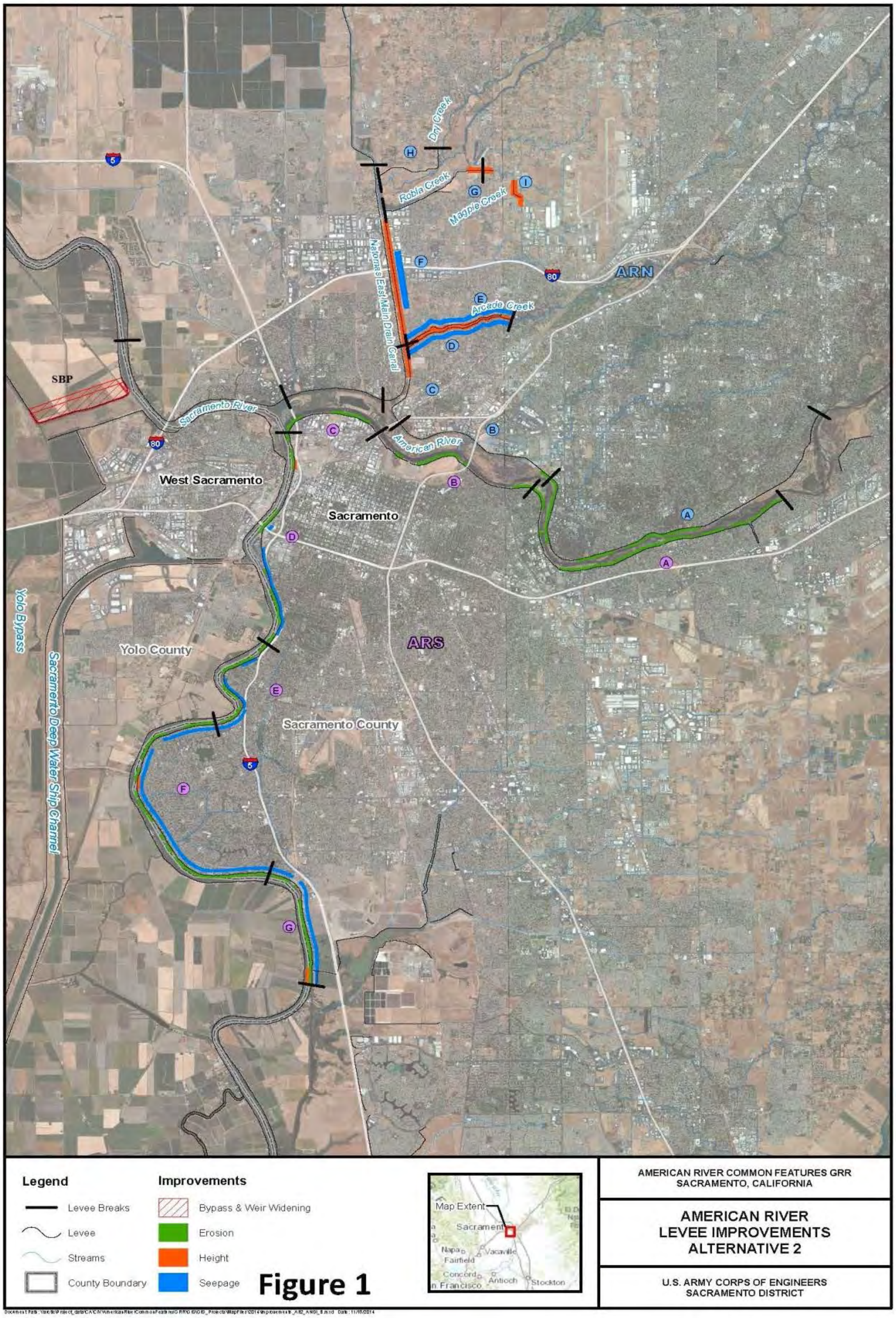

Figure 1. ARCF GRR Study Area with Reach Identification.

2.2 Characterization of Existing Conditions

The following data sources were used to characterize SAM habitat conditions (as defined by bank slope, floodplain availability, substrate size, instream structure, aquatic vegetation, and overhanging shade) within the ARCF GRR project area under existing or pre-project conditions.

Sacramento River Revetment Database – This database was used to stratify the project reach into subreaches that encompass relatively uniform bank conditions based on their general physical characteristics (USACE 2007). This database was used to characterize existing habitat conditions within individual reaches where more recent data were unavailable.

Aerial images of the ARCF GRR project reach (Google™ Earth Pro), provided current and historical images of bank conditions that were used to address gaps or uncertainties related to existing cover characteristics within individual subreaches.

The following describes how input values for each of these attributes were derived for existing conditions in the SAM assessment. Specific input values for each site can be seen below at the end of report in (Tables 6-25).

2.2.1 Bank Slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change, dW:dH) along each seasonal shoreline (i.e., the line where the water surface intersects the bank on average fall, winter, spring, and summer) (USACE 2012). Existing bank slopes were extrapolated from cross sections along the Sacramento River, American River, and existing SAM analyses performed on regionally analogous sites. Bank slope along all reaches was assumed to be 2 for existing conditions.

2.2.2 Floodplain Availability

In the SAM, floodplain habitat availability is considered important for juvenile life stages and is defined by areas that are flooded by the 2-year flood event (Q2) and measured by calculating a Floodplain Inundation Ratio (USACE 2012). This ratio is calculated by dividing the wetted channel and inundated floodplain areas during the 2- year flood event (AQ2) by the wetted channel area (AQavg) during average winter and spring flows. The amount of available floodplain habitat is consequently proportional to the ratio’s positive deviation from unity (i.e., values greater than 1) (USACE 2012).

In this SAM analysis, it was assumed that the with-project floodplain inundation ratios would be the same as pre-project values, which is consistent with assumptions made during the pre-construction SAM analyses. As a result, no impacts to habitat quality at the ARCF GRR reaches are expected with respect to this habitat variable.

2.2.3 Bank Substrate Size

The median substrate size (D_{50}) along the summer-fall and winter-spring shorelines of the project reach was determined through by referencing the Revetment Database (USACE 2007) and current and historical aerial images. Based on previous analysis of Sacramento River Bank Protection Project (SRBPP) sites (USACE 2008, USACE 2013) sections of shoreline with natural substrate were assigned a D_{50} of 0.25 inches. Sections of shoreline with rock revetment were assigned a D_{50} of 10 inches.

2.2.4 Instream Structure

The shoreline coverage of Instream Woody Material (IWM) along the average summer-fall and winter-spring shorelines of the ARCF GRR project reach were determined by referencing the revetment database (USACE 2007). The revetment database uses four classes of instream structure, based on ranges of percent shoreline having IWM. Table 4 indicates how these revetment database attribute values were converted to a single value for input to SAM. These values were assumed to be appropriate for both the summer-fall and winter-spring seasons. For sub-reaches without available data, an estimate was based on shoreline conditions assessed from aerial images. Shorelines with dense riparian canopy were assigned 5% shoreline coverage of IWM. Shorelines without dense riparian canopy were assigned 0% shoreline coverage of IWM.

Table 4. Conversion of Revetment Database Instream Woody Material Classes to SAM Attribute Value for Instream Structure.

Revetment Database IWM Class	SAM Input Value
None	0%
1 - 10%	5%
11 - 50%	30%
> 50%	75%

2.2.5 Aquatic Vegetation

The revetment database attribute for Emergent Vegetation was used for summer-fall aquatic vegetation characterization, and the Ground Cover attribute was used for winter-spring characterization. Within the ARCF GRR project reaches, this approach generally gave a vegetation value of zero for summer-fall conditions, which is appropriate given the scarcity of emergent aquatic vegetation. Table 5 summarizes the conversion of revetment database attribute values for input to the SAM analysis.

Table 5. Conversion of Revetment Database Emergent Vegetation and Ground Cover Classes to SAM Attribute Values for Vegetation.

	Revetment Database IWM Class	SAM Input Value
Summer and Fall	False	0%
Revetment Database:	PEM 1 - 5%	3%
“Emergent Vegetation” Attribute	PEM 6 - 25%	15%
	PEM 26 – 75%	50%
	PEM >75%	85%
Winter and Spring	<25%	13%
Revetment Database:	26-50%	38%
“Ground Cover” Attribute	51-75%	63%
	>75%	88%

2.2.6 Overhanging Shade

The extent of overhanging shade along the summer-fall and winter-spring shorelines was determined through analysis of current and historic aerial images. Summer-fall conditions were analyzed using imagery from late summer and early fall months, typically representative of low water conditions. Winter-spring conditions were analyzed using imagery from late winter and early spring months, typically representative of high water conditions. Values for overhanging shade at winter and spring habitat conditions were modified by factors of 0.25 and 0.75 respectively to account for seasonal defoliation.

2.3 Characterization of With-Project Conditions

The with-project conditions were characterized using the project description outlined for Alternative 2 in the ARCF GRR BA. This analysis was conducted at a feasibility level of design; specific project designs will be developed under a Planning and Engineering Design phase. In the absence of more specific designs, this SAM analysis was developed using a set of “reasonable worst-case” parameters. The parameters were developed by evaluating the applicability of past levee repair designs to the project reach. Past levee repairs were conducted under the Sacramento River Bank Protection Project (SRBPP) within each of the sub-reaches (USACE 2008, USACE 2013). Applicability of design features was evaluated using the professional judgment and experience of the project team. In cases where the applicability of a particular design feature for a particular reach was in question, the analysis erred on the side of caution and applied reduced values or omitted the feature from final analysis. The set of reasonable worst-case parameters is designed to provide a maximum estimation of impact for the purpose of consultation at feasibility planning level. A Vegetation Variance Request (VVR) was assumed to be in place for the Sacramento and American River reaches. The Corps will obtain an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The Corps will be complying with the ETL on the American River via a SWIF. The VVR is not assumed to apply to the SBP. Specific habitat attributes are provided by site in (Tables 6-25) and specific justifications for each variable is also provided in those tables.

The following describes how input values for each of the SAM habitat attributes were derived for with-project conditions:

2.3.1 Bank Slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change, dW:dH) along each seasonal shoreline (i.e., the line where the water surface intersects the bank on average fall, winter, spring, and summer) (USACE 2004). With-project bank slopes were based on the description of project actions for each reach. Bank slopes for the Sacramento and American River reaches were assumed to be analogous to associated SRBPP repair sites that were in close proximity to the reach being analyzed. Consequently, bank slopes with a summer-fall slope of 3 and winter-spring slope of 10 were used.

2.3.2 Floodplain Availability

The with-project floodplain inundation ratios used in this SAM analysis remained unchanged from existing conditions. Levee repair and bank stabilization actions typically do not increase floodplain availability (with exception of constructing setback levees). In the absence of levee setback actions, the amount of available floodplain areas and channel cross sections would not be greatly altered during levee repair activities.

In this SAM analysis, it was assumed that the with-project floodplain inundation ratios would be the same as pre-project values. As a result, no impacts to habitat quality at the ARCF GRR reaches are expected with respect to this habitat variable.

2.3.3 Bank Substrate Size

The median substrate size (D_{50}) along the summer-fall and winter-spring shorelines of the project reach were based on the description of project actions for each sub-reach. Bank substrate size along the American River sub-reaches were assumed to be 18 inch rock revetment at summer-fall shoreline and 0.25 inch natural substrate at winter-spring shoreline. Bank substrate size along the Sacramento River sub-reaches were assumed to be 12 inch rock revetment at summer-fall shoreline and 0.25 inch natural substrate at winter-spring shoreline.

2.3.4 Instream Structure

The shoreline coverage of IWM along the average summer-fall and winter-spring shorelines was based on the description of project actions for each reach. In the SAM analysis, IWM coverage along the Sacramento and American River reaches were assumed to include installation of 40% shoreline coverage at summer-fall and winter-spring shoreline conditions.

2.3.5 Aquatic Vegetation

The shoreline coverage of aquatic vegetation along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Aquatic vegetation along the Sacramento and American River sub-reaches were assumed to be analogous to SRBPP repair sites. The vegetation growth models below applied to the Sacramento and American River sub-reaches were taken from previous SAM analysis'. For the American River (ARN_AB, ARS_ABC) four previously constructed SRBPP sites within the ARCF GRR project area were used for analysis (LAR 0.3L, LAR 2.8L, LAR 10.0L, and LAR 10.6L)(USACE, 2013). For the Sacramento River 15 previously constructed SRBPP sites within the ARCF GRR project area were used for analysis (SAC 49.7L, SAC 52.3L, and SAC 53.5R)(USACE 2013) and (RM 47.0L, RM 47.9R, RM 48.2R, RM 49.6R, RM 49.9L, RM 50.2L, RM 50.4L, RM 50.8L, RM 51.5 L, RM 52.4L, RM 53.1L, and RM 56.7L)(USACE 2008). Relevant O&M activities were considered but excluded from this analysis. The assumed vegetation variance would apply to woody vegetation only and O&M activities would be expected to result in the removal of shrubs on the slope of the levee; however, it was assumed that typical SRBPP repair designs would locate the planted riparian bench at appropriate elevations and distance from the levee to allow for revegetation efforts. Any removal of shrubby vegetation as the result of O&M activities would take place on the upper slope of the levee and would not impact the habitat considered in a typical SAM analysis.

2.3.6 Overhanging Shade

The shoreline coverage of overhanging shade along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Overhanging shade along the Sacramento and American River sub-reaches were assumed to be analogous to SRBPP repair sites. It was assumed that a variance would be in place allowing for retention of woody vegetation along the lower 2/3 of the levee slope. As the result of constructing a planted bench, it was assumed that the with-project seasonal shoreline would be shifted away from the existing shade providing canopy. Under this assumption, existing summer-fall values for overhanging shade were taken as the starting point for with-project winter-spring conditions. The with-project winter-spring values were further reduced by 75% (winter) and 25% (spring) to account for defoliation. As a final step, these winter-spring values were reduced by 20% to account for trees removed for construction equipment access. With-project overhanging shade values were expected to start at 0% as the result of a constructed bench shifting the shoreline away from the existing canopy. The shade growth models below were applied to the starting seasonal values for overhanging shade described above along the Sacramento and American River sub-reaches. These shade growth models were taken from previous SRBPP SAM analysis' conducted within the ARCF GRR project area.

3.0 Results

The SAM results are presented as weighted response indices (WRI), that give a relative indication of fish response to a project action over time. A negative WRI can be interpreted as a reduction in habitat value and a positive WRI can be interpreted as a increase in habitat value Although the WRI values are not directly representative of actual lengths or areas, the resource agencies have used those values as proxies in determining mitigative requirements. Appropriate mitigation is typically determined by identifying the maximum negative WRI for critical life stages (spawning and egg incubation, fry and juvenile rearing, and juvenile migration) on a site-by-site basis. Therefore this section will present results with a focus on the identification of maximum negative WRIs.

As described above, the ARCF GRR project reaches were grouped into four SAM analysis reaches based on hydrologic connectivity. Results are presented below by reach and species and are summarized in tables 30-32 and figures 2-22 at the end of the document.

3.1 Sacramento River SAM Analysis (ARS_DEFG)

The Sacramento River SAM analysis reach includes the entire left bank (east side) of the Sacramento River from the American River confluence to approximately 4,020 linear feet (lf) below the Freeport Bridge. The response of all runs of Chinook salmon, steelhead, and green sturgeon to project actions were included in the analysis of this reach. The green sturgeon spawning and egg incubation life stage was excluded from the analysis because spawning does not occur in the project area.

3.1.1 Spring/ Fall/ Late-Fall/ Winter Run Chinook Salmon

Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a positive response by year 5 in the winter-spring when most juvenile Chinook salmon are expected in the ARCF GRR project area. Short term negative WRI are expected within the recommended recovery period for Chinook salmon. The maximum negative WRI identified is -4,258 ft for the juvenile migration life stage of Chinook salmon in the summer of year 9. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Table 28). The WRI response curves for juvenile migration and rearing can be located in (Figures 4 and 7). The NMFS SAM effects analysis summary tables can be seen in (Table 32).

3.1.2 Steelhead

Steelhead are expected to show a long term positive response to project actions in the Sacramento River SAM analysis reach over the lifetime of the project. Steelhead should exhibit a positive response by year 4 in the winter-spring when most juvenile steelhead will be migrating and rearing through the project area. The maximum negative WRI identified is -3,985 ft for the juvenile migration life stage of steelhead in the fall of year 10. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions. The WRI response curves for juvenile migration and rearing can be located in (Figures 10 and 13).

3.1.3 Green Sturgeon

SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species. SAM WRI's for green sturgeon generally indicate a negative response or no response to typical onsite mitigative features. Green sturgeon are expected to show long term negative response to project actions in the Sacramento River SAM analysis reach for several life stages at all seasonal habitat conditions over the lifetime of the project. The maximum negative WRI identified is -5,009 for fry and juvenile rearing in the summer of year 1. Negative WRI displayed a general trend toward decreasing beyond the lifetime of the project for fry and juvenile rearing life stages. Negative WRI values for adult life stages will result from the creation of a 10:1 planted bench at winter/spring habitat conditions. The WRI response curves for juvenile rearing can be located in (Figure 16).

3.2 American River SAM Analysis (ARN_AB and ARS_ABC)

The American River SAM analysis reaches include portions of the right and left bank of the American River from Goethe Park to the confluence of the Sacramento. The response of spring and fall runs of Chinook salmon, steelhead, and green sturgeon were included in the analysis of these reaches. Additional seasonal fall run juvenile migration life stage analysis was conducted after consultation with NMFS. Green sturgeon analysis was also included because of critical habitat in the lowest sub-reach (ARS_C) of the American River project area.

3.2.1 Spring/ Fall Chinook Salmon

Chinook salmon are expected to show a long term positive response to project actions in the American River SAM analysis reaches over the lifetime of the project when both IWM and planted benches are incorporated into the with-project conditions. Chinook salmon should exhibit a positive response by year 5. Short term habitat deficits are expected within the recommended recovery period for Chinook salmon. The maximum negative WRI value identified for the American River SAM ARN_AB and ARS_ABC is -3,129 ft for the juvenile migration life stage of fall-run Chinook salmon in the summer of year 1. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Tables 26-27). The WRI response curves for juvenile migration and rearing can be located in (Figures 2,3,5,and 6). Additional fall-run Chinook salmon juvenile migration life stages not normally set as default in SAM were included on the American River reaches per NMFS request.

3.2.2 Steelhead

Steelhead are expected to show a long term positive response to project actions in the American River SAM analysis reach over the lifetime of the project. Steelhead should exhibit a positive response by year 4. Short term habitat deficits are expected within the recommended recovery period for steelhead. The maximum negative WRI value identified for the American River SAM analysis is -3,061 ft for the adult residence life stage in the summer of year 1 (Figures 20 and 21). Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions. The WRI response curves for juvenile migration and rearing can be located in (Figures 8,9,11, and 12).

3.2.3 Green Sturgeon

Project actions in the American River SAM analysis reach will mimic SRBPP repair site onsite mitigative features. SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species; green sturgeon will exhibit a negative response for juvenile rearing in the summer/fall to these onsite mitigative features. However, during the winter/spring green sturgeon juvenile rearing life stages will exhibit a positive response to these onsite mitigative features. The maximum negative WRI value identified is -7,118 ft for the fry and juvenile rearing life stage in the summer of year 1. The WRI response curves for juvenile rearing can be located in (Figures 14 and 15).

3.3 Sacramento Bypass and Weir SAM Analysis

The Sacramento Bypass SAM analysis reach includes the right bank (north side) of the Sacramento Bypass levee in its entirety from the confluence of the Sacramento River to its termination at the Yolo Bypass. The response of all runs of Chinook salmon, steelhead, and green sturgeon were included in the analysis of this reach.

3.3.1 Spring/ Fall/ Late-Fall/ Winter Run Chinook Salmon

Chinook salmon are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a negative response by year 1. The maximum negative WRI value identified is -188 ft for the juvenile migration life stage of Spring and Winter-run Chinook salmon in the spring of year 2. Short term and long term negative WRI values will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Table 29). The NMFS SAM effects analysis summary tables can be seen in (Table 33).

3.3.2 Steelhead

Steelhead are also expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Steelhead should exhibit a negative response by year 1. The maximum negative WRI value identified is -174 ft for the juvenile migration life stage in the spring of year 2. Short term and long term negative WRI values will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir. The NMFS SAM effects analysis summary tables can be seen in (Table 33).

3.3.3 Green Sturgeon

Green Sturgeon are expected to show a long term positive response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project for the fry and juvenile rearing life stages in the winter/spring/summer/fall of year 1. The maximum negative WRI value identified is -8 ft for the adult residence life stage of green sturgeon in the winter/spring/summer of year 1 which carries over through the life of the project into year 50. The SAM data iterations for the various life stages for green sturgeon can be seen in (Table 29). The NMFS SAM effects analysis summary tables can be seen in (Table 33).

4.0 Discussion

The SAM analysis indicates that the project actions in the Sacramento River SAM analysis reach, American River SAM analysis reach, and the Sacramento Bypass SAM analysis reach would result in short and longer-term impacts for focus fish species. Impacts to Chinook salmon, Central Valley steelhead, and green sturgeon are generally the result of reduction in the available natural substrate, shade and the alteration of near-shore slope resulting from bank armoring. Long term recovery of onsite vegetation, addition of IWM, and retention of existing vegetation are all expected to minimize impact as well as contribute to long term gains in habitat value.

This SAM analysis employed a set of worst case scenario parameters developed to capture the maximum potential impacts of the project for the Section 7 consultation process. Future implementation of the project is expected to result in significantly lower impacts. Project actions along portions of the American River reach will likely not include bank armoring in their final design, which will significantly reduce estimated impacts to fish species. Additional mitigative design features or improved erosion repair designs may result in reduced impact compared to the legacy designs used for the basis of this analysis. Site specific designs will be implemented on a site by site basis in consultation with resource agencies and project partners to minimize impacts as well as maximize opportunities for implementing onsite mitigative features.

During project implementation, site specific SAM analyses will be run on final designs to better evaluate impact. SAM results will be used by the Corps and NMFS in the negotiation of appropriate mitigation for project actions. Although short term impacts are generally self mitigating through the development of onsite mitigative features, the Corps will compensate for the temporal impacts to habitat through the purchase of offsite mitigative credits. Typically appropriate mitigation will be based on the identification of maximum negative WRI values. By mitigating for the maximum negative WRI, lesser impacts are expected to be appropriately mitigated. As a general rule, the SAM applies any habitat characteristics at summer/fall conditions to winter/spring conditions with the assumption that those characteristics would provide similar value during inundation. Onsite mitigation at summer/fall conditions is expected to provide similar habitat benefit for winter/spring conditions. Offsite mitigation is expected to provide mitigative value at all seasonal habitat conditions. Longer term impacts to habitat may not recover to baseline conditions over the life of the project due to design restrictions. These impacts to habitat will be compensated through the purchase of offsite mitigative credits as well as the incorporation of additional onsite mitigative features (ie. low water plantings, additional IWM, additional revegetation).

Additional mitigative concerns, not considered in a SAM analysis, will be addressed along the Sacramento Bypass reach, including potential adult and juvenile passage issues, loss of shoreline riparian vs. gain in floodplain, and contradicting ESA species habitat requirements. These issues will be considered and appropriate actions will be taken where possible in coordination with other agencies.

4.1 Chinook Salmon

Impacts to Chinook salmon were analyzed for the Sacramento River SAM analysis reach (ARS_DEFG), American River SAM analysis reach (ARN_AB, ARS_ABC) and the Sacramento Bypass SAM analysis reach. In the Sacramento River SAM analysis reach, negative WRI values are due to short term removal of aquatic vegetation and overhanging shade caused by the repair action. The SAM analysis indicates that repair actions would result in a maximum negative WRI value of -4,258 ft. This value is based on the maximum negative WRI value observed for juvenile migration life stage of Chinook salmon in the summer of year 9. USACE will mitigate for -4,258 ft of equivalent habitat as described above in Section 4.0.

In the American River SAM analysis reaches ARN_AB and ARS_ABC negative WRI values are due to short term removal of aquatic vegetation and overhanging shade caused by the repair action. The SAM analysis incorporating planted benches and IWM indicates that repair actions would result in a maximum habitat deficit of -3,129 ft. This value is based on the maximum negative WRI value observed for the juvenile migration life stage of spring and fall-run Chinook salmon in the summer and fall of year 1. USACE will mitigate for -3,129 ft of equivalent habitat as described above in Section 4.0.

There were no initial construction impact negative WRI values for the juvenile rearing life stage of Chinook salmon in the winter and spring water levels on the American and Sacramento River reaches. A possible explanation is that the SAM ECT does not produce an output at Year-0. It does not calculate the difference from the baseline to with-Project results. SAM at Year-0 is zero. The relative response for Year-1 is actually the Year-0 results+Year-1 results divided by 2, see pages 5-29 to 5-31 in the SAM Certification Update for SAM formula detailed explanation. In Year-0 revetment will be added, vegetation will be removed and slope will have a positive change. In Year-1 IWM will be added, soil and planting on the bench will occur, and the VVR will kick in. Year-0 habitat deficits would be more than the Year-1 deficits where the positive and negative deficits are equal.

In the Sacramento Bypass SAM analysis reach negative WRI values are due to short and long term removal of aquatic vegetation and overhanging shade for the upstream extension of the Sacramento Bypass Weir. The SAM analysis indicates that repair and removal actions would result in a maximum negative WRI value of -146 ft. This value is based on the maximum negative WRI value observed for juvenile migration of Chinook salmon in the winter of year 1. USACE will mitigate for -146 ft of equivalent habitat as described above in Section 4.0.

4.2 Steelhead

Impacts to steelhead were analyzed for the Sacramento River SAM analysis reach, American River SAM analysis reach, and the Sacramento Bypass SAM analysis reach. The Sacramento River SAM analysis indicates that repair actions would result in maximum negative WRI values of -3,985 ft. This value is based on the maximum negative WRI value observed for the juvenile migration life stage of steelhead in the fall of year 10.

The American River SAM analysis ARN_AB and ARS_ABC indicates that repair actions would result in negative WRI values of -3,061 ft. This negative WRI is expected to be adequately compensated through mitigation of a greater negative WRI for Chinook salmon.

There were no initial construction impact negative WRI values for the juvenile rearing life stage of steelhead in the winter and spring water levels on the Sacramento River reaches. A possible explanation is that the SAM ECT does not produce an output at Year-0. It does not calculate the difference from the baseline to with-Project results. SAM at Year-0 is zero. The relative response for Year-1 is actually the Year-0 results+Year-1 results divided by 2, see pages 5-29 to 5-31 in the SAM Certification Update for SAM formula detailed explanation. In Year-0 revetment will be added, vegetation will be removed and slope will have a positive change. In Year-1 IWM will be added, soil and planting on the bench will occur, and the VVR will kick in. Year-0 habitat deficits would be more than the Year-1 habitat deficits where the positive and negative deficits are equal.

The Sacramento Bypass SAM analysis indicates that repair actions would result in maximum negative WRI values of -174 ft. This value is based on the maximum negative WRI value observed for the juvenile migration life stage of steelhead in the spring of year 4. This negative WRI is expected to be adequately compensated through mitigation of a greater negative WRI for Chinook salmon.

4.3 Green Sturgeon

Impacts to green sturgeon were analyzed for the Sacramento and American River SAM and Sacramento Bypass analysis reaches. Green sturgeon critical habitat in the American River extends from the confluence of the Sacramento River to the Highway 160 bridge (ARS_C). Additional SAM elements were incorporated to address potential green sturgeon effects in the American River reaches (ARN_AB and ARS_AB), as per NMFS request, even though use of these reaches by green sturgeon has not been documented. Recently a white sturgeon (161mm) was collected in a rotary screw trap (RST) by the U.S. Fish and Wildlife Service (USFWS) at the Watt Avenue bridge, the first such documented catch of a sturgeon since records have been kept dating back to approximately 1996. There have been no green sturgeon collected, and the correlation of green sturgeon presence to white sturgeon presence is not well understood for larval life stages in this region of the river. This additional analysis allowed for a more conservative estimate of impacts and may not necessarily reflect the true impacts from the project.

The habitat requirements of green sturgeon are not well understood; assumptions built into the SAM on fish response to shoreline features were based on limited information. Habitat use of the American River, Sacramento River, and Sacramento Bypass project reaches by green sturgeon are likely limited to use as a migration corridor by adults and potential rearing area by juvenile life stages. Although the SAM indicates negative response to habitat by adult life stages, it is unlikely that shoreline repair activities would significantly impact the river for residence or as a migration corridor. SRBPP style repairs are designed to mimic naturally occurring habitat types and are not expected to significantly alter the width of the river. USACE does not expect any significant impacts to the adult residence or adult migration life stages in the American or Sacramento River and does not propose any additional mitigation.

No suitable spawning habitat exists in the Sacramento River, American River, and Sacramento Bypass project reaches. Green sturgeon spawning with concurrent egg incubation and early life history primarily takes place upriver of Colusa on the Sacramento River and in the lower Feather River outside of the project area. Because no suitable spawning habitat is present in the project reaches under existing conditions, USACE does not expect any significant impacts to the spawning and egg incubation life stage of green sturgeon and does not propose any additional mitigation.

The American River SAM analysis ARN_AB and ARS_ABC indicates that repair actions would result in a maximum negative WRI values of -7,118 ft. for fry and juvenile rearing in the summer of year one. The Sacramento River SAM analysis ARS_DEFG indicates that repair actions would result in a maximum negative WRI values of -5,009 for fry and juvenile rearing in the summer of year one.

The Sacramento Bypass SAM analysis indicates that repair actions would result in maximum negative WRI values of -8 ft in response to the removal of aquatic vegetation and SRA for the expansion of the Sacramento Bypass and Weir. This value is based on the maximum negative WRI values observed for the adult residence life stage of green sturgeon in the winter/spring /summer of year 1 continuing through the life of the project to year 50.

Little is known about the fry and juvenile rearing and juvenile migration life stages of green sturgeon. The SAM does not evaluate response to specific habitat attributes for the juvenile migration life stage. For the purpose of this analysis it is assumed that these life stages exhibit similar responses to analogous life stages of Chinook and steelhead. This approach assumes that fry and juvenile rearing and juvenile migration life stages of green sturgeon will exhibit a positive response to “good riparian habitat” (i.e. increased shoreline coverage of overhanging shade, aquatic vegetation, and IWM). During the planning and design phase of the project, opportunities for the incorporation of additional onsite mitigative features will be evaluated in coordination with resource agencies to ensure the projected longer term impacts are appropriately compensated for green sturgeon. Potential onsite mitigative features include the planting of vegetation at the low water line, the incorporation of additional IWM, and limitations in instream revetment.

Table 6

SAM data summary of existing conditions at site Lower American River RM 10.0L and 10.6L (ARN_AB).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	18,576	18,576	18,576	18,576
	2074	18,576	18,576	18,576	18,576
Bank Slope (dH:dV) [2]	2024	2	2	2	2
	2074	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	2.5	2.5	2.5	2.5
	2074	2.5	2.5	2.5	2.5
Instream Structure (% shoreline) [5]	2024	31	31	31	31
	2074	31	31	31	31
Vegetation (% shoreline) [6]	2024	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [7]	2024	60	15	45	60
	2074	60	15	45	60

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 7

SAM data summary of with-project conditions at site Lower American River RM 10.0L and 10.6L (ARN_AB).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	18,576	18,576	18,576	18,576
	2074	18,576	18,576	18,576	18,576
Bank Slope (dH:dV) [2]	2024	2	3	3	3
	2025	3	10	10	3
	2074	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	2.5	18	18	18
	2025	18	0.25	0.25	18
	2074	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2024	31	0	0	0
	2025	40	40	40	40
	2074	40	40	40	40
Vegetation (% shoreline) [6]	2024	0	0	0	0
	2025	0	25	50	0
	2029	0	88	88	0
	2039	0	88	88	0
	2049	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [6]	2024	0	13	38	0
	2025	0	13	40	0
	2029	0	25	75	0
	2039	100	25	75	100
	2049	100	25	75	100
	2074	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

[2] Assume no significant change to Bank Slope.

[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).

[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.

[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee.

Table 8

SAM data summary of existing conditions at site Lower American River RM 10.0L and 10.6L (ARS_A).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	14,345	14,345	14,345	14,345
	2070	14,345	14,345	14,345	14,345
Bank Slope (dH:dV) [2]	2020	2.00	2.00	2.00	2.00
	2070	2.00	2.00	2.00	2.00
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	1.2	1.2	1.2	1.2
	2070	1.2	1.2	1.2	1.2
Instream Structure (% shoreline) [5]	2020	1.7	1.7	1.7	1.7
	2070	1.7	1.7	1.7	1.7
Vegetation (% shoreline) [6]	2020	0	63	63	0
	2070	0	63	63	0
Shade (% shoreline) [7]	2020	42	11	32	42
	2070	42	11	32	42

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 9

SAM data summary of with-project conditions at site Lower American River RM 10.0L and 10.6L (ARS_A).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	14,345	14,345	14,345	14,345
	2070	14,345	14,345	14,345	14,345
Bank Slope (dH:dV) [2]	2020	2.0	3.0	3.0	3.0
	2021	3.0	10.0	10.0	3.0
	2070	3.0	10.0	10.0	3.0
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	1.2	18	18	18
	2021	18	0.25	0.25	18
	2070	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2020	1.7	0.0	0.0	0
	2021	40	40	40	40
	2070	40	40	40	40
Vegetation (% shoreline) [6]	2020	0	0	0	0
	2021	0	25	50	0
	2025	0	88	88	0
	2035	0	88	88	0
	2045	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [6]	2020	0	9	27	0
	2021	0	9	29	0
	2025	0	24	74	0
	2035	100	25	75	100
	2045	100	25	75	100
	2070	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

[2] Assume no significant change to Bank Slope.

[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).

[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.

[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 10

SAM data summary of existing conditions at site Lower American River RM 2.8L (ARS_B).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2023	5,472	5,472	5,472	5,472
	2073	5,472	5,472	5,472	5,472
Bank Slope (dH:dV) [2]	2023	2	2	2	2
	2073	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2023	1	1	1	1
	2073	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2023	1.5	1.5	1.5	1.5
	2073	1.5	1.5	1.5	1.5
Instream Structure (% shoreline) [5]	2023	5	5	5	5
	2073	5	5	5	5
Vegetation (% shoreline) [6]	2023	0	65	65	0
	2073	0	65	65	0
Shade (% shoreline) [7]	2023	30	7	22	30
	2073	30	7	22	30

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 1 SRBPP repair site modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 11

SAM data summary of with-project conditions at site Lower American River RM 2.8L (ARS_B).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2023	5,472	5,472	5,472	5,472
	2073	5,472	5,472	5,472	5,472
Bank Slope (dH:dV) [2]	2023	2	3	3	3
	2024	3	10	10	3
	2073	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2023	1	1	1	1
	2073	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2023	1.5	18	18	18
	2024	18	0.25	0.25	18
	2073	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2023	5	0	0	0
	2024	40	40	40	40
	2073	40	40	40	40
Vegetation (% shoreline) [6]	2023	0	0	0	0
	2024	0	25	50	0
	2028	0	88	88	0
	2038	0	88	88	0
	2048	0	88	88	0
	2073	0	88	88	0
Shade (% shoreline) [6]	2023	0	7	20	0
	2024	0	7	22	0
	2028	0	22	67	0
	2038	100	25	75	100
	2048	100	25	75	100
	2073	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Assume no significant change to Bank Slope.
3 Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
4 Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Assume installation of rock revetment at summer/fall (D50 of 18 in) and natural substrate at winter/spring (D50 of 0.25 in).
6 Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
6 Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 12

SAM data summary of existing conditions at site Lower American River RM 0.3L (ARS_C).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2026	3,988	3,988	3,988	3,988
	2076	3,988	3,988	3,988	3,988
Bank Slope (dH:dV) [2]	2026	2	2	2	2
	2076	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2026	1	1	1	1
	2076	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2026	0.25	0.25	0.25	0.25
	2076	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [5]	2026	5	5	5	5
	2076	5	5	5	5
Vegetation (% shoreline) [6]	2026	0	88	88	0
	2076	0	88	88	0
Shade (% shoreline) [7]	2026	67	16	50	67
	2076	67	16	50	67

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 1 SRBPP repair site modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 13

SAM data summary of with-project conditions at site Lower American River RM 0.3L (ARS_C).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2026	3,988	3,988	3,988	3,988
	2076	3,988	3,988	3,988	3,988
Bank Slope (dH:dV) [2]	2026	2	3	3	3
	2027	3	10	10	3
	2076	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2026	1	1	1	1
	2076	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2026	0.25	18	18	18
	2027	18	0.25	0.25	18
	2076	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2026	5	0	0	0
	2027	40	40	40	40
	2076	40	40	40	40
Vegetation (% shoreline) [6]	2026	0	0	0	0
	2027	0	25	50	0
	2031	0	88	88	0
	2041	0	88	88	0
	2051	0	88	88	0
	2076	0	88	88	0
Shade (% shoreline) [6]	2026	0	14	42	0
	2027	0	14	44	0
	2031	0	25	75	0
	2041	100	25	75	100
	2051	100	25	75	100
	2076	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Assume no significant change to Bank Slope.
3 Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
4 Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Assume installation of rock revetment at summer/fall (D50 of 18 in) and natural substrate at winter/spring (D50 of 0.25 in).
6 Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
6 Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 14
SAM data summary of existing conditions at site Sacramento River RM 56.7L (ARS_D).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2025	9,131	9,131	9,131	9,131
	2075	9,131	9,131	9,131	9,131
Bank Slope (dH:dV) [2]	2025	1.8	1.8	1.8	1.8
	2075	1.8	1.8	1.8	1.8
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2025	1	1	1	1
	2075	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2025	7.6	7.6	7.6	7.6
	2075	7.6	7.6	7.6	7.6
Instream Structure (% shoreline) [5]	2025	22	22	22	22
	2075	22	22	22	22
Vegetation (% shoreline) [6]	2025	0	88	88	0
	2075	0	88	88	0
Shade (% shoreline) [7]	2025	40	10	30	40
	2075	40	10	30	40

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 1 SRBPP repair site modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 15

SAM data summary of with-project conditions at site Sacramento River RM 56.7L (ARS_D).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2025	9,131	9,131	9,131	9,131
	2075	9,131	9,131	9,131	9,131
Bank Slope (dH:dV) [2]	2025	2.5	1.5	1.5	1.5
	2026	1.5	6.5	6.5	1.5
	2075	1.5	6.5	6.5	1.5
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2025	1	1	1	1
	2075	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2025	7.6	12	12	12
	2026	12	0.25	0.25	12
	2075	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2025	22	0	0	0
	2026	0	0	0	0
	2075	0	0	0	0
Vegetation (% shoreline) [6]	2025	0	0	0	0
	2026	0	0	0	0
	2030	10	60	60	10
	2040	10	88	88	10
	2050	10	88	88	10
	2075	10	88	88	10
Shade (% shoreline) [6]	2025	0	8	24	0
	2026	0	8	25	0
	2030	0	9	35	0
	2040	61	13	66	61
	2050	97	15	75	97
	2075	99	15	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Assume no significant change to Bank Slope.
3 Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
4 Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Assume installation of rock revetment at summer/fall (D50 of 12 in) and natural substrate at winter/spring (D50 of 0.25 in).
6 Assume no installation of shoreline coverage of IWM at summer/fall and winter/spring.
6 Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 16

SAM data summary of existing conditions at site Sacramento River RM 53.1L and RM 53.5R (ARS_E).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2021	9,149	9,149	9,149	9,149
	2071	9,149	9,149	9,149	9,149
Bank Slope (dH:dV) [2]	2021	1.7	1.7	1.7	1.7
	2071	1.7	1.7	1.7	1.7
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2021	1	1	1	1
	2071	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2021	7	7	7	7
	2071	7	7	7	7
Instream Structure (% shoreline) [5]	2021	30	30	30	30
	2071	30	30	30	30
Vegetation (% shoreline) [6]	2021	0	88	88	0
	2071	0	88	88	0
Shade (% shoreline) [7]	2021	60	15	45	60
	2071	60	15	45	60

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 17

SAM data summary of with-project conditions at site Sacramento River RM 53.1L and 53.5R (ARS_E).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2021	9,149	9,149	9,149	9,149
	2071	9,149	9,149	9,149	9,149
Bank Slope (dH:dV) [2]	2021	1.7	2	2	2
	2022	2	6	6	2
	2071	2	6	6	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2021	1	1	1	1
	2071	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2021	7	12	12	12
	2022	12	0.25	0.25	12
	2071	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2021	30	0	0	0
	2022	40	40	40	40
	2071	40	40	40	40
Vegetation (% shoreline) [6]	2021	0	0	0	0
	2022	0	50	50	0
	2026	0	88	88	0
	2036	0	88	88	0
	2046	0	88	88	0
	2071	0	88	88	0
Shade (% shoreline) [6]	2021	0	12	36	0
	2022	0	12	37	0
	2026	0	13	42	0
	2036	61	17	75	61
	2046	97	19	75	97
	2071	99	19	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

[2] Assume no significant change to Bank Slope.

[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).

[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.

[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 18

SAM data summary of existing conditions at site Sacramento River RM 48.2L-52.4L (ARS_F).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	21,379	21,379	21,379	21,379
	2070	21,379	21,379	21,379	21,379
Bank Slope (dH:dV) [2]	2020	1.8	1.8	1.8	1.8
	2070	1.8	1.8	1.8	1.8
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	8.7	8.7	8.7	8.7
	2070	8.7	8.7	8.7	8.7
Instream Structure (% shoreline) [5]	2020	17	17	17	17
	2070	17	17	17	17
Vegetation (% shoreline) [6]	2020	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [7]	2020	73	18	54	73
	2070	73	18	54	73

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 10 SRBPP repair sites modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 19

SAM data summary of with-project conditions at site Sacramento River RM 48.2L-52.4L (ARS_F).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	21,379	21,379	21,379	21,379
	2070	21,379	21,379	21,379	21,379
Bank Slope (dH:dV) [2]	2020	1.8	2.0	2.0	2
	2021	2	6	6	2
	2070	2	6	6	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	8.7	12	12	12
	2021	12	0.25	0.25	12
	2070	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2020	17	0	0	0
	2021	40	40	40	40
	2070	40	40	40	40
Vegetation (% shoreline) [6]	2020	0	0	0	0
	2021	0	50	50	0
	2025	0	88	88	0
	2035	0	88	88	0
	2045	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [6]	2020	0	14	43	0
	2021	0	14	44	0
	2025	0	15	54	0
	2035	61	19	75	61
	2045	97	21	75	97
	2070	99	21	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Assume no significant change to Bank Slope.
3 Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
4 Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Assume installation of rock revetment at summer/fall (D50 of 12 in) and natural substrate at winter/spring (D50 of 0.25 in).
6 Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
6 Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 20

SAM data summary of existing conditions at site Sacramento River RM 47.0L and 47.9R (ARS_G).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	11,066	11,066	11,066	11,066
	2074	11,066	11,066	11,066	11,066
Bank Slope (dH:dV) [2]	2024	2	2	2	2
	2074	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	9.40	9.40	9.40	9.40
	2074	9.40	9.40	9.40	9.40
Instream Structure (% shoreline) [5]	2024	5.5	5.5	5.5	5.5
	2074	5.5	5.5	5.5	5.5
Vegetation (% shoreline) [6]	2024	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [7]	2024	90	22	67	90
	2074	90	22	67	90

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
2 Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
3 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
4 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
5 Instream Structure data taken from USACE Revetment Database (2007).
6 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
7 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 21

SAM data summary of with-project conditions at site Sacramento River RM 47.0L and 47.9R (ARS_G).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	11,066	11,066	11,066	11,066
	2074	11,066	11,066	11,066	11,066
Bank Slope (dH:dV) [2]	2024	2.5	3	3	3
	2025	3	10	10	3
	2074	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	9.4	12	12	12
	2025	12	0.25	0.25	12
	2074	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2024	5.5	0	0	0
	2025	40	40	40	40
	2074	40	40	40	40
Vegetation (% shoreline) [6]	2024	0	0	0	0
	2025	0	50	50	0
	2029	0	88	88	0
	2039	0	88	88	0
	2049	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [6]	2024	0	18	54	0
	2025	0	18	55	0
	2029	0	19	65	0
	2039	100	23	75	100
	2049	100	25	75	100
	2074	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

1 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

2 Assume no significant change to Bank Slope.

3 Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

4 Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

5 Assume installation of rock revetment at summer/fall (D50 of 12 in) and natural substrate at winter/spring (D50 of 0.25 in).

6 Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
6 Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 22

SAM data summary of existing conditions at site Sacramento River 50.0L (SBP Levee).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	8,799,296	8,799,296	8,799,296	8,799,296
	2062	8,799,296	8,799,296	8,799,296	8,799,296
Shoreline Length (feet) [2]	2012	9,047	9,047	9,047	9,047
	2062	9,047	9,047	9,047	9,047
Bank Slope (dH:dV) [3]	2012	2	2	2	2
	2062	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	2.4	2.4	2.4	2.4
	2062	2.4	2.4	2.4	2.4
Instream Structure (% shoreline) [6]	2012	3.9	3.9	3.9	3.9
	2062	3.9	3.9	3.9	3.9
Vegetation (% shoreline) [7]	2012	0	71	71	0
	2062	0	71	71	0
Shade (% shoreline) [8]	2012	48	12	36	48
	2062	48	12	36	48

1 Wetted area estimated from aerial images in Google Earth Pro. Length x Width
2 USACE Revetment Database (2007) and Google Earth Pro.
3 Repairs not expected to affect slope, assume slope of 2 for consistency with USACE standards.
4 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
6 Instream Structure data taken from USACE Revetment Database (2007).
7 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
8 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 23
SAM data summary of with-project conditions at site Sacramento River RM 50.0L (SBP Levee).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	23,022,296	23,022,296	23,022,296	23,022,296
	2062	23,022,296	23,022,296	23,022,296	23,022,296
Shoreline Length (feet) [2]	2012	9,047	9,047	9,047	9,047
	2062	9,047	9,047	9,047	9,047
Bank Slope (dH:dV)	2012	2.5	2.5	2.5	2.5
	2013	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg)	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [3]	2012	2.4	2.4	2.4	2.4
	2013	2.4	2.4	2.4	2.4
	2062	2.4	2.4	2.4	2.4
Instream Structure (% shoreline) [3]	2012	3.9	3.9	3.9	3.9
	2013	3.9	3.9	3.9	3.9
	2062	3.9	3.9	3.9	3.9
Vegetation (% shoreline) [3]	2012	0	71	71	0
	2013	0	71	71	0
	2017	0	71	71	0
	2027	0	71	71	0
	2037	0	71	71	0
	2062	0	71	71	0
Shade (% shoreline)[3]	2012	48	12	36	48
	2013	48	12	36	48
	2017	48	12	36	48
	2027	48	12	36	48
	2037	48	12	36	48
	2062	48	12	36	48

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Wetted area calculated by aerial images and a length x width with-project conditions
2 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
3 Assumed to stay the same due to only degrading and moving levee

Table 24

SAM data summary of existing conditions at site Sacramento River RM 50.0L (SBP Weir).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	283,968	283,968	283,968	283,968
	2062	283,968	283,968	283,968	283,968
Shoreline Length (feet) [2]	2012	1,500	1,500	1,500	1,500
	2062	1,500	1,500	1,500	1,500
Bank Slope (dH:dV) [3]	2012	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	10	10	10	10
	2062	10	10	10	10
Instream Structure (% shoreline) [6]	2012	0	0	0	0
	2062	0	0	0	0
Vegetation (% shoreline) [7]	2012	0	88	88	0
	2062	0	88	88	0
Shade (% shoreline) [8]	2012	48	12	36	48
	2062	48	12	36	48

1 Wetted area estimated from aerial images in Google Earth Pro. Length x Width
2 USACE Revetment Database (2007) and Google Earth Pro.
3 Repairs not expected to affect slope, assume slope of 2 for consistency with USACE standards.
4 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D50 of 10 inches.
6 Instream Structure data taken from USACE Revetment Database (2007).
7 Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
8 Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation

Table 25
SAM data summary of with-project conditions at site Sacramento River RM 50.0L (SBP Weir).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	742,968	742,968	742,968	742,968
	2062	742,968	742,968	742,968	742,968
Shoreline Length (feet) [2]	2012	1,500	1,500	1,500	1,500
	2062	1,500	1,500	1,500	1,500
Bank Slope (dH:dV) [3]	2012	2.5	2.5	2.5	2.5
	2013	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	10	10	10	10
	2013	10	10	10	10
	2062	10	10	10	10
Instream Structure (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2062	0	0	0	0
Vegetation (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2017	0	0	0	0
	2027	0	0	0	0
	2037	0	0	0	0
	2062	0	0	0	0
Shade (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2017	0	0	0	0
	2027	0	0	0	0
	2037	0	0	0	0
	2062	0	0	0	0

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
1 Wetted area calculated by aerial images and a length x width with-project conditions
2 Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
3 Repairs not expected to affect slope, assume slope of 2.5 for consistency with USACE standards.

4 Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
5 Assume installation of rock revetment at summer/fall (D50 of 12 in) and natural substrate at winter/spring (D50 of 0.25 in).
6 Assume no vegetation variance and no placement of IWM and O&M activities

Table 26 American River SAM Analysis Reach

ARN_AB

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0			0	0				0	0				0					0		
1			-366	-1,945				59	-3,002				124					-421		
2			-365	-2,166				411	-1,357				634					-392		
3			-365	-2,240				564	-662				827					-383		
4			-364	-2,277				667	-201				941					-378		
5			-364	-2,299				751	167				1,024					-375		
6			-361	-2,303				816	450				1,085					-370		
7			-353	-2,288				863	653				1,129					-360		
8			-341	-2,260				897	805				1,161					-348		
9			-328	-2,225				925	924				1,187					-334		
10			-314	-2,183				946	1,018				1,207					-319		
11			-298	-2,138				964	1,096				1,224					-303		
12			-282	-2,089				979	1,160				1,238					-287		
13			-265	-2,038				991	1,215				1,250					-270		
14			-248	-1,985				1,002	1,261				1,260					-252		
15			-230	-1,930				1,011	1,302				1,268					-234		
25			-124	-1,600				1,063	1,529				1,317					-126		
50			-44	-1,352				1,102	1,699				1,354					-45		
Fall-run Chinook																				
0	0	0	0	0		0	0	0	0			0	0	0					0	
1	-877	0	-366	-1,945		-759	0	59	-3,002			0	124	-2,681					-3,129	
2	-853	0	-365	-2,166		-339	0	411	-1,357			0	634	-755					-2,759	
3	-845	0	-365	-2,240		-180	0	564	-662			0	827	-80					-2,635	
4	-841	0	-364	-2,277		-87	0	667	-201			0	941	282					-2,573	
5	-839	0	-364	-2,299		-20	0	751	167			0	1,024	519					-2,536	
6	-828	0	-361	-2,303		29	0	816	450			0	1,085	686					-2,501	
7	-804	0	-353	-2,288		64	0	863	653			0	1,129	805					-2,457	
8	-773	0	-341	-2,260		90	0	897	805			0	1,161	894					-2,408	
9	-736	0	-328	-2,225		111	0	925	924			0	1,187	963					-2,356	
10	-695	0	-314	-2,183		127	0	946	1,018			0	1,207	1,018					-2,302	
11	-652	0	-298	-2,138		141	0	964	1,096			0	1,224	1,064					-2,245	
12	-606	0	-282	-2,089		152	0	979	1,160			0	1,238	1,102					-2,188	
13	-559	0	-265	-2,038		161	0	991	1,215			0	1,250	1,134					-2,129	
14	-511	0	-248	-1,985		170	0	1,002	1,261			0	1,260	1,161					-2,069	
15	-462	0	-230	-1,930		177	0	1,011	1,302			0	1,268	1,185					-2,009	
25	-164	0	-124	-1,600		216	0	1,063	1,529			0	1,317	1,318					-1,647	
50	59	0	-44	-1,352		245	0	1,102	1,699			0	1,354	1,418					-1,375	

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 26 (cont.)

American River SAM Analysis Reach

ARN_AB

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0		0	0	0	0		0	0	0	0	0	0			0	0	0
1	-1,554		-701		-1,554	-1,558	0	-36		-1,558	-1,635	0	-1	-2,096	-1,635			-833	-3,013	-3,061
2	-1,508		-708		-1,508	-701	0	519		-701	-739	0	734	-520	-739			-774	-2,634	-2,262
3	-1,493		-711		-1,493	-381	0	750		-381	-411	0	1,009	23	-411			-755	-2,507	-1,996
4	-1,486		-712		-1,486	-195	0	900		-195	-225	0	1,168	309	-225			-745	-2,444	-1,862
5	-1,481		-712		-1,481	-63	0	1,018		-63	-96	0	1,282	491	-96			-739	-2,406	-1,782
6	-1,463		-707		-1,463	34	0	1,109		34	-3	0	1,365	617	-3			-729	-2,369	-1,714
7	-1,423		-693		-1,423	103	0	1,174		103	63	0	1,424	708	63			-712	-2,323	-1,639
8	-1,371		-674		-1,371	155	0	1,222		155	113	0	1,469	775	113			-691	-2,271	-1,559
9	-1,309		-651		-1,309	196	0	1,260		196	152	0	1,504	828	152			-666	-2,215	-1,477
10	-1,242		-626		-1,242	228	0	1,290		228	183	0	1,531	870	183			-639	-2,156	-1,392
11	-1,170		-599		-1,170	254	0	1,315		254	209	0	1,554	904	209			-611	-2,095	-1,307
12	-1,095		-571		-1,095	276	0	1,335		276	230	0	1,573	933	230			-582	-2,033	-1,220
13	-1,017		-541		-1,017	295	0	1,353		295	248	0	1,589	957	248			-551	-1,970	-1,133
14	-937		-511		-937	311	0	1,367		311	263	0	1,603	978	263			-520	-1,906	-1,044
15	-855		-480		-855	325	0	1,380		325	276	0	1,615	996	276			-489	-1,841	-956
25	-362		-293		-362	402	0	1,453		402	351	0	1,681	1,097	351			-298	-1,450	-422
50	8		-153		8	460	0	1,507		460	407	0	1,731	1,173	407			-156	-1,157	-22
Green Sturgeon																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	-3,250	-2,873	0	-11	0	-3,250	-5,020	0	-2,750	0	-3,250	-5,020	0	-2,750	0	-6,500	-7,118	0	-942
2	0	-4,875	-4,304	0	-16	0	-1,625	-3,280	0	-3,194	0	-1,625	-3,280	0	-3,194	0	-6,500	-6,426	0	-482
3	0	-5,417	-4,781	0	-18	0	-1,083	-2,699	0	-3,343	0	-1,083	-2,699	0	-3,343	0	-6,500	-6,196	0	-328
4	0	-5,688	-5,019	0	-19	0	-812	-2,409	0	-3,417	0	-812	-2,409	0	-3,417	0	-6,500	-6,081	0	-252
5	0	-5,850	-5,162	0	-20	0	-650	-2,235	0	-3,461	0	-650	-2,235	0	-3,461	0	-6,500	-6,011	0	-206
6	0	-5,958	-5,258	0	-20	0	-541	-2,119	0	-3,491	0	-541	-2,119	0	-3,491	0	-6,500	-5,965	0	-175
7	0	-6,036	-5,326	0	-20	0	-464	-2,036	0	-3,512	0	-464	-2,036	0	-3,512	0	-6,500	-5,932	0	-153
8	0	-6,094	-5,377	0	-20	0	-406	-1,974	0	-3,528	0	-406	-1,974	0	-3,528	0	-6,500	-5,908	0	-137
9	0	-6,139	-5,417	0	-20	0	-361	-1,926	0	-3,540	0	-361	-1,926	0	-3,540	0	-6,500	-5,888	0	-124
10	0	-6,175	-5,448	0	-21	0	-325	-1,887	0	-3,550	0	-325	-1,887	0	-3,550	0	-6,500	-5,873	0	-114
11	0	-6,205	-5,475	0	-21	0	-295	-1,855	0	-3,558	0	-295	-1,855	0	-3,558	0	-6,500	-5,860	0	-105
12	0	-6,229	-5,496	0	-21	0	-271	-1,829	0	-3,565	0	-271	-1,829	0	-3,565	0	-6,500	-5,850	0	-98
13	0	-6,250	-5,515	0	-21	0	-250	-1,807	0	-3,570	0	-250	-1,807	0	-3,570	0	-6,500	-5,841	0	-92
14	0	-6,268	-5,530	0	-21	0	-232	-1,787	0	-3,575	0	-232	-1,787	0	-3,575	0	-6,500	-5,833	0	-87
15	0	-6,283	-5,544	0	-21	0	-216	-1,771	0	-3,579	0	-216	-1,771	0	-3,579	0	-6,500	-5,827	0	-83
25	0	-6,370	-5,620	0	-21	0	-130	-1,678	0	-3,603	0	-130	-1,678	0	-3,603	0	-6,500	-5,790	0	-58
50	0	-6,435	-5,677	0	-21	0	-65	-1,608	0	-3,621	0	-65	-1,608	0	-3,621	0	-6,500	-5,762	0	-40

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 27

American River SAM Analysis Reach

ARS_ABC

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0			0	0				0	0				0					0		
1			-200	-620				114	-333				194					-229		
2			-192	-507				366	912				561					-207		
3			-201	-522				467	1,280				689					-214		
4			-212	-557				571	1,647				816					-225		
5			-217	-568				691	2,137				965					-228		
6			-224	-588				779	2,453				1,068					-234		
7			-229	-602				861	2,736				1,169					-239		
8			-229	-595				947	3,058				1,278					-237		
9			-224	-577				1,019	3,328				1,368					-232		
10			-216	-549				1,079	3,554				1,441					-223		
11			-206	-513				1,131	3,748				1,502					-212		
12			-193	-471				1,175	3,915				1,553					-199		
13			-179	-422				1,213	4,056				1,596					-184		
14			-163	-369				1,246	4,177				1,634					-167		
15			-145	-312				1,275	4,283				1,666					-150		
25			-11	126				1,440	4,881				1,849					-14		
50			100	488				1,564	5,329				1,986					99		
Fall-run Chinook																				
0	0	0	0	0		0	0	0	0			0	0	0					0	
1	9	0	-200	-620		456	0	114	-333			0	194	52					-967	
2	284	0	-192	-507		783	0	366	912			0	561	1,529					-681	
3	347	0	-201	-522		886	0	467	1,280			0	689	1,860					-694	
4	399	0	-212	-557		994	0	571	1,647			0	816	2,176					-728	
5	463	0	-217	-568		1,119	0	691	2,137			0	965	2,612					-705	
6	497	0	-224	-588		1,202	0	779	2,453			0	1,068	2,845					-723	
7	536	0	-229	-602		1,282	0	861	2,736			0	1,169	3,072					-735	
8	592	0	-229	-595		1,367	0	947	3,058			0	1,278	3,353					-712	
9	646	0	-224	-577		1,436	0	1,019	3,328			0	1,368	3,577					-681	
10	701	0	-216	-549		1,492	0	1,079	3,554			0	1,441	3,758					-642	
11	758	0	-206	-513		1,539	0	1,131	3,748			0	1,502	3,908					-598	
12	815	0	-193	-471		1,580	0	1,175	3,915			0	1,553	4,034					-548	
13	875	0	-179	-422		1,614	0	1,213	4,056			0	1,596	4,141					-494	
14	936	0	-163	-369		1,643	0	1,246	4,177			0	1,634	4,232					-436	
15	999	0	-145	-312		1,669	0	1,275	4,283			0	1,666	4,311					-374	
25	1,452	0	-11	126		1,815	0	1,440	4,881			0	1,849	4,755					89	
50	1,821	0	100	488		1,926	0	1,564	5,329			0	1,986	5,088					469	

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 27 (cont.)

American River SAM Analysis Reach

ARS_ABC

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0		0	0	0	0		0	0	0	0	0	0			0	0	0
1	203		-406		203	979	0	83		979	1,019	0	146	-10	1,019			-482	-970	90
2	763		-399		763	1,642	0	489		1,642	1,715	0	686	1,201	1,715			-437	-677	707
3	899		-419		899	1,857	0	633		1,857	1,938	0	857	1,465	1,938			-454	-688	821
4	1,016		-444		1,016	2,080	0	779		2,080	2,169	0	1,026	1,715	2,169			-477	-720	926
5	1,156		-458		1,156	2,337	0	955		2,337	2,437	0	1,231	2,066	2,437			-485	-694	1,084
6	1,235		-474		1,235	2,507	0	1,077		2,507	2,615	0	1,366	2,250	2,615			-500	-711	1,160
7	1,325		-487		1,325	2,673	0	1,190		2,673	2,789	0	1,497	2,431	2,789			-512	-722	1,248
8	1,442		-489		1,442	2,849	0	1,312		2,849	2,974	0	1,643	2,656	2,974			-511	-697	1,375
9	1,552		-484		1,552	2,990	0	1,414		2,990	3,122	0	1,762	2,835	3,122			-504	-663	1,492
10	1,660		-472		1,660	3,106	0	1,499		3,106	3,243	0	1,859	2,980	3,243			-490	-621	1,606
11	1,765		-456		1,765	3,203	0	1,571		3,203	3,343	0	1,939	3,099	3,343			-472	-573	1,716
12	1,872		-435		1,872	3,286	0	1,634		3,286	3,427	0	2,007	3,198	3,427			-450	-519	1,827
13	1,980		-411		1,980	3,356	0	1,687		3,356	3,499	0	2,065	3,283	3,499			-425	-460	1,938
14	2,089		-384		2,089	3,416	0	1,732		3,416	3,560	0	2,114	3,355	3,560			-396	-397	2,051
15	2,200		-354		2,200	3,468	0	1,773		3,468	3,614	0	2,157	3,418	3,614			-366	-330	2,164
25	2,988		-124		2,988	3,766	0	2,002		3,766	3,914	0	2,399	3,769	3,914			-131	171	2,967
50	3,627		67		3,627	3,991	0	2,175		3,991	4,140	0	2,581	4,033	4,140			64	583	3,616
Green Sturgeon																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	-2,510	-714	0	564	0	-2,510	-876	0	-980	0	-2,510	-876	0	-980	0	-5,020	-2,496	0	417
2	0	-3,765	-1,071	0	846	0	-1,255	468	0	-1,323	0	-1,255	468	0	-1,323	0	-5,020	-1,962	0	772
3	0	-4,183	-1,190	0	940	0	-1,156	654	0	-1,482	0	-1,156	654	0	-1,482	0	-5,339	-2,046	0	846
4	0	-4,632	-1,344	0	1,021	0	-1,106	807	0	-1,661	0	-1,106	807	0	-1,661	0	-5,738	-2,183	0	916
5	0	-5,092	-1,512	0	1,096	0	-885	1,104	0	-1,821	0	-885	1,104	0	-1,821	0	-5,977	-2,183	0	1,013
6	0	-5,399	-1,624	0	1,147	0	-854	1,249	0	-1,943	0	-854	1,249	0	-1,943	0	-6,253	-2,236	0	1,061
7	0	-5,718	-1,707	0	1,197	0	-831	1,416	0	-2,072	0	-831	1,416	0	-2,072	0	-6,550	-2,276	0	1,109
8	0	-6,045	-1,771	0	1,247	0	-727	1,634	0	-2,193	0	-727	1,634	0	-2,193	0	-6,772	-2,268	0	1,171
9	0	-6,299	-1,820	0	1,286	0	-647	1,803	0	-2,287	0	-647	1,803	0	-2,287	0	-6,945	-2,263	0	1,218
10	0	-6,502	-1,860	0	1,317	0	-582	1,939	0	-2,362	0	-582	1,939	0	-2,362	0	-7,084	-2,258	0	1,256
11	0	-6,668	-1,893	0	1,343	0	-529	2,050	0	-2,423	0	-529	2,050	0	-2,423	0	-7,197	-2,254	0	1,287
12	0	-6,807	-1,920	0	1,364	0	-485	2,142	0	-2,475	0	-485	2,142	0	-2,475	0	-7,292	-2,251	0	1,313
13	0	-6,924	-1,943	0	1,382	0	-448	2,220	0	-2,518	0	-448	2,220	0	-2,518	0	-7,371	-2,249	0	1,335
14	0	-7,024	-1,962	0	1,397	0	-416	2,287	0	-2,555	0	-416	2,287	0	-2,555	0	-7,440	-2,247	0	1,354
15	0	-7,111	-1,979	0	1,411	0	-388	2,346	0	-2,587	0	-388	2,346	0	-2,587	0	-7,499	-2,245	0	1,370
25	0	-7,599	-2,075	0	1,486	0	-233	2,671	0	-2,767	0	-233	2,671	0	-2,767	0	-7,832	-2,234	0	1,461
50	0	-7,964	-2,146	0	1,542	0	-116	2,915	0	-2,902	0	-116	2,915	0	-2,902	0	-8,081	-2,226	0	1,529

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28

Sacramento River SAM Analysis Reach

ARS_DEFG

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0	0	
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193	-3,484		-2,136		-460	-3,759	
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900	-1,147		-1,776		-468	-3,638	
3	-1,058		-434	-2,738		-121		836	15		-141		1,302	289		-1,525		-462	-3,479	
4	-1,125		-459	-2,923		-16		940	430		-23		1,470	753		-1,514		-483	-3,555	
5	-1,197		-498	-3,127		44		1,046	642		47		1,638	990		-1,604		-526	-3,809	
6	-1,266		-532	-3,373		110		1,183	999		124		1,847	1,366		-1,659		-559	-4,037	
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017	1,726		-1,679		-575	-4,171	
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159	2,045		-1,676		-578	-4,237	
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282	2,337		-1,656		-573	-4,258	
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393	2,608		-1,621		-561	-4,244	
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490	2,847		-1,571		-542	-4,201	
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574	3,047		-1,507		-518	-4,138	
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648	3,218		-1,433		-490	-4,059	
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714	3,366		-1,351		-459	-3,968	
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774	3,495		-1,263		-426	-3,867	
25	-396		-144	-2,879		497		2,094	3,968		731		3,136	4,242		-491		-150	-3,038	
50	298		94	-2,269		631		2,366	4,728		914		3,419	4,810		251		91	-2,349	
Fall-run Chinook																				
0	0		0	0		0		0	0				0	0		0		0	0	
1	-1,101		-400	-2,119		-892		97	-3,451				193	-3,484		-2,136		-460	-3,759	
2	-1,075		-427	-2,526		-415		571	-1,306				900	-1,147		-1,776		-468	-3,638	
3	-1,058		-434	-2,738		-121		836	15				1,302	289		-1,525		-462	-3,479	
4	-1,125		-459	-2,923		-16		940	430				1,470	753		-1,514		-483	-3,555	
5	-1,197		-498	-3,127		44		1,046	642				1,638	990		-1,604		-526	-3,809	
6	-1,266		-532	-3,373		110		1,183	999				1,847	1,366		-1,659		-559	-4,037	
7	-1,342		-551	-3,601		160		1,296	1,340				2,017	1,726		-1,679		-575	-4,171	
8	-1,381		-558	-3,738		200		1,390	1,645				2,159	2,045		-1,676		-578	-4,237	
9	-1,394		-555	-3,815		233		1,472	1,926				2,282	2,337		-1,656		-573	-4,258	
10	-1,385		-544	-3,845		261		1,545	2,187				2,393	2,608		-1,621		-561	-4,244	
11	-1,357		-527	-3,838		286		1,611	2,421				2,490	2,847		-1,571		-542	-4,201	
12	-1,311		-504	-3,806		308		1,668	2,621				2,574	3,047		-1,507		-518	-4,138	
13	-1,252		-478	-3,752		329		1,719	2,797				2,648	3,218		-1,433		-490	-4,059	
14	-1,183		-448	-3,683		348		1,765	2,952				2,714	3,366		-1,351		-459	-3,968	
15	-1,105		-415	-3,602		366		1,807	3,091				2,774	3,495		-1,263		-426	-3,867	
25	-396		-144	-2,879		497		2,094	3,968				3,136	4,242		-491		-150	-3,038	
50	298		94	-2,269		631		2,366	4,728				3,419	4,810		251		91	-2,349	

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28 (cont.)

Sacramento River SAM Analysis Reach

ARS_DEFG

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Late-fall-run Chinook																				
0	0		0	0		0		0	0		0		0					0		
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193					-460		
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900					-468		
3	-1,058		-434	-2,738		-121		836	15		-141		1,302					-462		
4	-1,125		-459	-2,923		-16		940	430		-23		1,470					-483		
5	-1,197		-498	-3,127		44		1,046	642		47		1,638					-526		
6	-1,266		-532	-3,373		110		1,183	999		124		1,847					-559		
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017					-575		
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159					-578		
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282					-573		
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393					-561		
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490					-542		
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574					-518		
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648					-490		
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714					-459		
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774					-426		
25	-396		-144	-2,879		497		2,094	3,968		731		3,136					-150		
50	298		94	-2,269		631		2,366	4,728		914		3,419					91		
Winter-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0		
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193	-3,484		-2,136		-460		
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900	-1,147		-1,776		-468		
3	-1,058		-434	-2,738		-121		836	15		-141		1,302	289		-1,525		-462		
4	-1,125		-459	-2,923		-16		940	430		-23		1,470	753		-1,514		-483		
5	-1,197		-498	-3,127		44		1,046	642		47		1,638	990		-1,604		-526		
6	-1,266		-532	-3,373		110		1,183	999		124		1,847	1,366		-1,659		-559		
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017	1,726		-1,679		-575		
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159	2,045		-1,676		-578		
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282	2,337		-1,656		-573		
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393	2,608		-1,621		-561		
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490	2,847		-1,571		-542		
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574	3,047		-1,507		-518		
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648	3,218		-1,433		-490		
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714	3,366		-1,351		-459		
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774	3,495		-1,263		-426		
25	-396		-144	-2,879		497		2,094	3,968		731		3,136	4,242		-491		-150		
50	298		94	-2,269		631		2,366	4,728		914		3,419	4,810		251		91		

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28 (cont.)

Sacramento River SAM Analysis Reach

ARS_DEFG

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
1	-1,747		-820	-2,239	-1,747	-1,747		-77	-3,044	-1,747	-1,801		-36	-3,082	-1,801	-3,793		-964		-3,793
2	-1,656		-871	-2,645	-1,656	-772		649	-1,266	-772	-774		946	-1,173	-774	-3,047		-970		-3,047
3	-1,609		-887	-2,848	-1,609	-170		1,060	-188	-170	-132		1,508	-16	-132	-2,536		-952		-2,536
4	-1,702		-938	-3,038	-1,702	56		1,206	116	56	119		1,722	324	119	-2,465		-998		-2,465
5	-1,780		-1,021	-3,256	-1,780	195		1,339	234	195	280		1,917	463	280	-2,574		-1,089		-2,574
6	-1,865		-1,094	-3,513	-1,865	345		1,525	482	345	450		2,177	731	450	-2,634		-1,161		-2,634
7	-1,984		-1,139	-3,749	-1,984	457		1,684	735	457	581		2,397	1,002	581	-2,644		-1,196		-2,644
8	-2,040		-1,156	-3,887	-2,040	545		1,818	961	545	688		2,583	1,244	688	-2,617		-1,206		-2,617
9	-2,053		-1,154	-3,961	-2,053	617		1,936	1,170	617	779		2,747	1,467	779	-2,566		-1,199		-2,566
10	-2,030		-1,137	-3,985	-2,030	678		2,042	1,367	678	858		2,896	1,675	858	-2,492		-1,177		-2,492
11	-1,974		-1,106	-3,971	-1,974	732		2,137	1,544	732	928		3,027	1,861	928	-2,394		-1,143		-2,394
12	-1,890		-1,065	-3,929	-1,890	780		2,220	1,696	780	991		3,141	2,017	991	-2,274		-1,098		-2,274
13	-1,784		-1,016	-3,866	-1,784	824		2,293	1,828	824	1,048		3,240	2,152	1,048	-2,139		-1,047		-2,139
14	-1,661		-960	-3,786	-1,661	864		2,359	1,946	864	1,101		3,329	2,269	1,101	-1,990		-989		-1,990
15	-1,524		-900	-3,692	-1,524	901		2,420	2,051	901	1,151		3,409	2,372	1,151	-1,832		-926		-1,832
25	-343		-391	-2,871	-343	1,167		2,823	2,718	1,167	1,472		3,899	2,973	1,472	-528		-407		-528
50	734		58	-2,166	734	1,431		3,200	3,301	1,431	1,733		4,282	3,433	1,733	641		50		641
Green Sturgeon																				
0			0	0		0		0		0	0		0	0	0	0		0	0	0
1			-708	0		0		-4,397		-1,551	0		-4,397	0	-1,551	0		-5,009	0	-1,298
2			-1,391	0		0		-3,248		-1,199	0		-3,248	0	-1,199	0		-4,297	0	-765
3			-1,830	0		0		-2,485		-966	0		-2,485	0	-966	0		-3,767	0	-436
4			-2,032	0		0		-2,310		-923	0		-2,310	0	-923	0		-3,709	0	-344
5			-2,076	0		0		-2,380		-1,146	0		-2,380	0	-1,146	0		-3,899	0	-323
6			-2,305	0		0		-2,394		-1,476	0		-2,394	0	-1,476	0		-4,077	0	-288
7			-2,685	0		0		-2,368		-1,731	0		-2,368	0	-1,731	0		-4,203	0	-264
8			-2,970	0		0		-2,348		-1,923	0		-2,348	0	-1,923	0		-4,298	0	-245
9			-3,191	0		0		-2,333		-2,072	0		-2,333	0	-2,072	0		-4,372	0	-231
10			-3,369	0		0		-2,321		-2,191	0		-2,321	0	-2,191	0		-4,431	0	-220
11			-3,514	0		0		-2,311		-2,288	0		-2,311	0	-2,288	0		-4,480	0	-210
12			-3,634	0		0		-2,302		-2,369	0		-2,302	0	-2,369	0		-4,520	0	-203
13			-3,737	0		0		-2,295		-2,438	0		-2,295	0	-2,438	0		-4,554	0	-196
14			-3,824	0		0		-2,289		-2,497	0		-2,289	0	-2,497	0		-4,583	0	-190
15			-3,900	0		0		-2,284		-2,548	0		-2,284	0	-2,548	0		-4,609	0	-185
25			-4,326	0		0		-2,255		-2,834	0		-2,255	0	-2,834	0		-4,751	0	-158
50			-4,645	0		0		-2,233		-3,048	0		-2,233	0	-3,048	0		-4,857	0	-138

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 29

Sacramento Bypass Levee and Weir SAM Analysis Reach

SBP Weir and Levee

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0	0	
1	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
2	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
3	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
4	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
5	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
6	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
7	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
8	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
9	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
10	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
11	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
12	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
13	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
14	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
15	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
25	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
50	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
Fall-run Chinook																				
0	0		0			0		0	0				0			0		0		
1	-60		-4			-21		-9	-146				-21			-60		-4		
2	-60		-4			-21		-9	-146				-21			-60		-4		
3	-60		-4			-21		-9	-146				-21			-60		-4		
4	-60		-4			-21		-9	-146				-21			-60		-4		
5	-60		-4			-21		-9	-146				-21			-60		-4		
6	-60		-4			-21		-9	-146				-21			-60		-4		
7	-60		-4			-21		-9	-146				-21			-60		-4		
8	-60		-4			-21		-9	-146				-21			-60		-4		
9	-60		-4			-21		-9	-146				-21			-60		-4		
10	-60		-4			-21		-9	-146				-21			-60		-4		
11	-60		-4			-21		-9	-146				-21			-60		-4		
12	-60		-4			-21		-9	-146				-21			-60		-4		
13	-60		-4			-21		-9	-146				-21			-60		-4		
14	-60		-4			-21		-9	-146				-21			-60		-4		
15	-60		-4			-21		-9	-146				-21			-60		-4		
25	-60		-4			-21		-9	-146				-21			-60		-4		
50	-60		-4			-21		-9	-146				-21			-60		-4		

4.0 defaults used for all response curves

4.0 defaults used for all timing tables

Table 29 (cont.)

Sacramento Bypass Levee and Weir SAM Analysis Reach

SBP Weir and Levee

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Late-fall-run Chinook																				
0	0		0	0		0		0	0		0		0					0		
1	-60		-4	-26		-21		-9	-146		-51		-21					-4		
2	-60		-4	-26		-21		-9	-146		-51		-21					-4		
3	-60		-4	-26		-21		-9	-146		-51		-21					-4		
4	-60		-4	-26		-21		-9	-146		-51		-21					-4		
5	-60		-4	-26		-21		-9	-146		-51		-21					-4		
6	-60		-4	-26		-21		-9	-146		-51		-21					-4		
7	-60		-4	-26		-21		-9	-146		-51		-21					-4		
8	-60		-4	-26		-21		-9	-146		-51		-21					-4		
9	-60		-4	-26		-21		-9	-146		-51		-21					-4		
10	-60		-4	-26		-21		-9	-146		-51		-21					-4		
11	-60		-4	-26		-21		-9	-146		-51		-21					-4		
12	-60		-4	-26		-21		-9	-146		-51		-21					-4		
13	-60		-4	-26		-21		-9	-146		-51		-21					-4		
14	-60		-4	-26		-21		-9	-146		-51		-21					-4		
15	-60		-4	-26		-21		-9	-146		-51		-21					-4		
25	-60		-4	-26		-21		-9	-146		-51		-21					-4		
50	-60		-4	-26		-21		-9	-146		-51		-21					-4		
Winter-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0		
1	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
2	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
3	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
4	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
5	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
6	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
7	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
8	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
9	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
10	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
11	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
12	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
13	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
14	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
15	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
25	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
50	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		

4.0 defaults used for all response curves

4.0 defaults used for all timing tables

Table 29 (cont.)

Sacramento Bypass Levee and Weir SAM Analysis Reach

SBP Weir and Levee

Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
1	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
2	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
3	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
4	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
5	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
6	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
7	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
8	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
9	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
10	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
11	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
12	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
13	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
14	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
15	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
25	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
50	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
Green Sturgeon																				
0			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
1			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
2			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
3			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
4			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
5			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
6			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
7			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
8			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
9			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
10			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
11			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
12			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
13			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
14			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
15			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
25			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
50			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8

4.0 defaults used for all response curves

4.0 defaults used for all timing tables

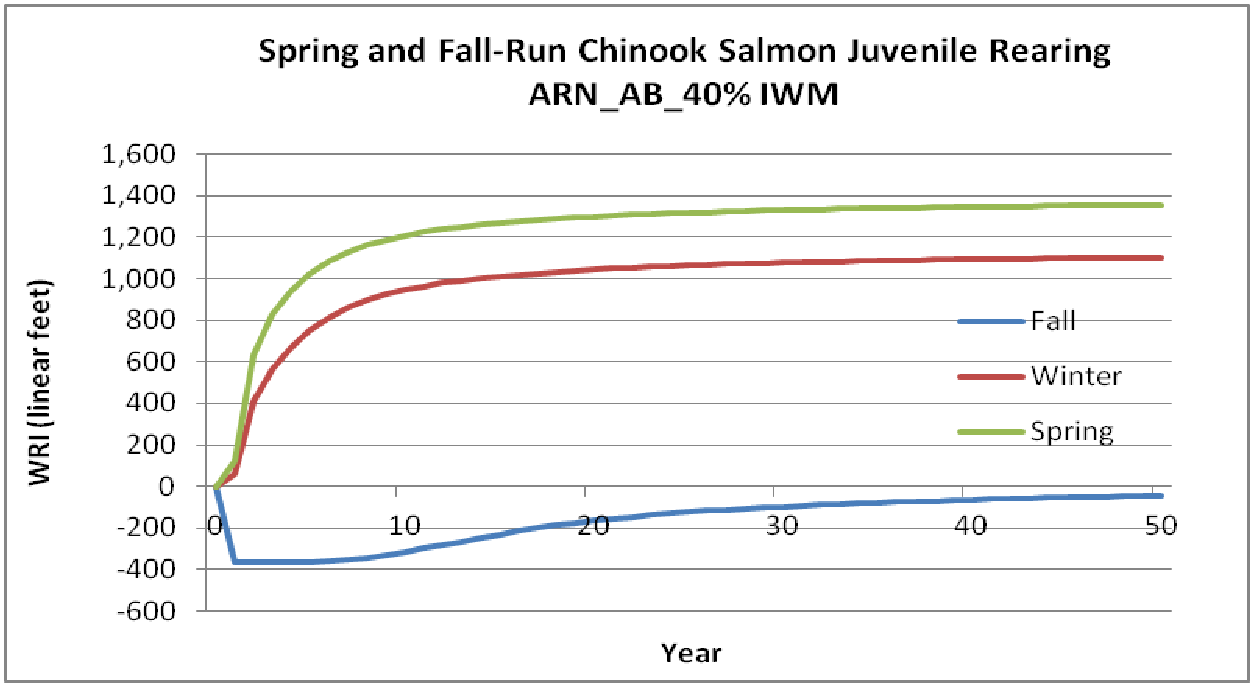

Figure 2. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for spring and fall-run Chinook salmon juvenile rearing.

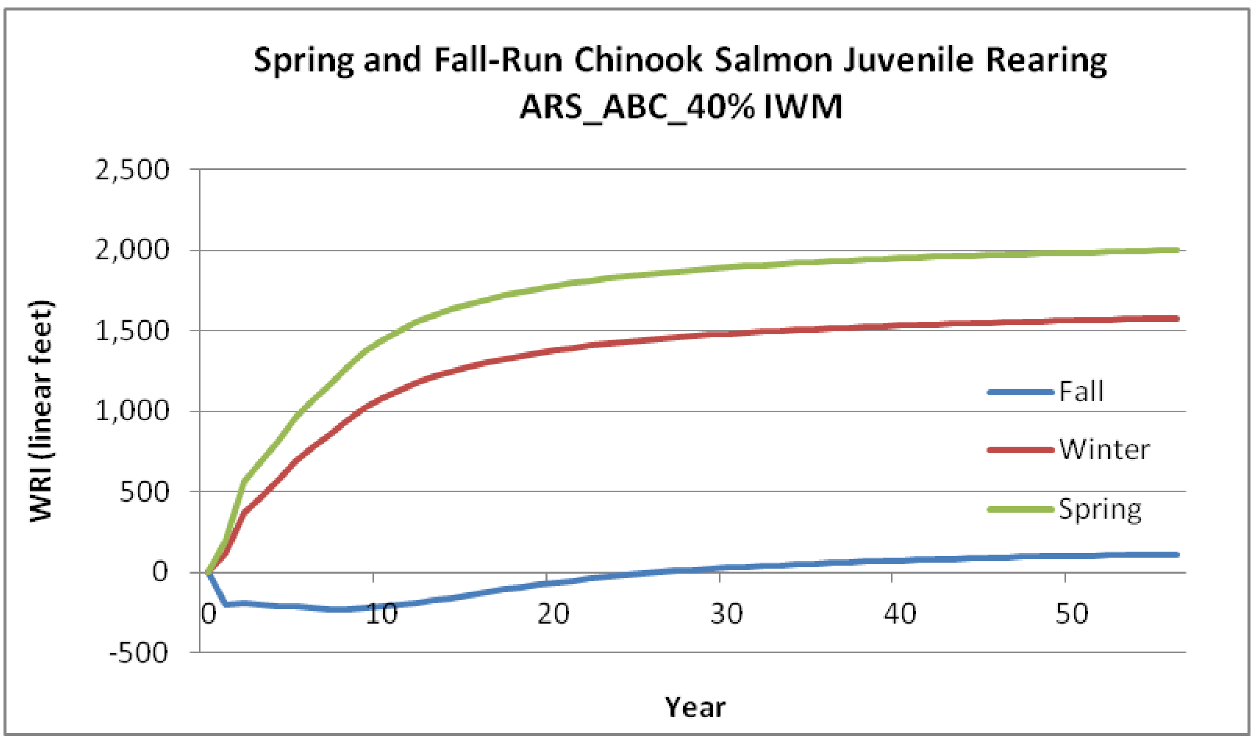

Figure 3. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for spring and fall-run Chinook salmon juvenile rearing.

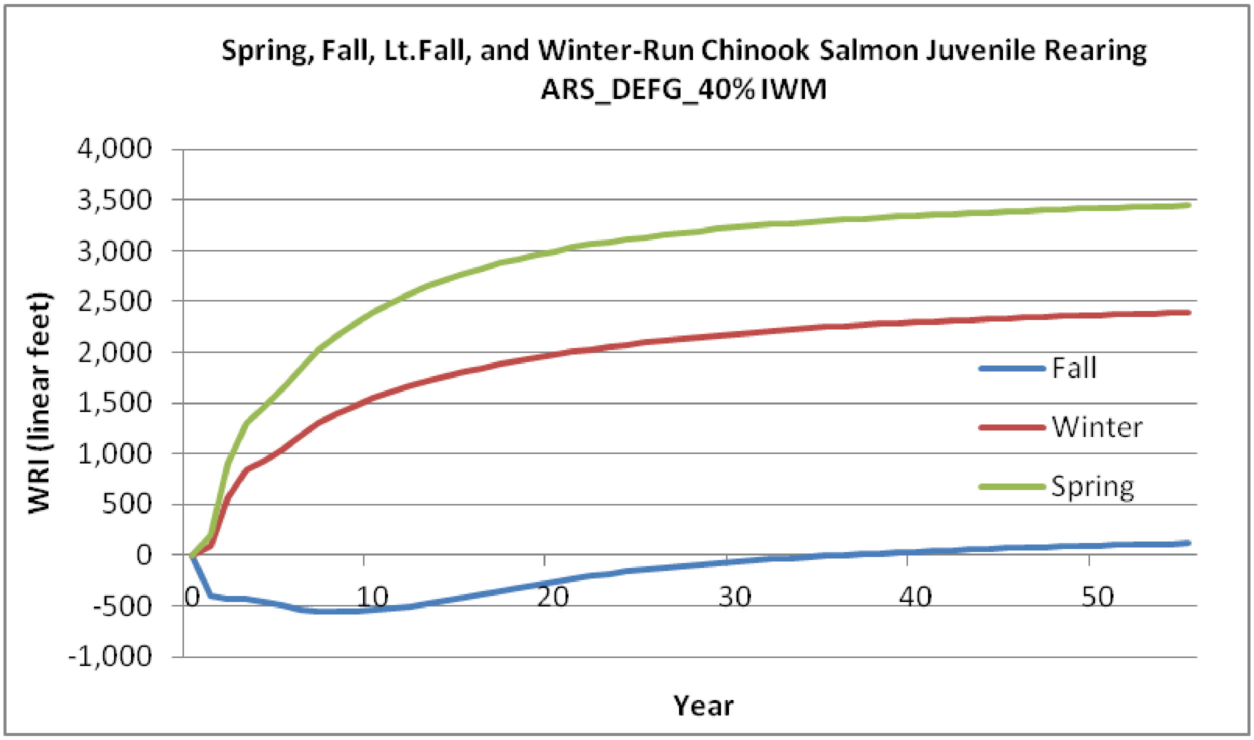

Figure 4. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for Chinook salmon juvenile rearing.

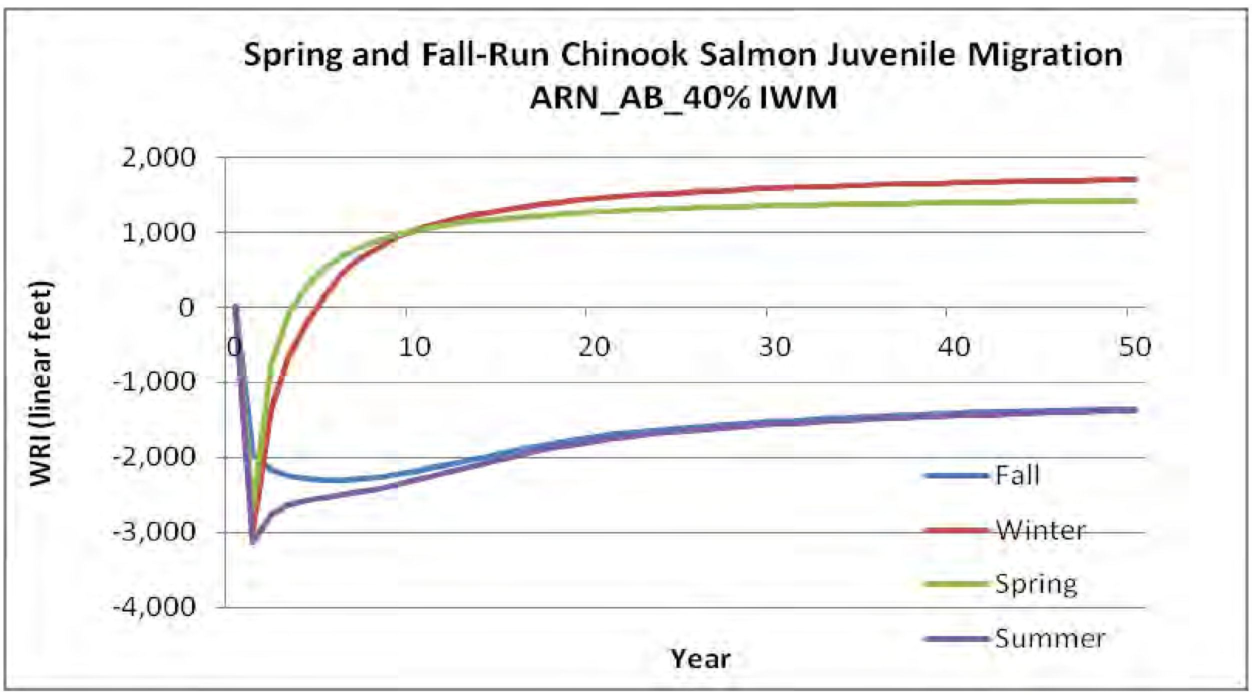

Figure 5. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for spring and fall-run Chinook salmon juvenile migration.

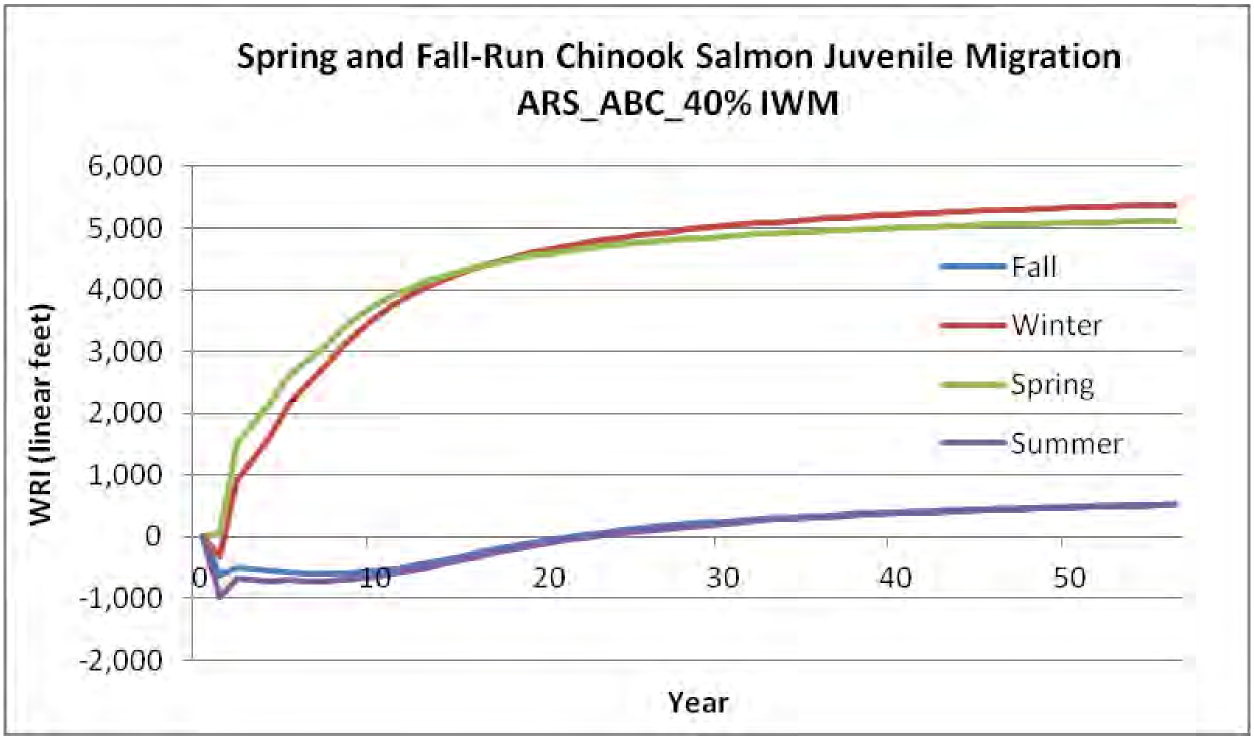

Figure 6. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for spring and fall-run Chinook salmon juvenile migration.

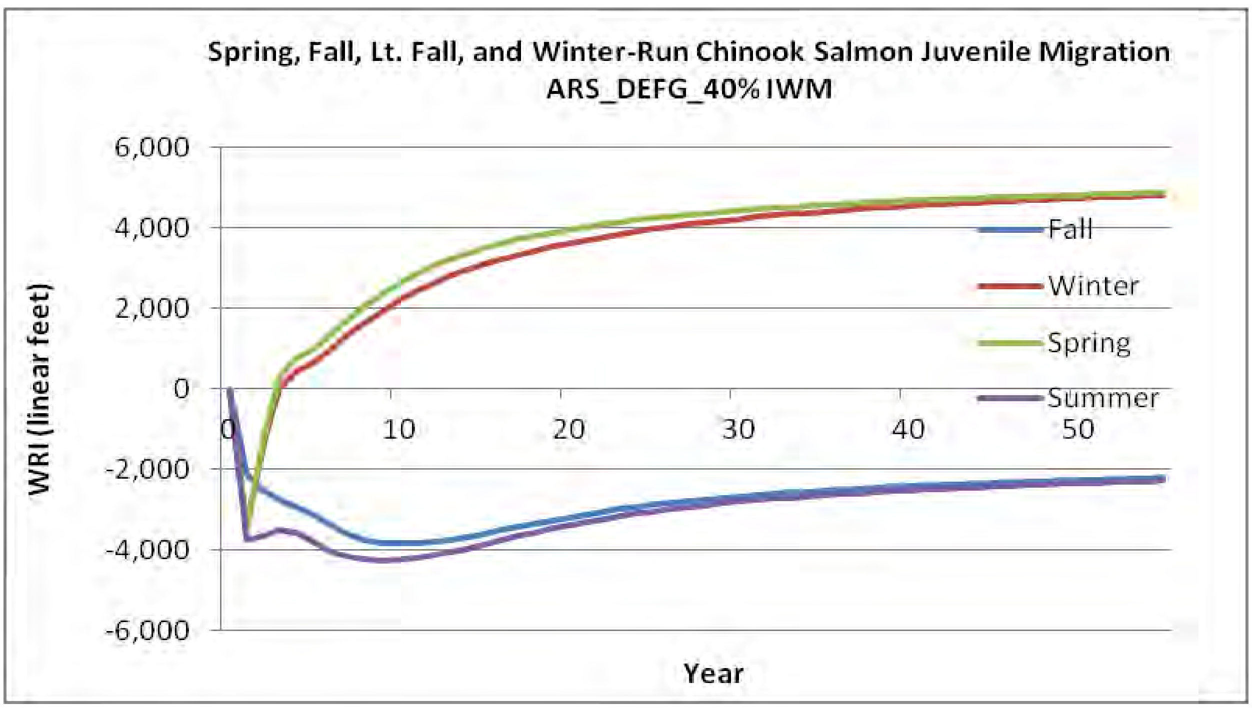

Figure 7. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for Chinook salmon juvenile migration.

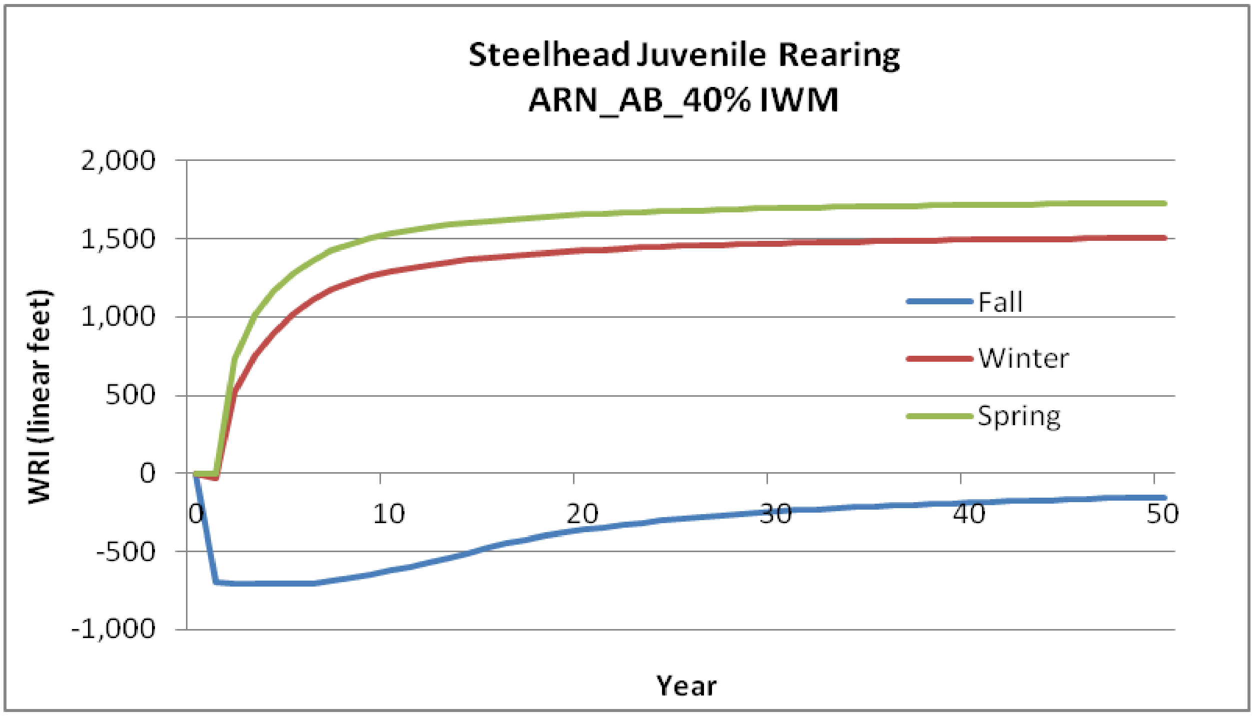

Figure 8. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for steelhead juvenile rearing.

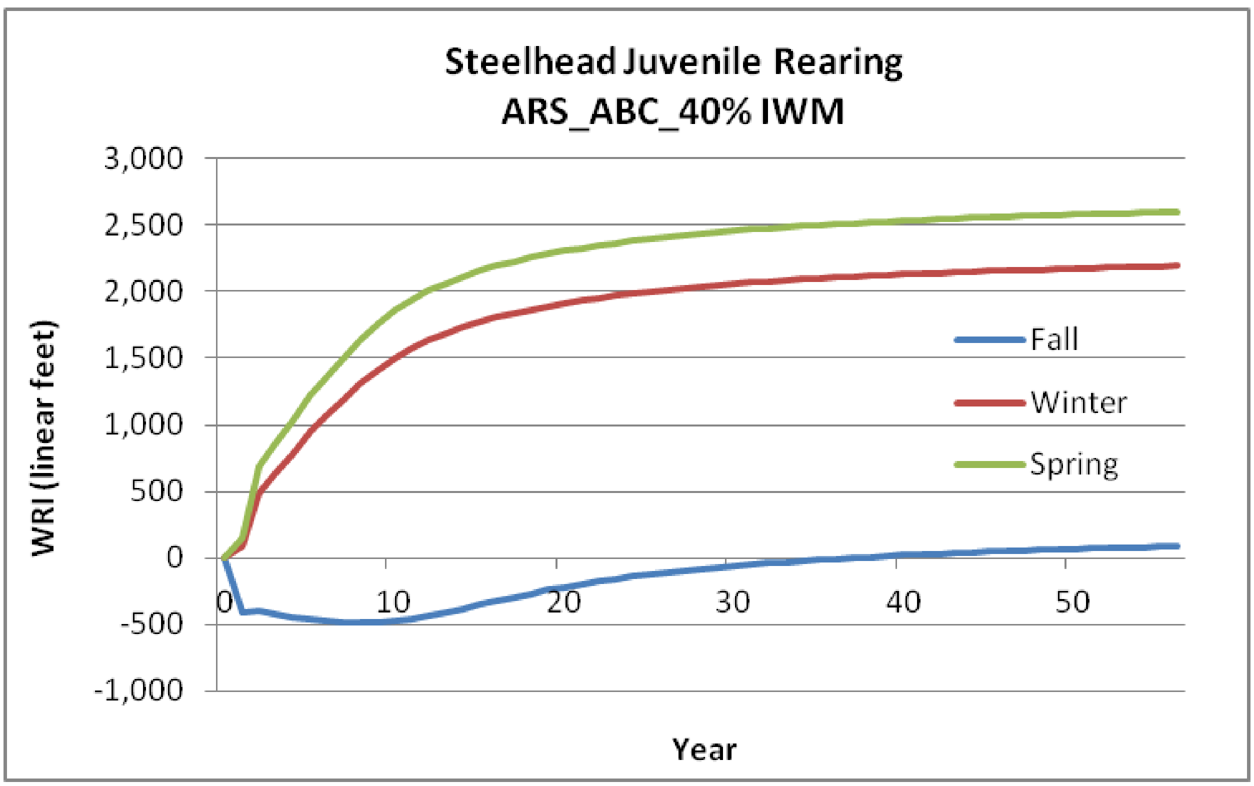

Figure 9. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for steelhead juvenile rearing.

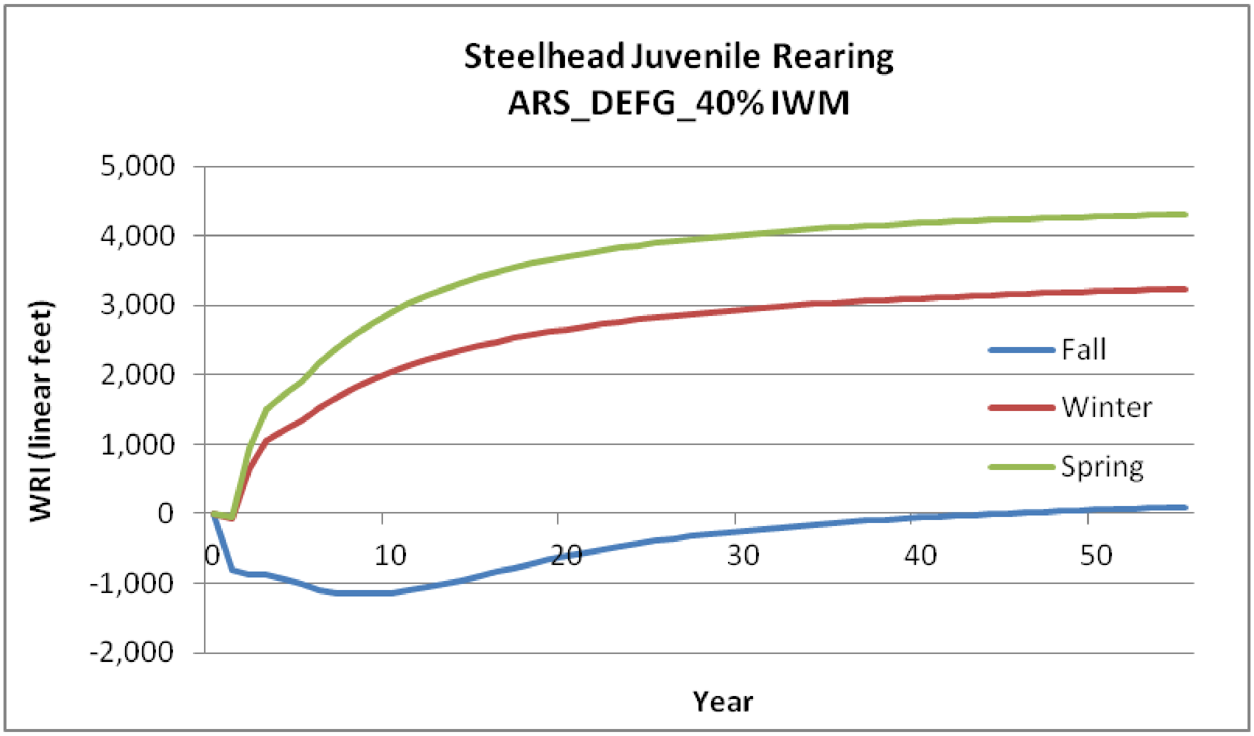

Figure 10. Weighted response indices at 40% IWM placement on the American River (ARS_DEFG) for steelhead juvenile rearing.

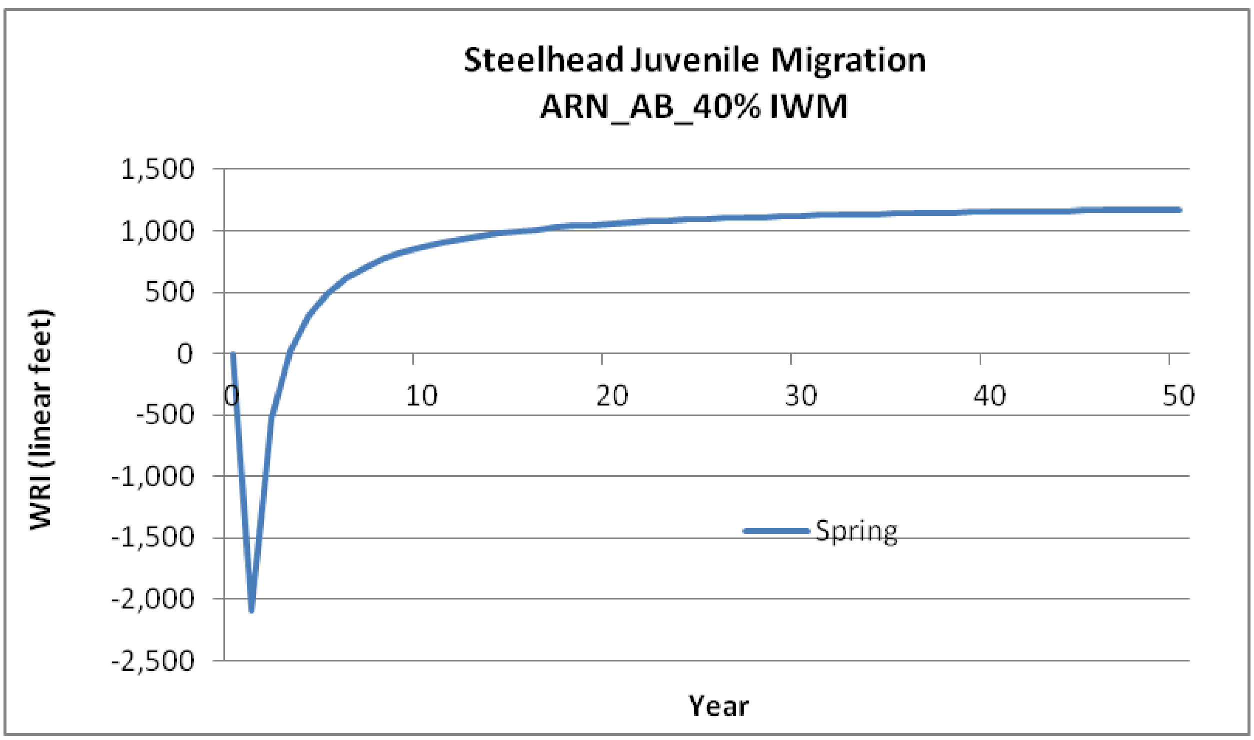

Figure 11. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for steelhead juvenile migration.

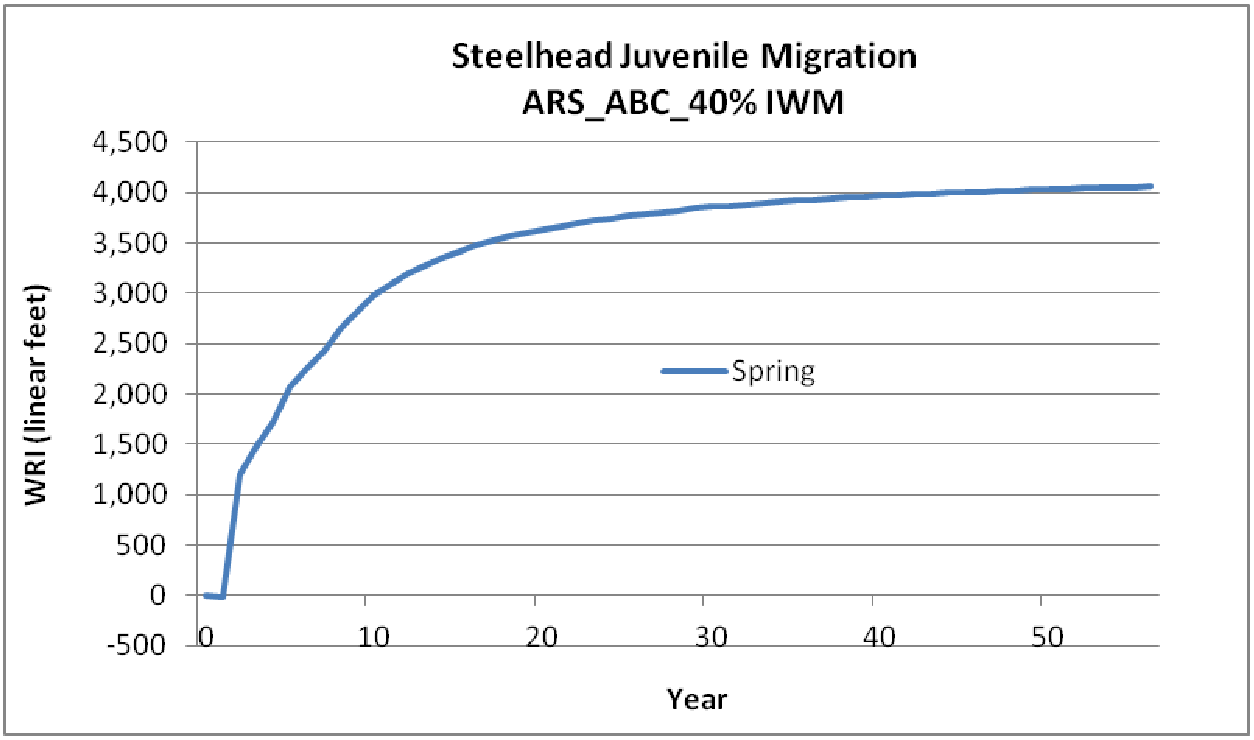

Figure 12. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for steelhead juvenile migration.

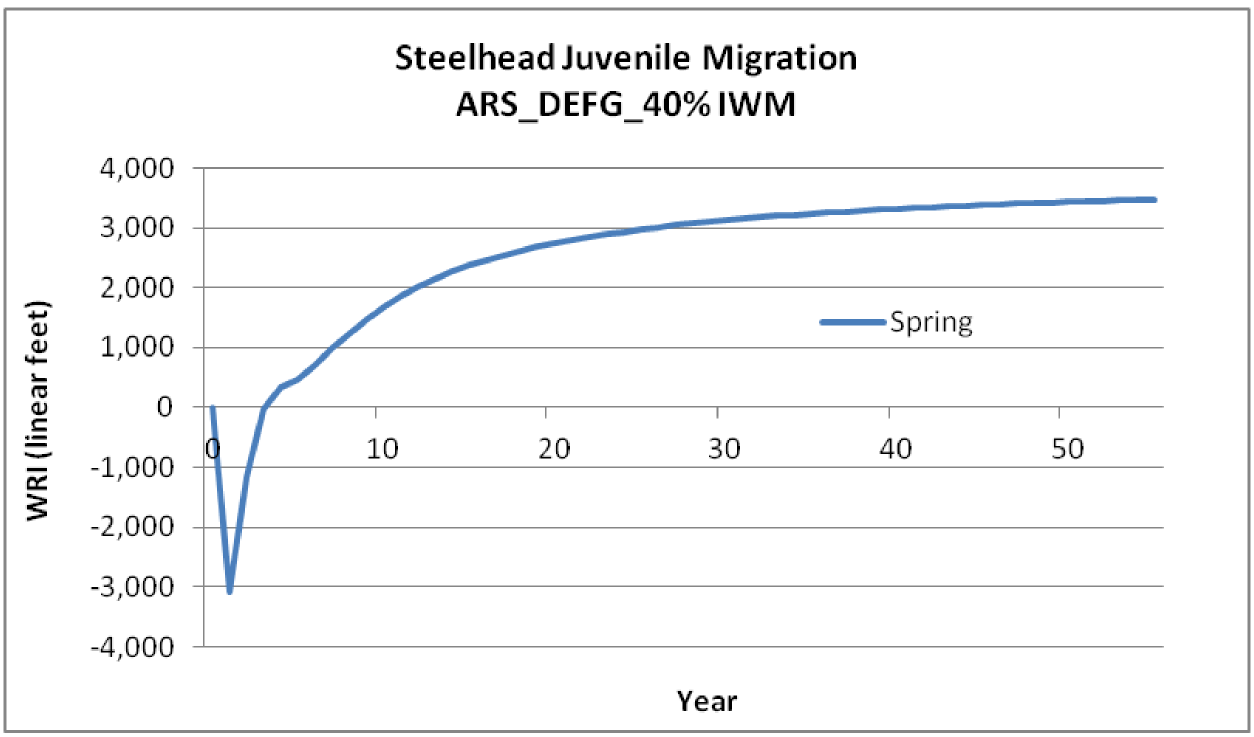

Figure 13. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead juvenile migration.

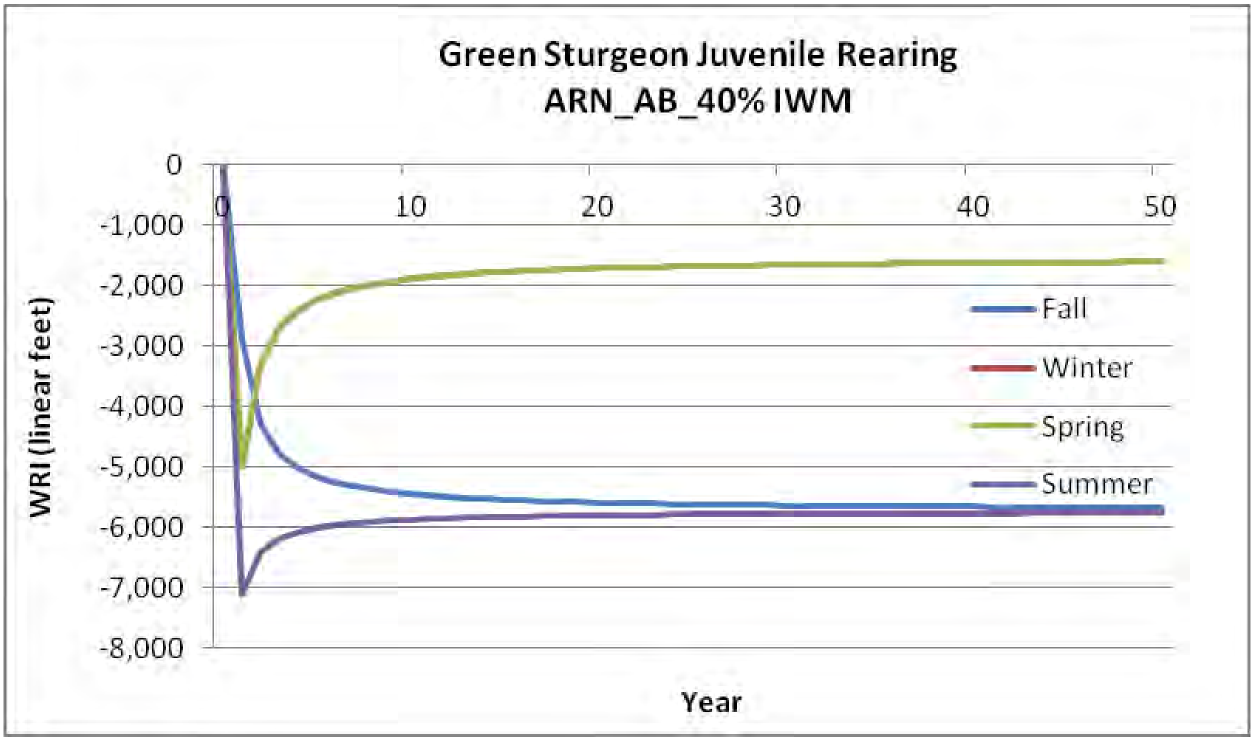

Figure 14. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for green sturgeon juvenile rearing.

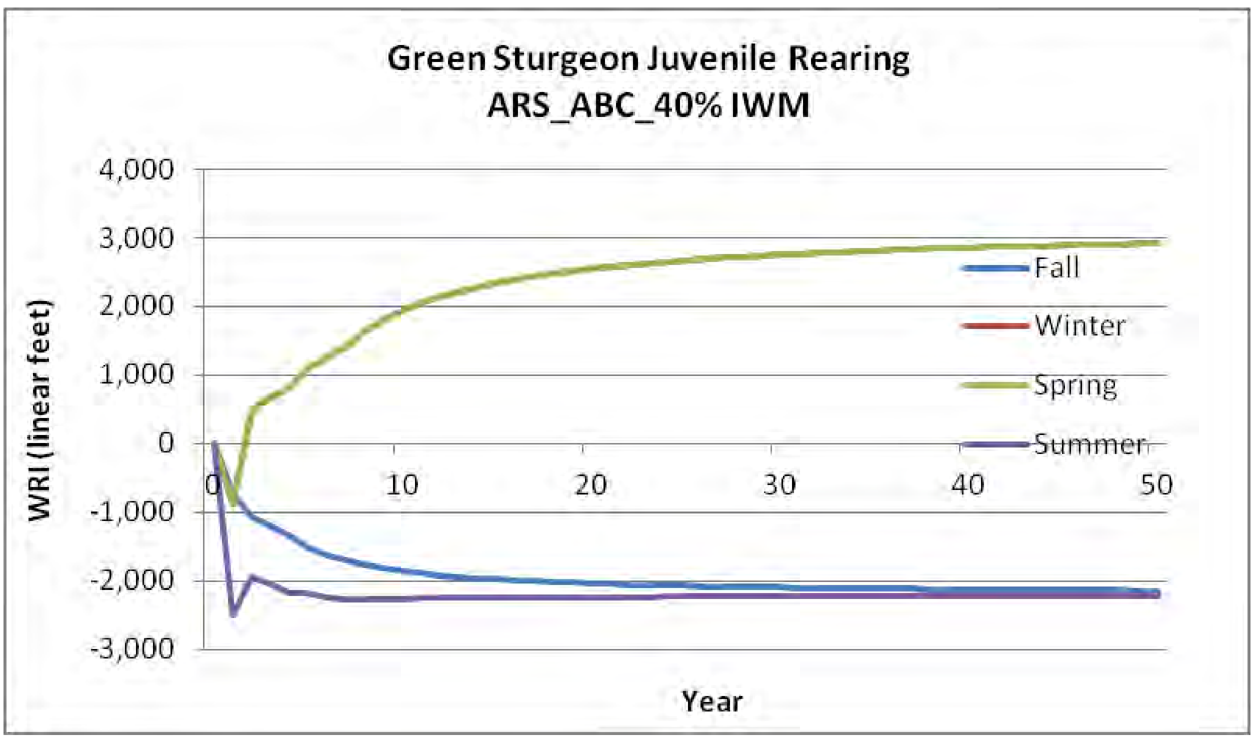

Figure 15. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for green sturgeon juvenile rearing.

Figure 16. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for green sturgeon juvenile rearing.

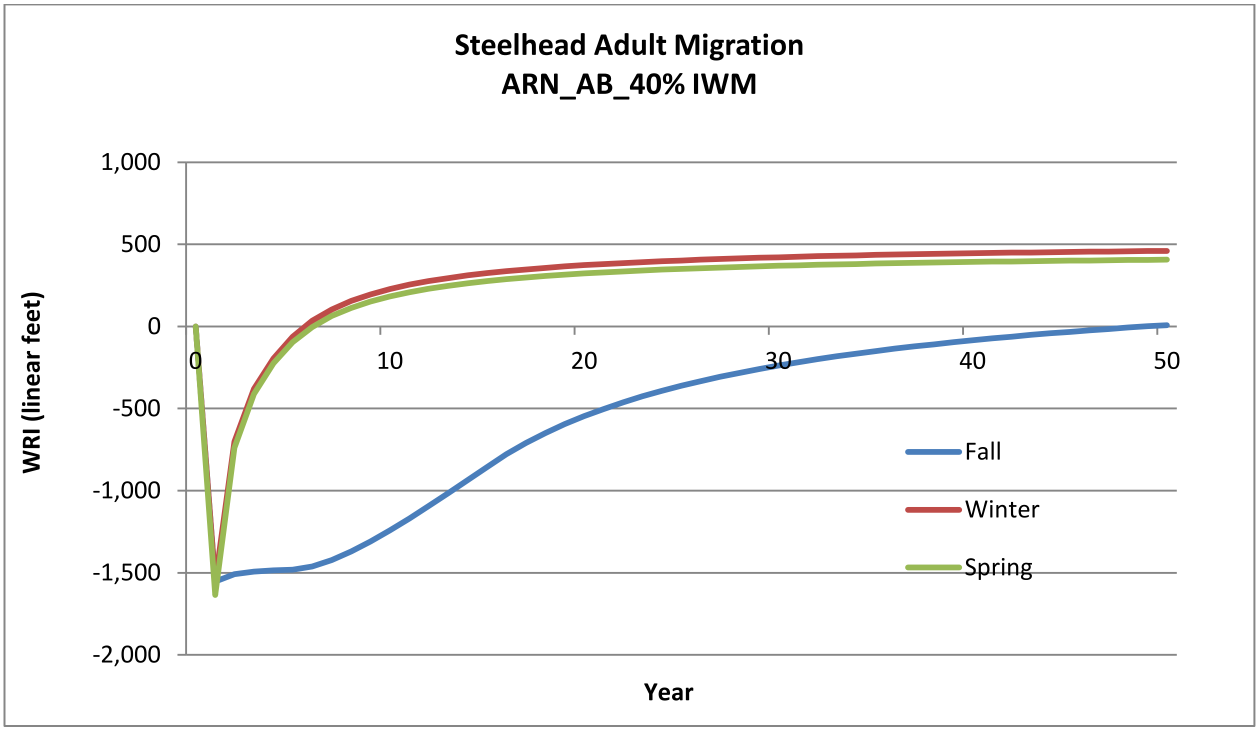

Figure 17. Weighted response indices at 40% IWM placement on the Sacramento River (ARN_AB) for steelhead adult migration.

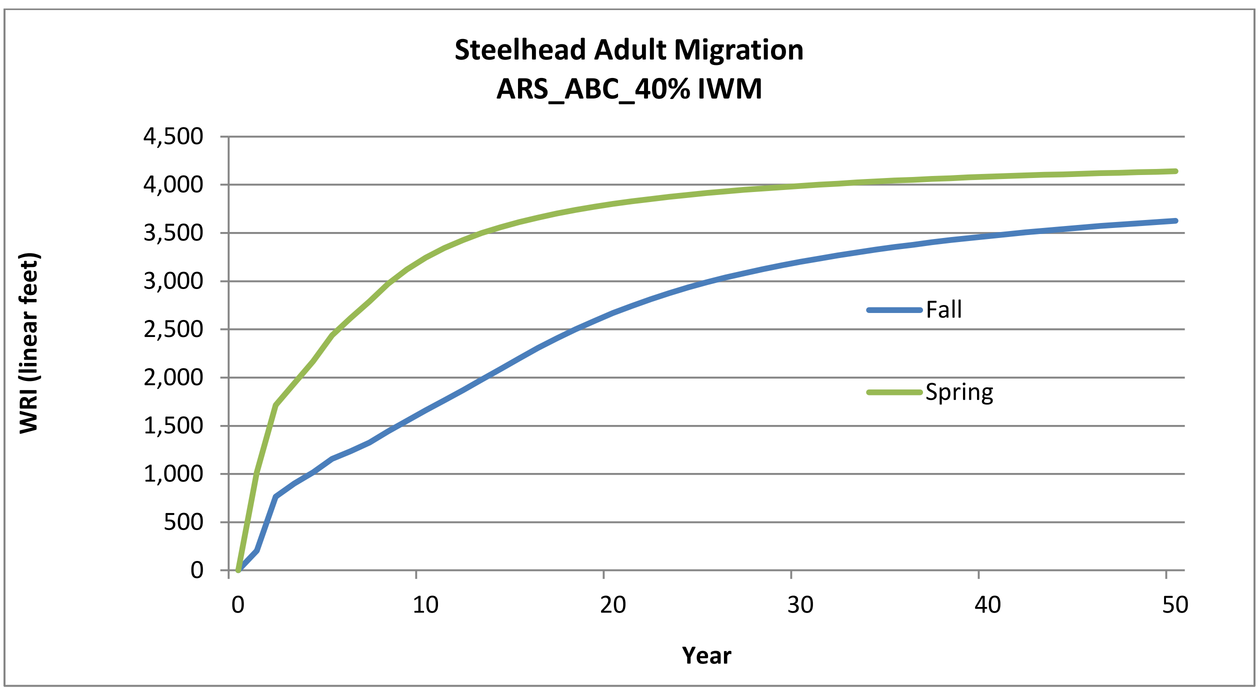

Figure 18. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_ABC) for steelhead adult migration.

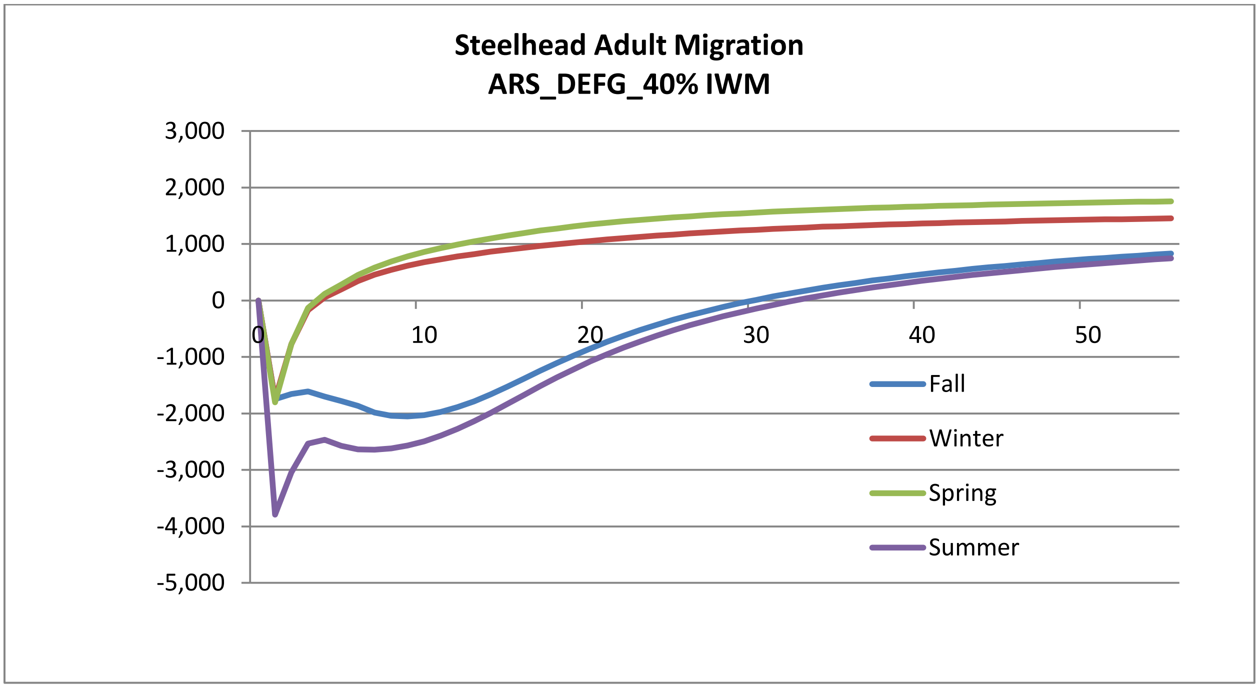

Figure 19. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead adult migration.

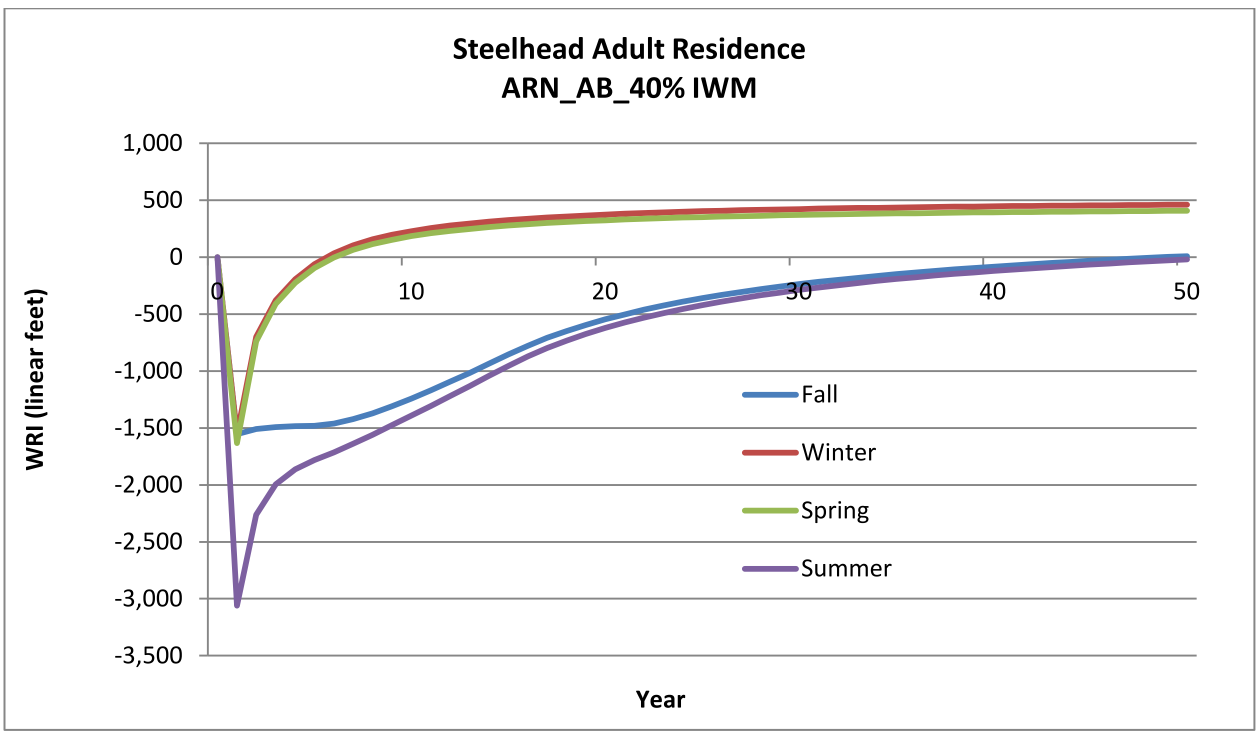

Figure 20. Weighted response indices at 40% IWM placement on the Sacramento River (ARN_AB) for steelhead adult residence.

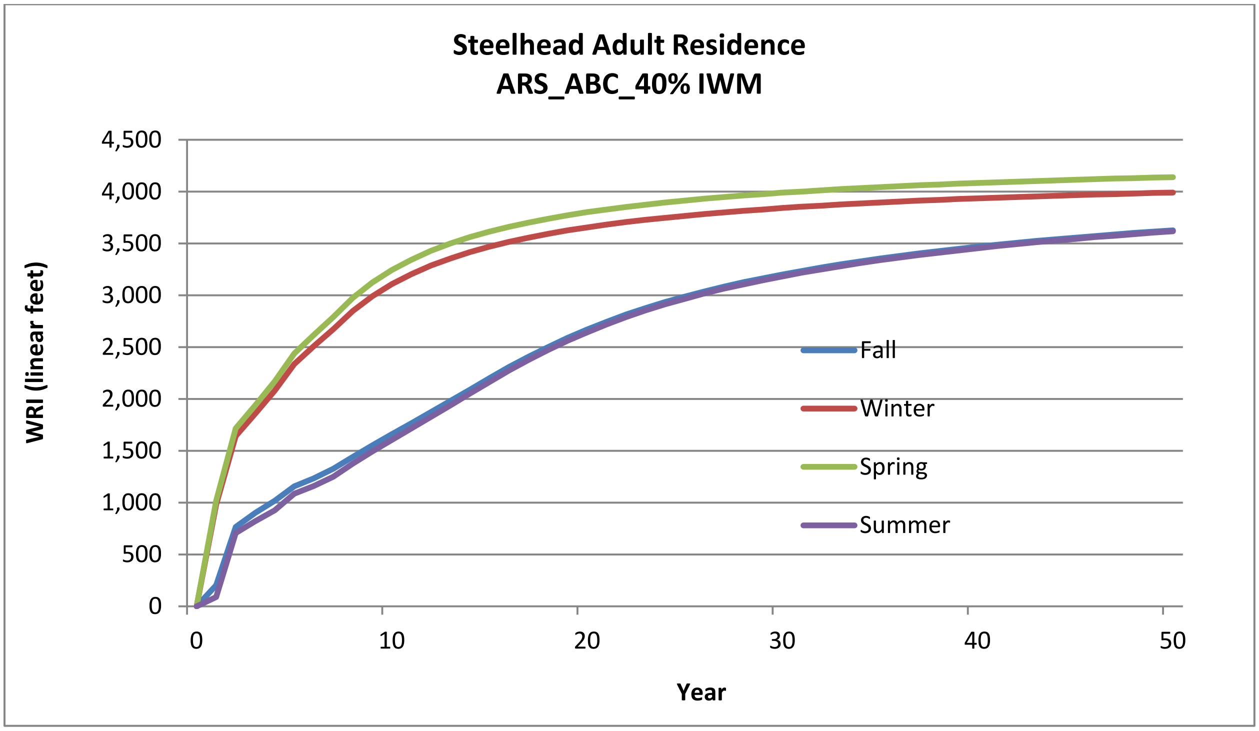

Figure 21. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_ABC) for steelhead adult residence.

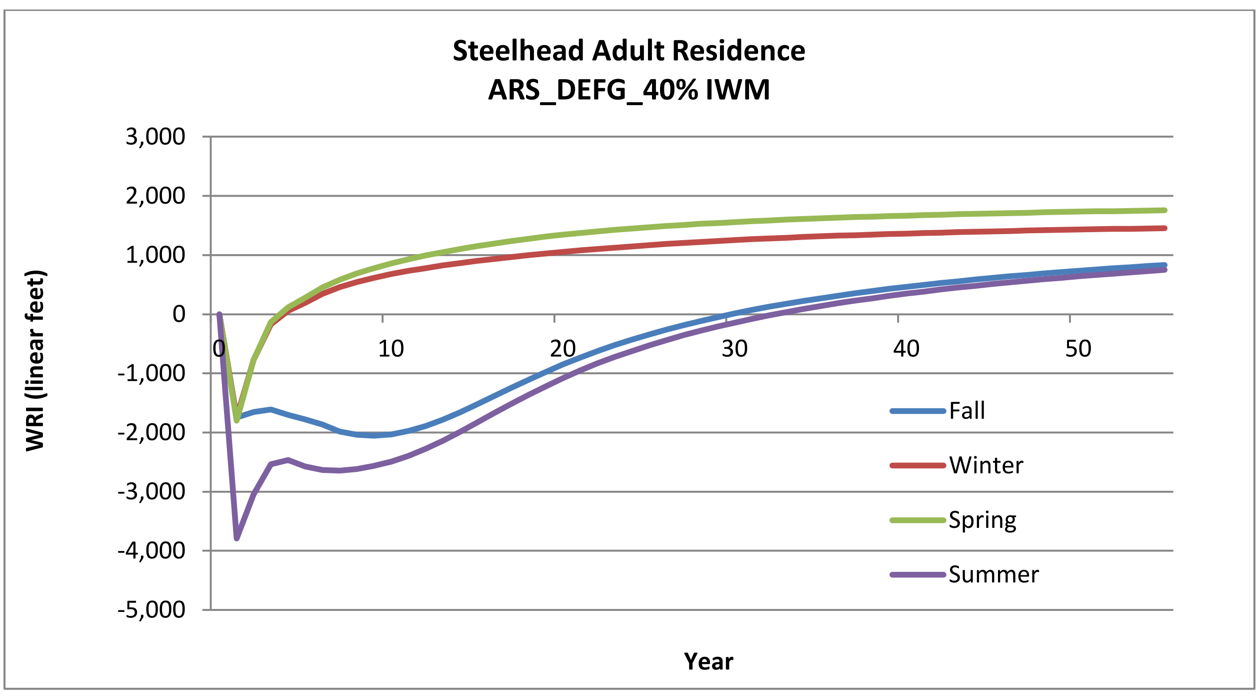

Figure 22. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead adult residence.

Table 30

ARN_AB_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	2	1,699
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	4	1,699
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-877	39	59
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	-759	5	245
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	4	1,699
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	3	1,418
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Steelhead				
Fall	Adult Migration	-1,554	48	8
	Fry and Juvenile Rearing	-712	50	0
	Juvenile Migration	***	***	***
	Adult Residence	-1,554	48	8
Winter	Adult Migration	-1,558	5	460

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Fry and Juvenile Rearing	-36	1	1,507
	Juvenile Migration	***	***	***
	Adult Residence	-1,558	5	460
Spring	Adult Migration	-1,635	6	407
	Fry and Juvenile Rearing	-1	1	1,731
	Juvenile Migration	-2,096	2	1,173
	Adult Residence	-1,635	6	407
Summer	Fry and Juvenile Rearing	-833	50	0
	Juvenile Migration	-3,013	50	0
	Adult Residence	-3,061	50	0
Green Sturgeon				
Fall	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,677	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-21	50	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,621	50	0
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,621	50	0
Summer	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-7,118	0	0
	Juvenile Migration	0	0	0
	Adult Residence	-942	50	0

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.

*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 31

ARS_ABC_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	2,001
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Fall-Run Chinook Salmon				
Fall	Adult Migration	0	0	1,860
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	0	0	1,937
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	965
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Steelhead				
Fall	Adult Migration	0	0	3,696
	Fry and Juvenile Rearing	-489	36	88
	Juvenile Migration	***	***	***
	Adult Residence	0	0	3,696
Winter	Adult Migration	0	0	4,015

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Fry and Juvenile Rearing	0	0	2,194
	Juvenile Migration	***	***	***
	Adult Residence	0	0	4,015
Spring	Adult Migration	0	0	4,164
	Fry and Juvenile Rearing	0	0	2,601
	Juvenile Migration	0	0	4,061
	Adult Residence	0	0	4,164
Green Sturgeon				
Fall	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-2,154	50	0
	Juvenile Migration	0	0	0
	Adult Residence	0	0	1,548
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	-2,917	50	0
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	-2,917	50	0
Summer	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-2,496	50	0
	Juvenile Migration	0	0	0
	Adult Residence	0	0	1,537

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.

*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 32

ARS_DEFG_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Late-Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
Summer	Fry and Juvenile Rearing	-578	36	113
Winter-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
Steelhead				
Fall	Adult Migration	-2,053	29	832
	Fry and Juvenile Rearing	-1,156	44	99
	Juvenile Migration	-3,985	50	0
	Adult Residence	-2,053	29	832
Winter	Adult Migration	-1,747	3	1,455
	Fry and Juvenile Rearing	-77	1	3,234
	Juvenile Migration	-3,044	3	3,355
	Adult Residence	-1,747	3	1,455
Spring	Adult Migration	-1,801	3	1,757
	Fry and Juvenile Rearing	-36	1	4,317
	Juvenile Migration	-3,082	3	3,474
	Adult Residence	-1,801	3	1,757
Summer	Adult Migration	-3,793	32	748
	Fry and Juvenile Rearing	-1,206	45	92

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Adult Residence	-3,793	32	748
sDPS Green Sturgeon				
Fall	Fry and Juvenile Rearing	-4,674	50	0
	Juvenile Migration	0	0	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-4,397	50	0
	Adult Residence	-3,068	50	0
Spring	Fry and Juvenile Rearing	-4,397	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,068	50	0
	Adult Migration	0	0	0
Summer	Fry and Juvenile Rearing	-5,009	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-1,298	50	0

* Not applicable because adult fall-run Chinook salmon migrate in early fall.

Table 33

SBP

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	-51	50	0
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Winter-Run Chinook Salmon				
Fall	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	-51	50	0
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-60	50	0
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	***	***	***
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Late-Fall-Run Chinook Salmon				
Fall	Adult Migration	-60	50	0

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	****	****	****
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Steelhead				
Fall	Adult Migration	-100	50	0
	Fry and Juvenile Rearing	-17	50	0
	Juvenile Migration	-35	50	0
Winter	Adult Migration	-40	50	0
	Fry and Juvenile Rearing	-29	50	0
	Juvenile Migration	-127	50	0
Spring	Adult Migration	-87	50	0
	Fry and Juvenile Rearing	-55	50	0
	Juvenile Migration	-174	50	0
sDPS Green Sturgeon				
Fall	Fry and Juvenile Rearing	0	0	115
	Juvenile Migration	0	0	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	0	0	115
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	0	0	115
	Juvenile Migration	0	0	0

* Not applicable, adult spring-run Chinook salmon migrate upstream in the spring

** Not applicable, adult winter-run Chinook salmon migrate upstream in the winter

*** Not applicable, adult fall-run Chinook salmon migrate upstream in the fall

**** Not applicable, adult lt.fall-run Chinook salmon migrate upstream in the late fall and winter

7.0 References

USACE (U. S. Army Corps of Engineers). 2008. Standard assessment methodology (SAM) analysis of 29 constructed bank repair sites for the Sacramento River Bank Protection Project. Final. Contract No. W91238-07-C-0002. Prepared by Stillwater Sciences, Berkeley, California for USACE, Sacramento District, Sacramento, California. July.

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Appendix C

Delta Smelt Shallow Water Habitat Analysis

SACRAMENTO RIVER D/S OF AMERICAN RIVER

RIVER STATION (mi)	AVG. WS ELEV (NAVD88) MHHW	SHALLOW END	SUMMER	SHA DEPTH (ft)
60.39	8.76	-2.22	10.7	10.98
60.39	8.76	-2.22	10.7	10.98
60.25	8.73	-2.22	10.6	10.95
60.00	8.64	-2.25	10.6	10.89
59.75	8.59	-2.25	10.5	10.84
59.70	8.59	-2.25	10.5	10.84
59.69	8.59	-2.25	10.5	10.84
59.69	8.59	-2.25	10.5	10.84
59.68	8.59	-2.25	10.5	10.84
59.68	8.59	-2.25	10.5	10.84
59.68	8.59	-2.25	10.5	10.84
59.50	8.56	-2.25	10.5	10.81
59.29	8.55	-2.25	10.5	10.80
59.29	8.55	-2.25	10.5	10.80
59.27	8.55	-2.25	10.5	10.80
59.27	8.55	-2.25	10.5	10.80
59.25	8.55	-2.25	10.5	10.80
59.00	8.49	-2.26	10.5	10.75
58.75	8.42	-2.28	10.4	10.70
58.52	8.36	-2.29	10.4	10.65
58.52	8.36	-2.29	10.4	10.65
58.51	8.36	-2.29	10.3	10.65
58.50	8.36	-2.29	10.3	10.65
58.50	8.36	-2.29	10.3	10.65
58.50	8.36	-2.29	10.3	10.65
58.49	8.35	-2.29	10.3	10.64
58.49	8.35	-2.29	10.3	10.64
58.25	8.30	-2.30	10.3	10.60
58.00	8.25	-2.30	10.2	10.55
57.85	8.23	-2.30	10.2	10.53
57.64	8.19	-2.30	10.1	10.49
57.50	8.18	-2.30	10.1	10.48
57.25	8.13	-2.31	10.1	10.44
57.00	8.09	-2.31	10.0	10.40
56.75	8.05	-2.31	10.0	10.36
56.50	8.02	-2.31	10.0	10.33
56.25	7.98	-2.31	10.0	10.29
56.00	7.95	-2.32	9.9	10.27
55.75	7.93	-2.32	9.9	10.25
55.49	7.89	-2.32	9.9	10.21
55.25	7.87	-2.32	9.9	10.19
55.00	7.87	-2.32	9.9	10.19
54.75	7.84	-2.32	9.9	10.16

54.50	7.79	-2.32	9.8	10.11
54.25	7.76	-2.32	9.8	10.08
54.00	7.73	-2.32	9.8	10.05
53.75	7.69	-2.33	9.7	10.02
53.50	7.64	-2.33	9.7	9.97
53.25	7.61	-2.33	9.7	9.94
53.00	7.57	-2.33	9.7	9.90
52.75	7.50	-2.35	9.6	9.85
52.50	7.44	-2.36	9.6	9.80
52.25	7.39	-2.36	9.6	9.75
52.00	7.37	-2.36	9.5	9.73
51.75	7.33	-2.36	9.5	9.69
51.50	7.29	-2.37	9.5	9.66
51.25	7.21	-2.37	9.4	9.58
51.00	7.19	-2.37	9.4	9.56
50.75	7.16	-2.37	9.4	9.53
50.50	7.12	-2.38	9.4	9.50
50.25	7.08	-2.38	9.4	9.46
50.00	7.05	-2.38	9.3	9.43
49.75	7.00	-2.38	9.3	9.38
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49.25	6.91	-2.39	9.2	9.30
49.00	6.87	-2.39	9.2	9.26
48.75	6.84	-2.39	9.2	9.23
48.50	6.79	-2.39	9.2	9.18
48.25	6.75	-2.40	9.1	9.15
48.00	6.69	-2.41	9.1	9.10
47.75	6.62	-2.42	9.1	9.04
47.50	6.57	-2.42	9.0	8.99
47.25	6.53	-2.42	9.0	8.95
47.00	6.51	-2.42	9.0	8.93
46.75	6.49	-2.42	9.0	8.91
46.50	6.48	-2.42	9.0	8.90
46.43	6.47	-2.42	9.0	8.89
46.42	6.47	-2.42	9.0	8.89
46.42	6.47	-2.42	9.0	8.89
46.42	6.47	-2.42	9.0	8.89
46.25	6.44	-2.42	9.0	8.86
46.00	6.42	-2.42	9.0	8.84
45.75	6.39	-2.43	8.9	8.82
45.50	6.37	-2.43	8.9	8.80
45.25	6.34	-2.43	8.9	8.77
45.00	6.31	-2.43	8.9	8.74

SHADED HABITAT AREA

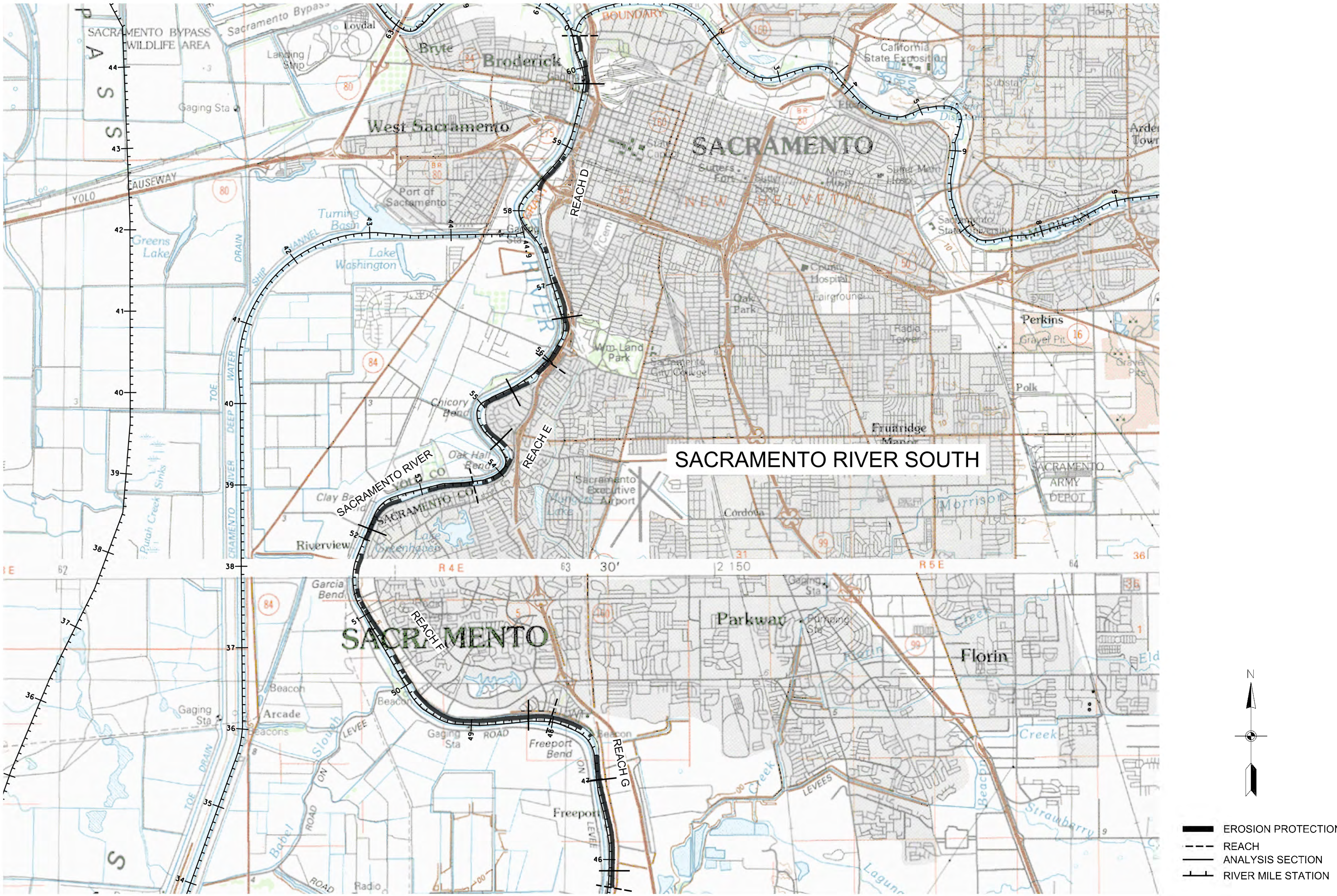
SECTIONS ANALYZED

REACH	RM	STA	WATER SURFACE MHHW	WATER SURFACE SHALLOW END	WATER SURFACE SUMMER
D	59.80	32+00	8.6	-2.3	10.5
D	56.55	195+00	8.0	-2.3	10.0
E	55.41	260+00	7.9	-2.3	9.9
E	54.40	305+00	7.8	-2.3	9.8
F	52.13	430+00	7.4	-2.4	9.5
F	48.30	625+00	6.8	-2.4	9.1
G	46.99	700+00	6.5	-2.4	9.0
G	45.87	760+00	6.4	-2.4	8.9

IMPACTED SHADED HABITAT AREA

REACH	FEATURE LENGTH (ft)	SHA SWATH (ft) EXISTING	SHA SWATH (ft) W/PROJECT	DIFFERENCE	IMPACTED AREAS SF	IMPACTED AREAS AC	WORST CASE
D	9,200	23.93	26.54	2.61	24,000	0.55	
D	9,200	53.17	26.33	-26.84	-246,900	-5.67	-5.67
E	8,850	22.84	27.97	5.13	45,400	1.04	
E	8,850	48.73	26.87	-21.86	-193,500	-4.44	-4.44
F	21,100	35.94	27.92	-8.02	-169,200	-3.88	-3.88
F	21,100	19.02	26.67	7.65	161,400	3.71	
G	11,150	29.55	26.17	-3.38	-37,700	-0.87	-0.87
G	11,150	21.05	26.07	5.02	56,000	1.29	

IMPACTED SPAWNING AREAS				
REACH	FEATURE LENGTH (ft)	EXISTING (ft)	SF	AC
D	9200	53.17	489164	11.23
E	8850	48.73	431261	9.90
F	21100	35.94	758334	17.41
G	11150	29.55	329483	7.56
				46.10



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SACRAMENTO RIVER
SHA ANALYSIS OVERVIEW

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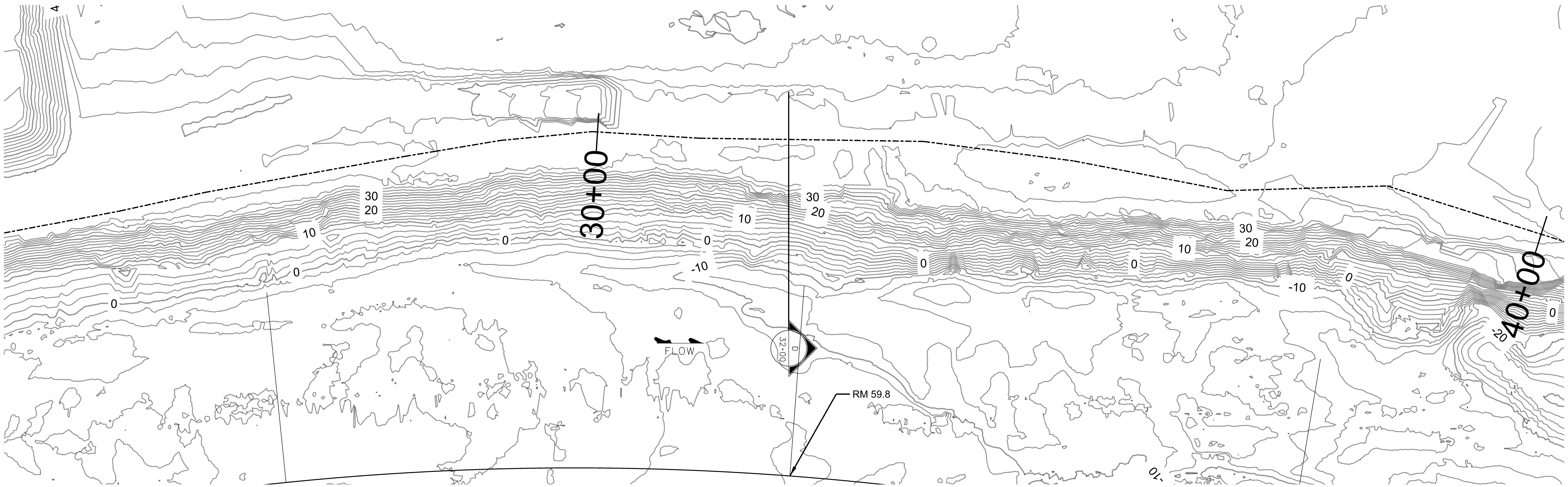

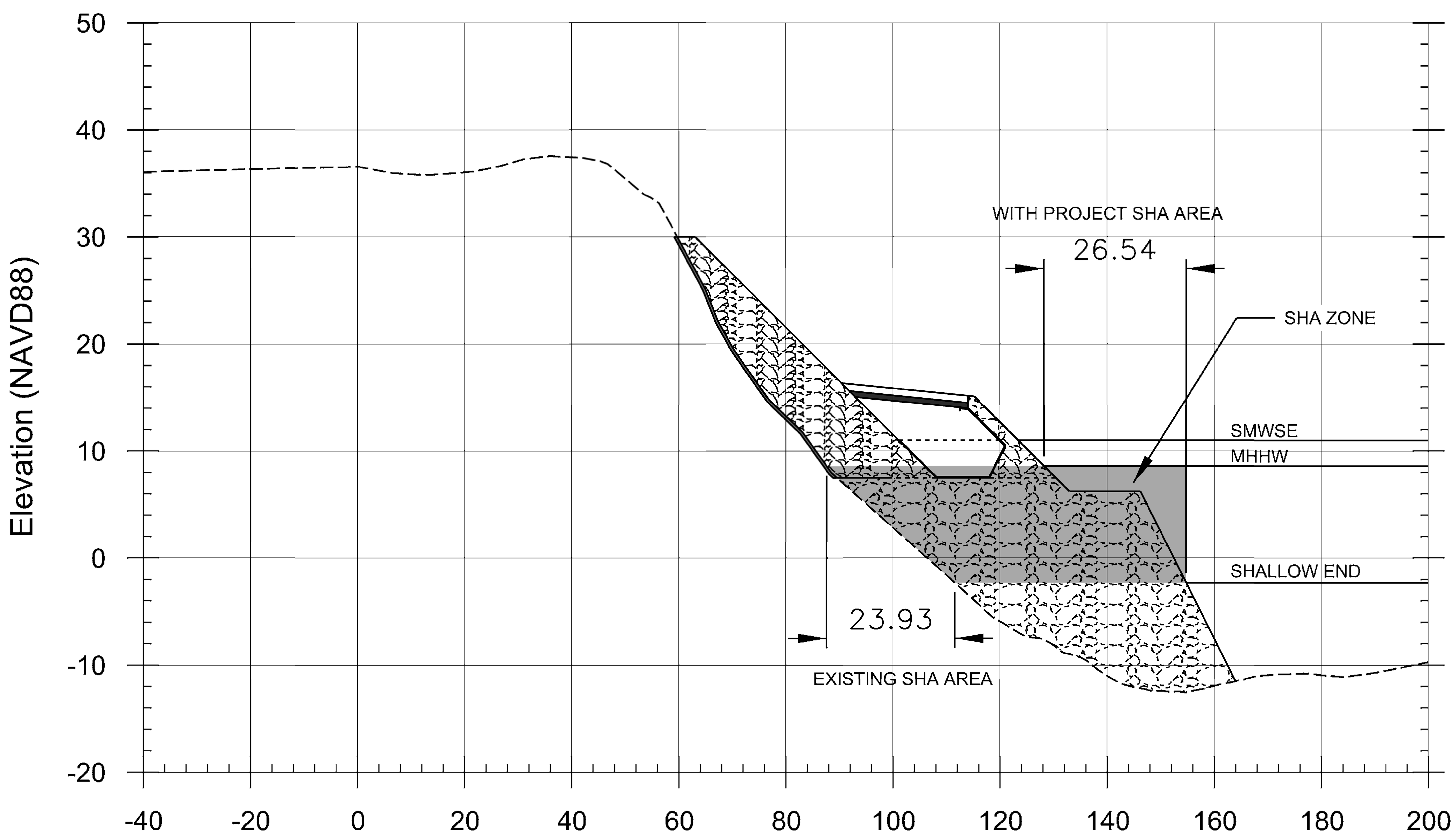

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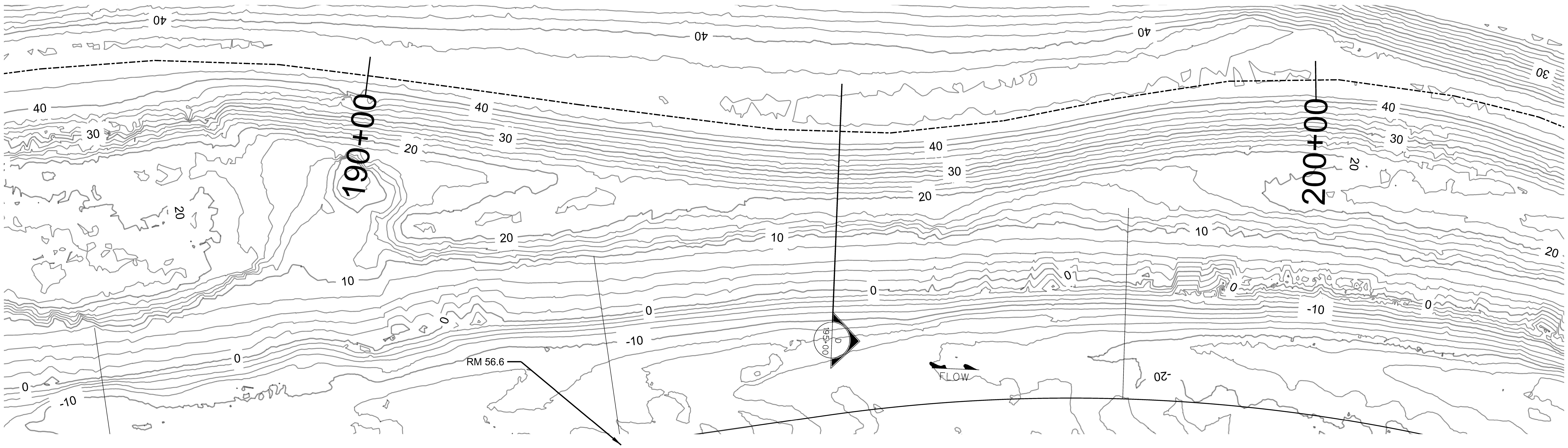

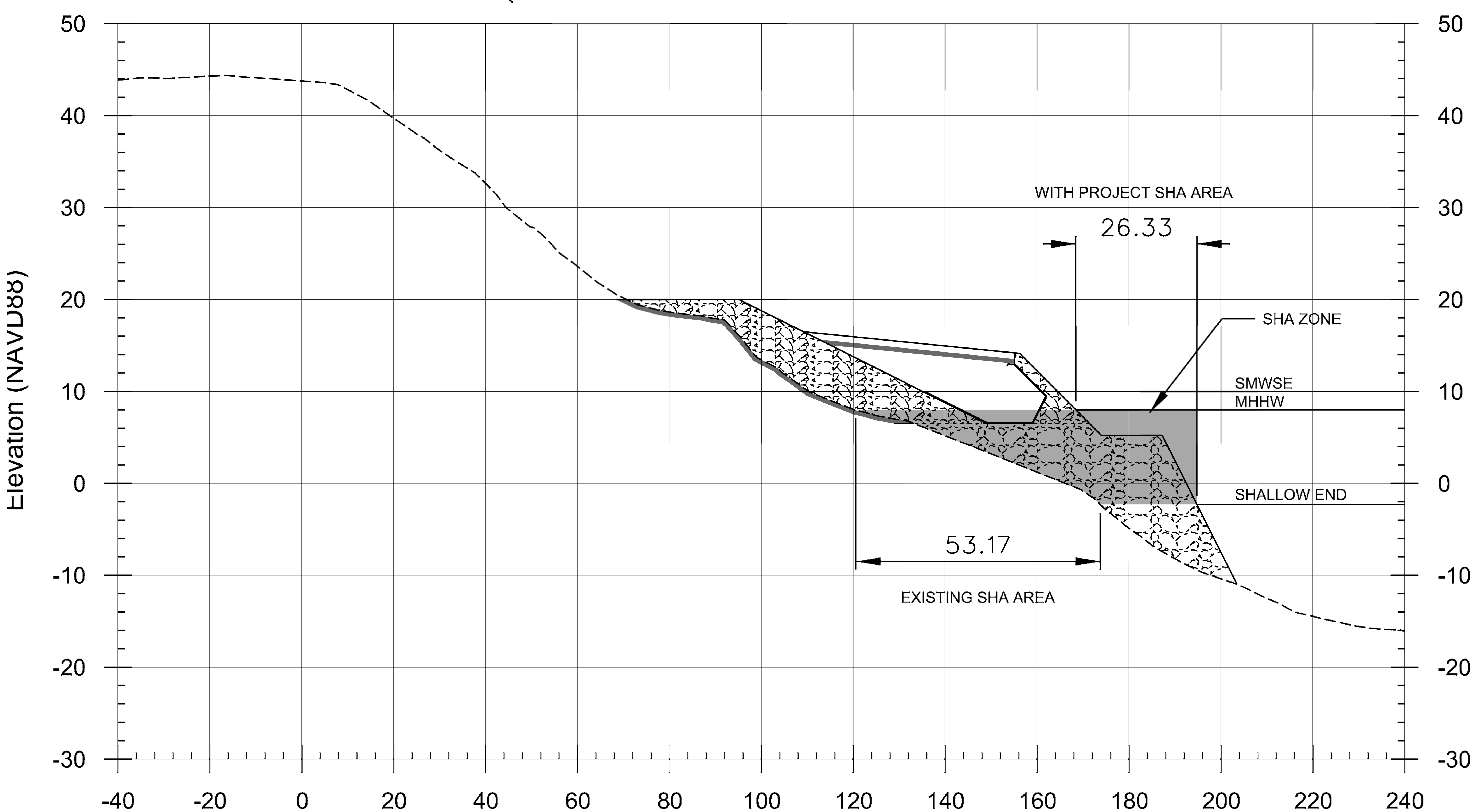

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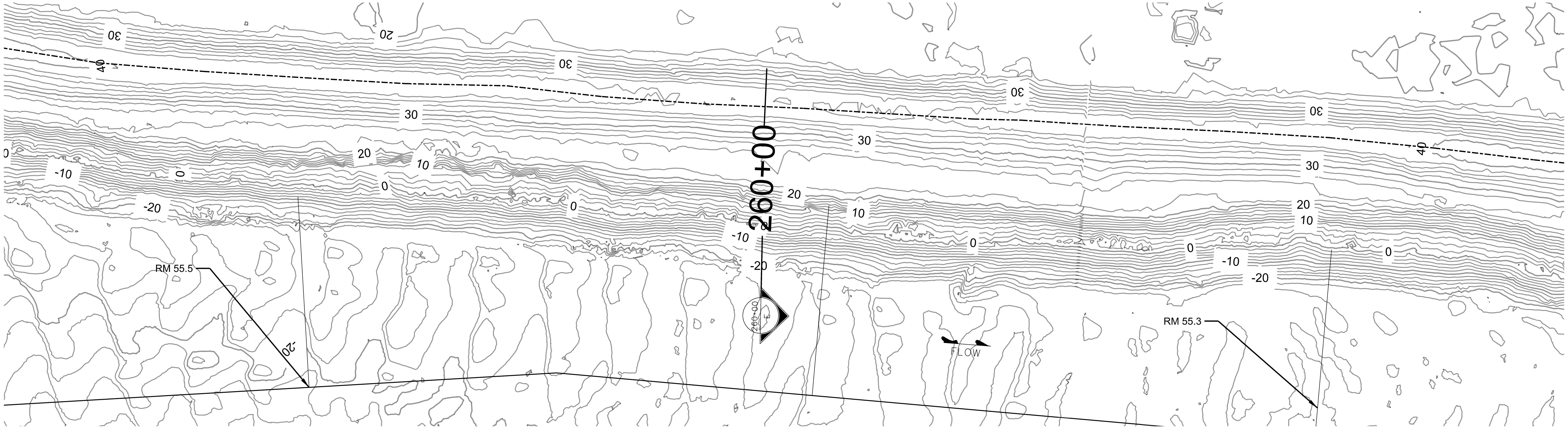

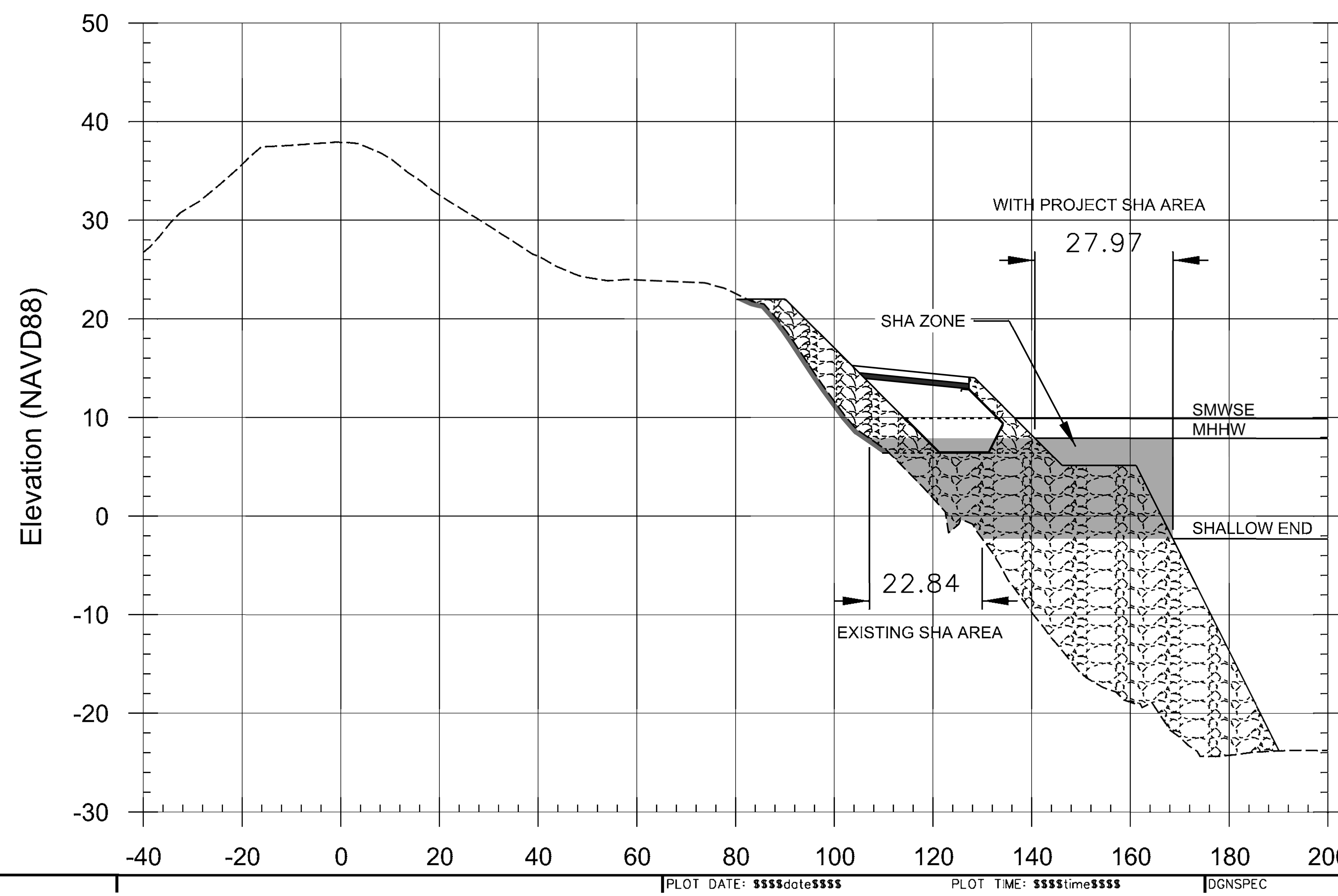

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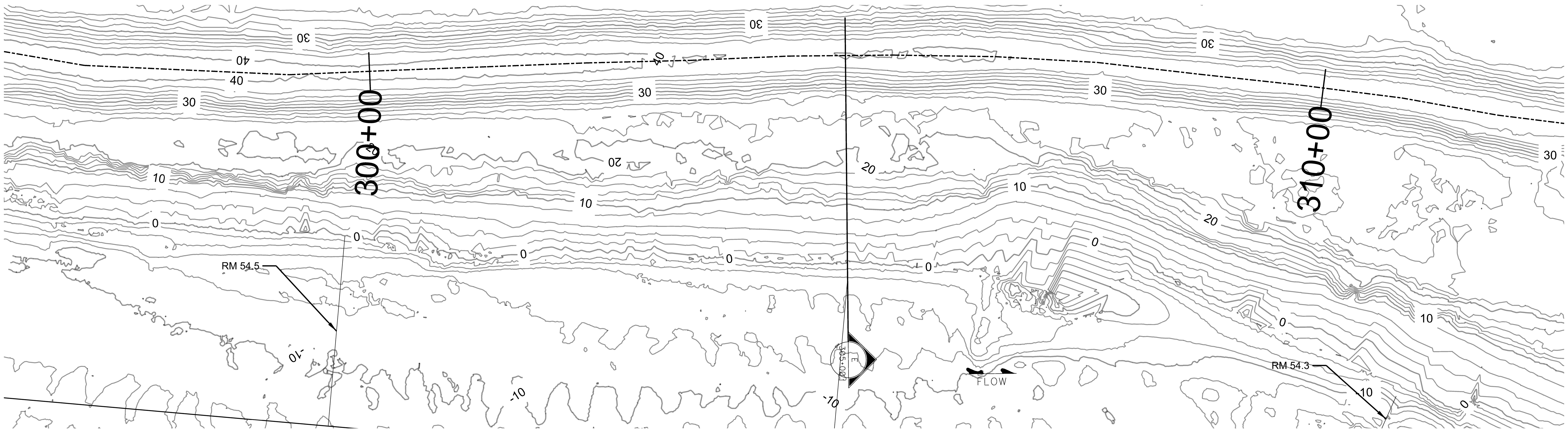

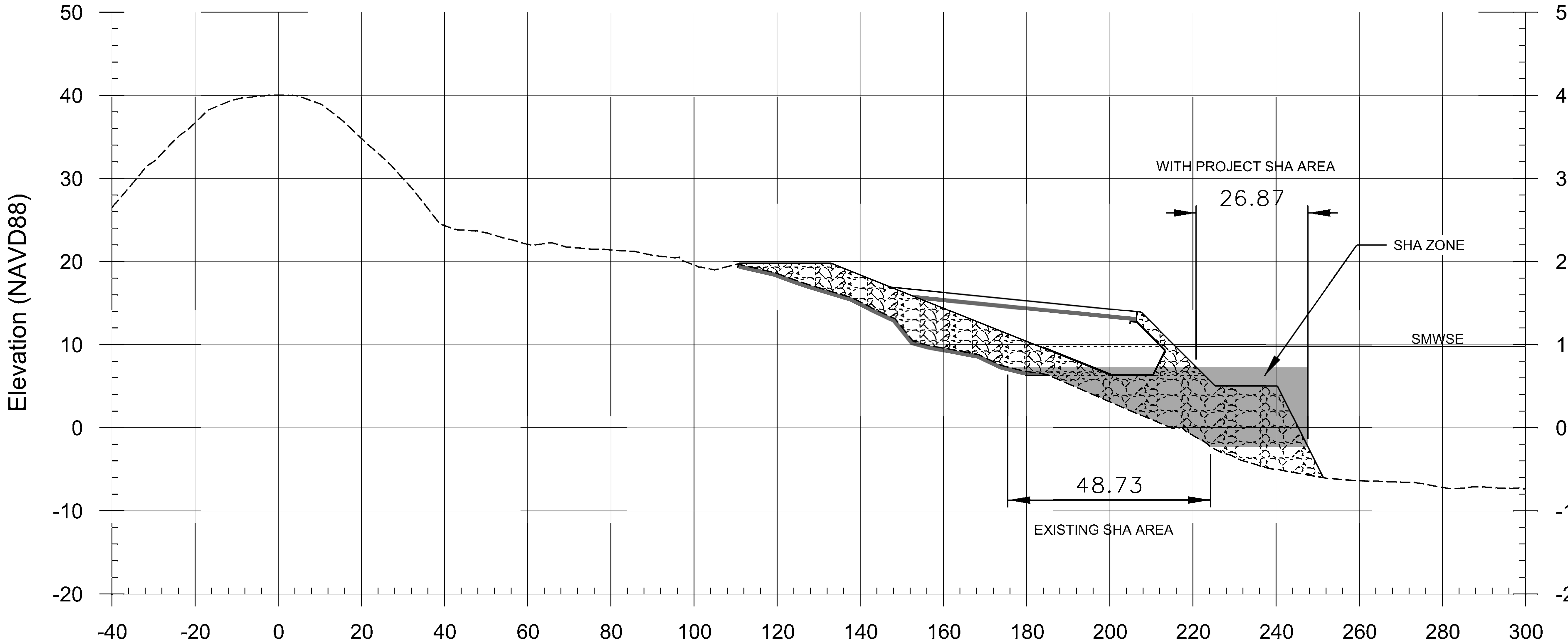

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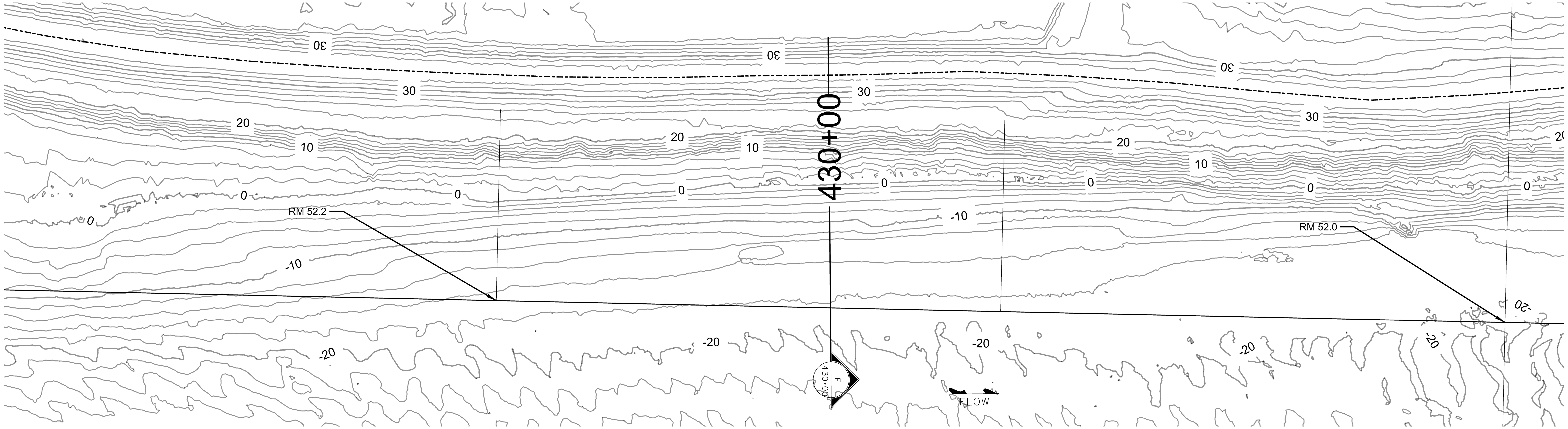

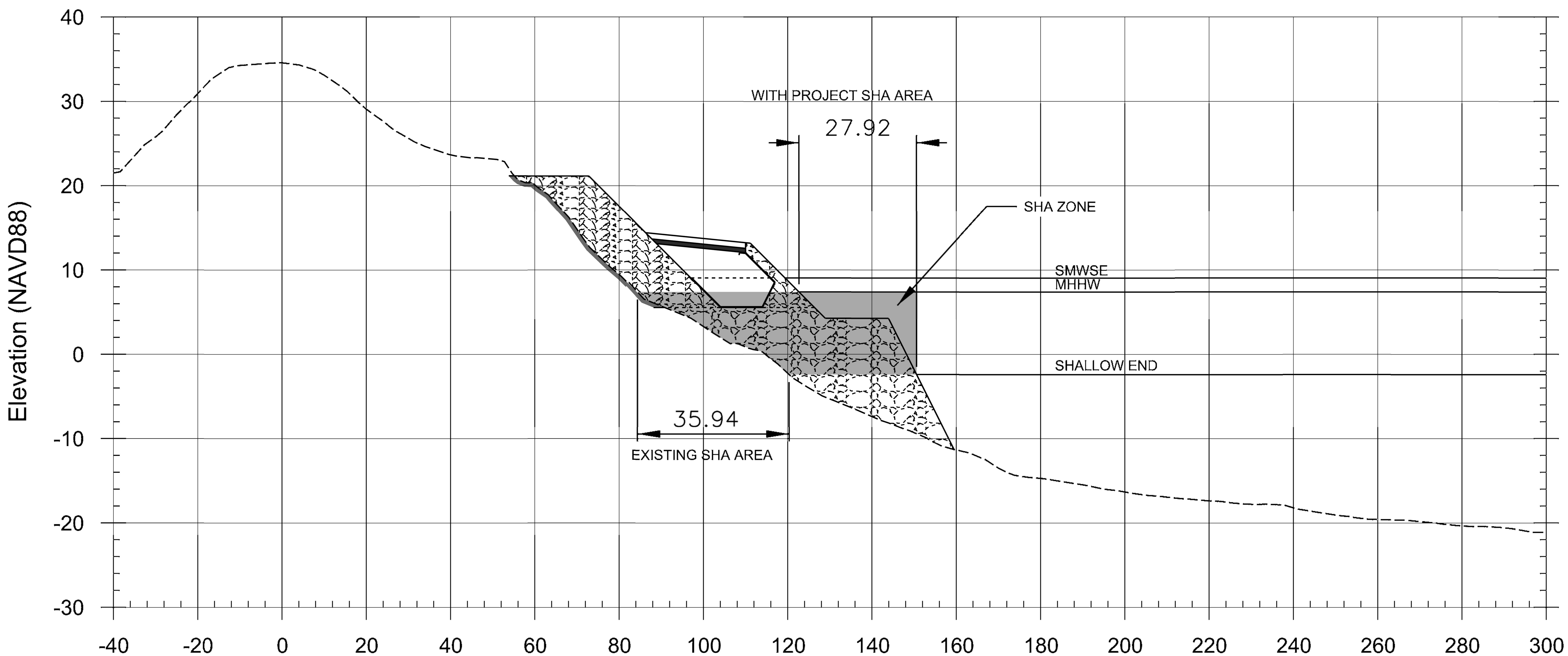

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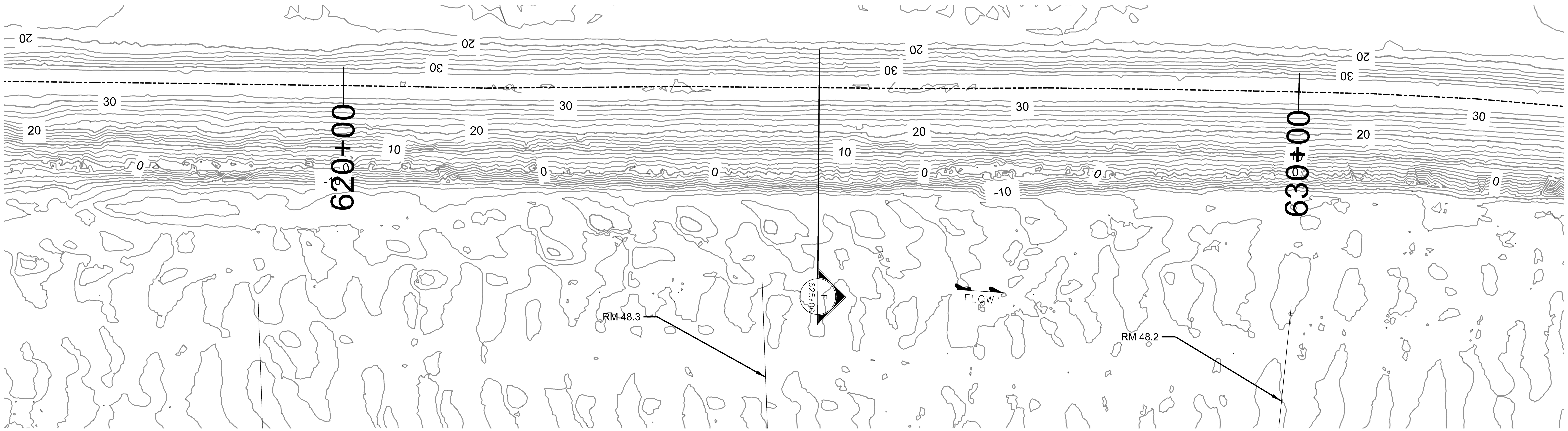

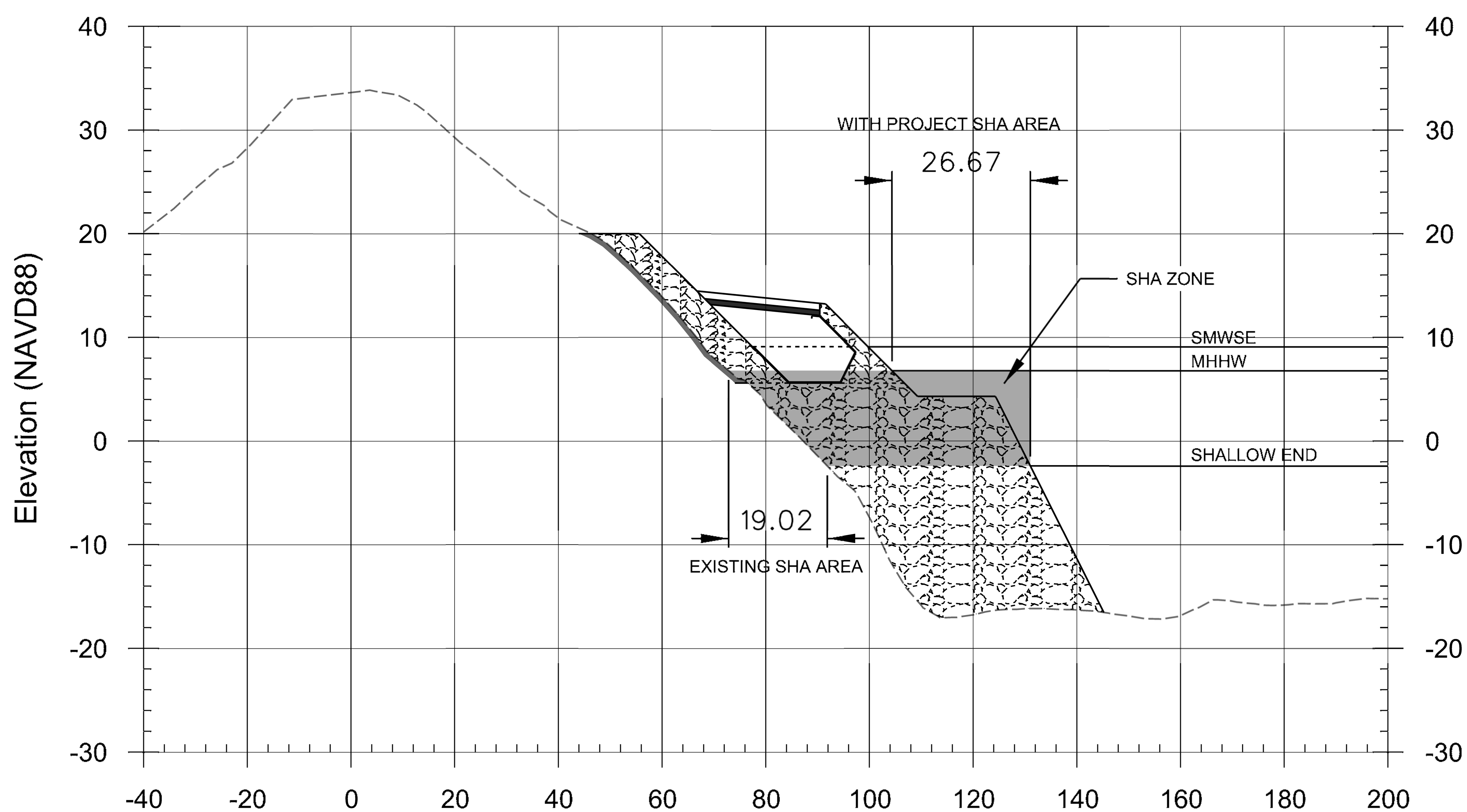

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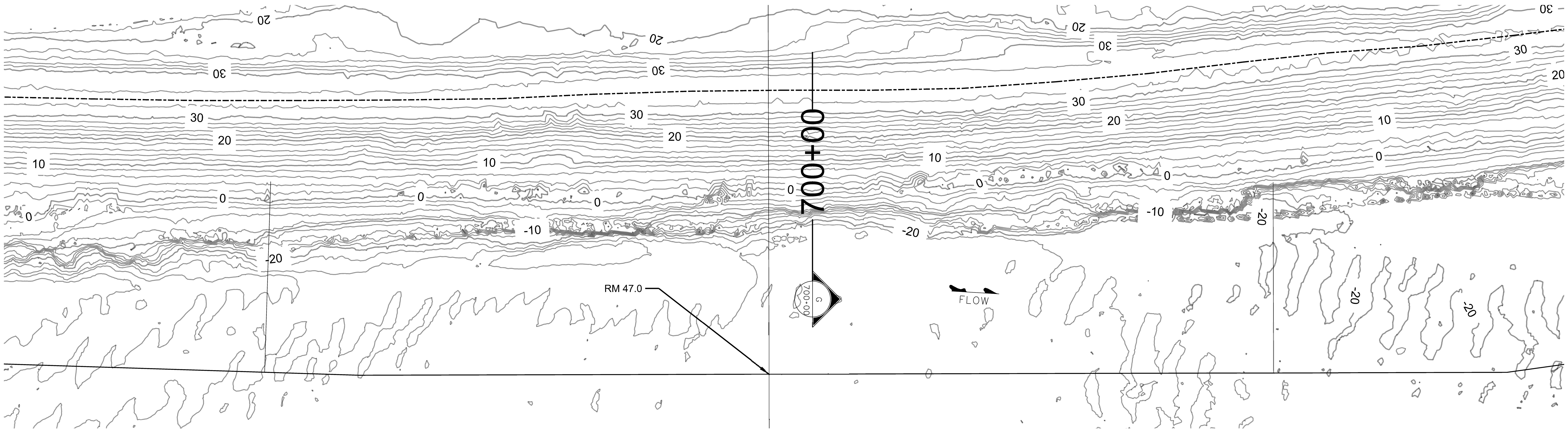

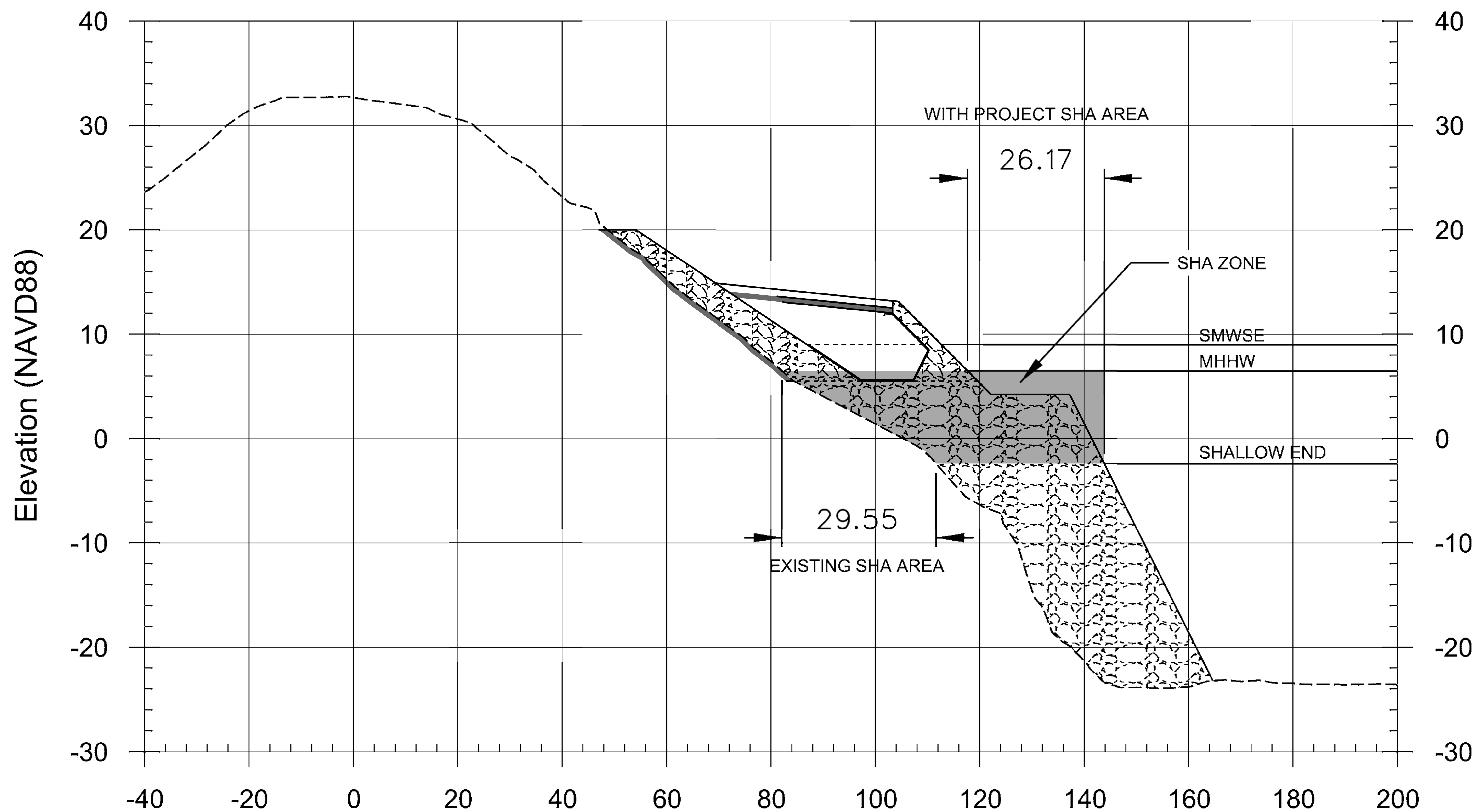

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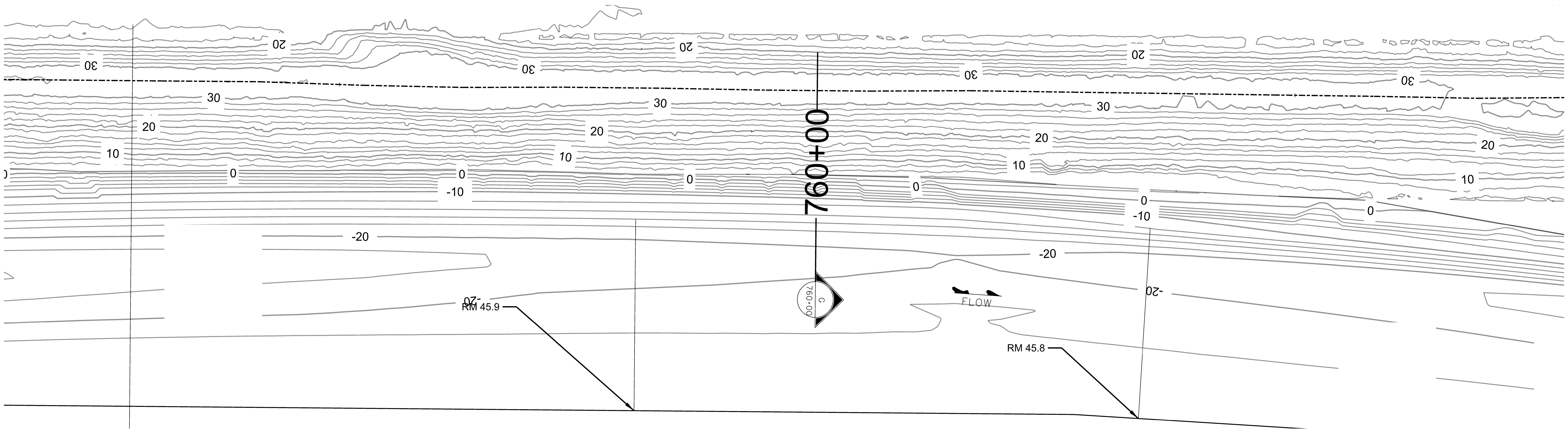

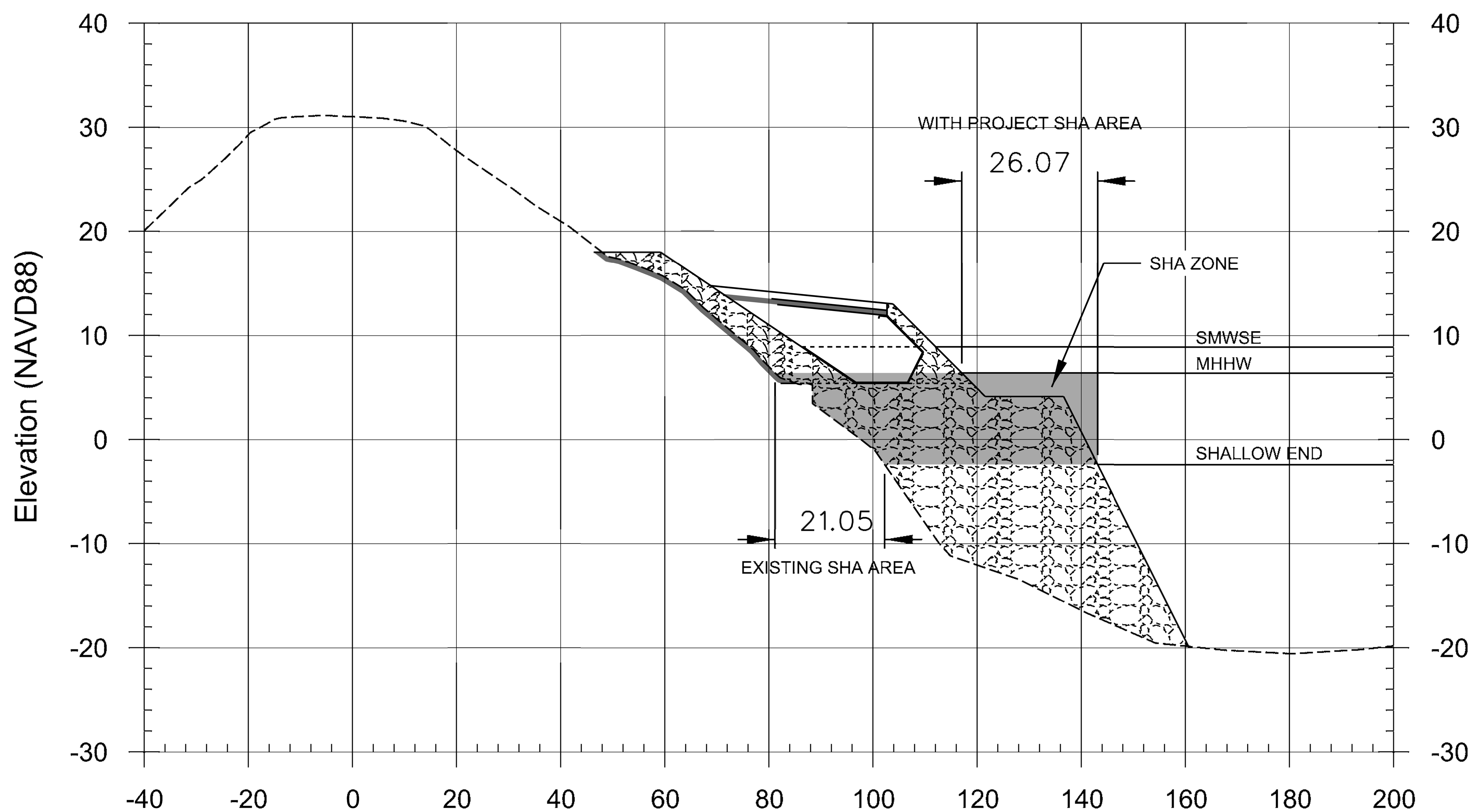

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Appendix D

North Sacramento Streams Levee Improvement Project

Preliminary Biological Evaluation

Preliminary Biological Evaluation

North Sacramento Streams Levee Improvements Project

Prepared for:

Sacramento Area Flood Control Agency

Prepared for submittal to:

U.S. Army Corps of Engineers
CESPK-PD
1325 J Street
Sacramento, CA 95814

Attn: Anne Baker

February 2015

TABLE OF CONTENTS

Section **Page**

Tables

Appendix A – Exhibits

1.0 INTRODUCTION

The purpose of this preliminary biological evaluation is to support the preparation of a forthcoming biological assessment (BA). The BA would analyze the North Sacramento Streams (NSS) component of the Sacramento Area Flood Control Agency's (SAFCA) proposed Levee Accreditation Project (NSS Levee Improvements Project) in sufficient detail to determine the extent to which the proposed action may affect any of the federally listed species described below under "Species Considered."

A BA is prepared in accordance with requirements set forth under Section 7 of the Federal Endangered Species Act (ESA) (16 United States Code [USC] 1536[c]). It serves to initiate consultation with the U.S. Fish and Wildlife Service (USFWS) and consultation with the National Marine Fisheries Service (NMFS) on effects of the NSS Levee Improvements Project on federally listed species. A BA also serves to initiate consultation with NMFS on essential fish habitat (EFH) conservation recommendations for Pacific salmon (*Oncorhynchus* spp.), as required by the Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 USC 1801). (See the "Essential Fish Habitat Assessment" section below.)

Section 7(a)(2) of the ESA directs federal agencies to ensure that their activities are not likely to jeopardize the continued existence of any listed species, or to result in the destruction or adverse modification of designated critical habitat. This section of the ESA also requires agencies with regulatory authority over listed species to issue biological opinions evaluating the direct and indirect effects of federal actions, and actions that are interrelated or interdependent with the federal action. The biological opinions must determine whether the actions being evaluated may appreciably reduce the listed species' likelihood of surviving or recovering in the wild by reducing their productivity, numbers, or distribution.

To implement the NSS Levee Improvements Project, SAFCA would request permission from the U.S. Army Corps of Engineers (USACE) for:

- alteration of federal project levees, pursuant to Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408, referred to in this preliminary biological evaluation as "Section 408"); and

- placement of fill in jurisdictional waters of the United States, pursuant to Section 404 of the Clean Water Act (33 USC 1344, referred to in this preliminary biological evaluation as "Section 404").

These activities are described in more detail under "Description of the Proposed Action." Similar to a BA, this preliminary biological evaluation analyzes direct, indirect, interrelated/interdependent, and cumulative effects of the proposed action on federally listed species.

The proposed action described herein is also part of a larger, joint project with USACE and the State of California called the American River Common Features (ARCF) Project. The ARCF Project is currently in the planning phase and therefore detailed design information is not available. Therefore, USACE is consulting with NMFS and USFWS on the ARCF Project using a worst-case approach. Since the NSS Levee Improvements Project is a subset of the ARCF Project, and because detailed design information for SAFCA's NSS Levee Improvements Project is available, consultation for the two projects is being combined. It should be noted that because design for the NSS Levee Improvements Project has progressed further than that for the ARCF Project, some areas (e.g., borrow sites) not identified by USACE are being identified below. SAFCA also anticipates future consultation as part of the ARCF Project consultation for work along the Sacramento River, although this effort is still in the planning phase by SAFCA.

2.0 SPECIES CONSIDERED

This document considers species or designated critical habitat that have been termed “threatened” or “endangered” under the jurisdiction of USFWS and NMFS. On February 22, 2015, biologists consulted the online database maintained by USFWS’s Sacramento Office to conduct a query of the Rio Linda (512B) and Sacramento East (512C) 7.5-minute quadrangles (USFWS 2015). Using the California Department of Fish and Wildlife’s (CDFW’s) California Natural Diversity Database (CNDDB) (2015) and the California Native Plant Society’s database of rare and endangered plant species (CNPS 2014), biologists also conducted a query of the topographic quadrangles in which the action area occurs and the surrounding quadrangles; these database queries were conducted on February 27, 2014, and March 3, 2014, respectively. This query identified all listed species in the area surrounding the action area, which is defined here in accordance with ESA guidelines as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 Code of Federal Regulations [CFR] 402.02).

On June 18, 20, 23, 24, and 25, 2014, AECOM biologists conducted field surveys of Arcade Creek. NEMDC/Steelhead Creek was surveyed by AECOM biologists on September 3 and 8, 2014. A qualitative survey of additional areas where other proposed project elements would occur, including Robla Creek, was conducted by AECOM biologists through interpretation of aerial imagery. The purpose of these surveys was to characterize general biological resources, map vegetation and land covers within the footprints of the various project elements (i.e., levee improvements, encroachment removal, vegetation management, and Conservation Strategy), and assess the potential for the project study area to support special-status species and other sensitive biological resources. Locations of elderberry shrubs within the project study area (including a 100-foot buffer area around the various levee improvement footprints) were mapped, but no protocol-level plant or wildlife surveys were conducted. Tree survey data collected along the project study area levees by MBK Engineers (2014) was reviewed in the field. Vegetation and land cover were mapped onto aerial photographs during field surveys. The polygons were later digitized into a GIS overlay and used to create maps depicting the location and extent of each cover type present in the project study area.

Based on these database queries, field surveys, and the biologists’ familiarity with local flora and fauna, 15 plant and wildlife species that are federally listed as endangered or threatened, or are federally proposed for listing, were considered as part of this assessment (**Table 1**).

Table 1
Fish and Wildlife Species Federally Listed or Proposed for Listing that Were Considered in the Evaluation of the North Sacramento Streams Levee Improvements Project

Species	Status	Habitat	Potential to Occur[1] in the Action Area[2]
Plants			
Slender Orcutt grass *Orcuttia tenuis*	Threatened	Vernal pools, often in gravelly soils; from 114 to 5,774 feet in elevation. Blooms May–October.	No potential to occur. No suitable habitat is present within the action area.[2]
Sacramento Orcutt grass *Orcuttia viscida*	Endangered	Vernal pools; from 98 to 328 feet in elevation. Blooms April–September.	No potential to occur. No suitable habitat is present within the action area.[2]
Invertebrates			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Threatened	Closely associated with blue elderberry (*Sambucus* sp.), which is an obligate host for the beetle larvae; CNDDB (2014) occurrences along the Sacramento	Could occur; elderberry shrubs present occasionally along the Arcade Creek; however, no shrubs were observed in NSS Levee Improvements Project area.

Table 1
Fish and Wildlife Species Federally Listed or Proposed for Listing that Were Considered in the Evaluation of the North Sacramento Streams Levee Improvements Project

Species	Status	Habitat	Potential to Occur[1] in the Action Area[2]
		and American Rivers.	
Vernal pool fairy shrimp *Branchinecta lynchii*	Threatened	Vernal pools and other seasonal wetlands, typically small but including a wide range of sizes; scattered CNDDB (2014) occurrences in vicinity of Dry Creek.	Could occur. Potentially suitable habitat is present within the action area.[2]
Vernal pool tadpole shrimp *Lepidurus packardi*	Endangered	Vernal pools and other seasonal wetlands, typically medium to large but including a wide range of sizes with relatively long inundation period; scattered CNDDB (2014) occurrences in vicinity of Dry Creek.	Could occur. Potentially suitable habitat is present within the action area.[2]
Fish			
Central Valley steelhead *Oncorhynchus mykiss*	Threatened	Anadromous. Requires cold freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta. Adult migration to upstream spawning areas occurs July–March (Hallock 1987). Juveniles typically spend 1–3 years in fresh water before migrating to the ocean, generally in December–August (McEwan 2001).	Likely to occur. Expected to occur in the NEMDC/Steelhead Creek, either as adults migrating to their upstream spawning habitat, or as juveniles and smolts, rearing and migrating towards the ocean. High water temperatures and low flows preclude occurrence in NEMDC/Steelhead Creek in summer. Not expected to occur in Arcade or Robla Creek as these streams lack suitable water quality conditions for spawning. Designated critical habitat is in the action area[2].
Central Valley fall-/late fall-run Chinook salmon *Oncorhynchus tshawytscha*	Species of Concern[2]	Anadromous. Requires cold freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta. Fall-run adults migrate in June–December, and juveniles migrate downstream and out to the ocean soon after emerging (December–March), rearing in fresh water for only a few months, and migrating to the ocean in March–July (Yoshiyama et al. 1998). Late fall-run adults migrate in October–April, and juveniles rear in their natal stream during summer; in some streams they remain throughout the year. Smolt outmigration can occur in November–May (Yoshiyama et al. 1998).	Likely to occur. Occurs in the Sacramento and San Joaquin Rivers, tributaries, and the Delta. Fall-run could occur in the NEMDC/Steelhead Creek, either as adults migrating upstream to their spawning habitat, spawning in the lower American River, or as juveniles and smolts, rearing and migrating towards the ocean. Not expected to occur in Arcade or Robla Creeks, as these streams regularly lack suitable water quality conditions or access for spawning. Essential fish habitat is in the action area[2].
Delta smelt *Hypomesus*	Threatened	Semi-anadromous. Typically restricted to the Delta and the	Unlikely to occur. Occurs in tidally influenced segments of the Sacramento and San Joaquin

Table 1
Fish and Wildlife Species Federally Listed or Proposed for Listing that Were Considered in the Evaluation of the North Sacramento Streams Levee Improvements Project

Species	Status	Habitat	Potential to Occur[1] in the Action Area[2]
transpacificus		lower Sacramento River downstream of Isleton; juveniles move downstream with the currents (USFWS 1996; Sommer et al. 2001a; Moyle 2002).	Rivers, tributaries, and Delta. No spawning habitat is in the action area.[2]
Sacramento River winter-run Chinook salmon *Oncorhynchus tshawytscha*	Endangered	Anadromous. Requires cold freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta. Adults migrate upstream in December–July (peak in March) (Moyle 2002), and juveniles migrate downstream soon after fry emerge, typically beginning in August and peaking in September and October (Vogel and Marine 1991).	Unlikely to occur. Occurs in the Sacramento River, tributaries, and the Delta. The Sacramento River channel is the main migration route for winter-run juveniles, and smolts (Yoshiyama et al. 1998). No spawning habitat is in the action area[2].
Central Valley spring-run Chinook salmon *Oncorhynchus tshawytscha*	Threatened	Anadromous. Requires cold freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta. Adults migrate upstream in March–September, (peak May–June) (Yoshiyama et al. 1998), and juveniles and yearlings migrate downstream following the onset of the winter storm season through March (CDFG 1998; Fisher 1994; S. P. Cramer and Associates 1995; Hill and Webber 1999). Adults: July–March (Hallock 1987).	Unlikely to occur. Occurs in the Sacramento River, tributaries, and the Delta. No spawning habitat is in the action area[2].
Green sturgeon *Acipenser medirostris*	Threatened	Anadromous. Requires seasonally inundated floodplains, rivers, tributaries, and the Delta. Adults migrate upstream to their spawning habitat (between late February and late July), and juveniles are reared and migrate to the ocean (year-round).	Unlikely to occur. Occurs in the Sacramento and San Joaquin Rivers, tributaries, and the Delta. No spawning habitat is in the action area[2].
Amphibians and Reptiles			
California red-legged frog *Rana draytonii (=R. aurora draytonii)*	Threatened	Prefers semi-permanent and permanent stream pools, ponds, and creeks with emergent riparian vegetation and typically without predatory fish. Requires adequate hibernacula such as small-mammal burrows and moist leaf litter.	No potential to occur. The action area is outside of the species' extant range.

Table 1
Fish and Wildlife Species Federally Listed or Proposed for Listing that Were Considered in the Evaluation of the North Sacramento Streams Levee Improvements Project

Species	Status	Habitat	Potential to Occur[1] in the Action Area[2]
California tiger salamander *Ambystoma californiense*	Threatened	Vernal pools and other seasonal wetlands with adequate inundation period and adjacent uplands, primarily grasslands, with burrows and other refugia; no known occurrences in the project vicinity.	No potential to occur. No suitable habitat is present within the action area.[2]
Giant garter snake *Thamnophis gigas*	Threatened	Open water associated with marshes, sloughs, and irrigation/drainage ditches within the Central Valley; requires emergent herbaceous wetland vegetation for escape and foraging habitat, grassy banks and openings in waterside vegetation for basking, and higher elevation upland habitat for cover and refuge from flooding. Nearest known extant populations are located in the Natomas Basin, adjacent to and just west of NEMDC/Steelhead Creek (CDFW 2014).	Could occur. In the NSS Levee Improvements Project area, the quality of habitat for giant garter snake is better along the NEDMC/ Steelhead Creek north of Dry Creek; Arcade and Robla Creeks and the NEMDC/Steelhead Creek south of Dry Creek are less suitable for this species. Giant garter snakes are known to occur in rice fields, associated canals, and managed marshes in the Natomas Basin west of the portion of NEMDC/Steelhead Creek that is north of Dry Creek; thus, there is potential for the species to occur, at least occasionally, in this portion of NEMDC/Steelhead Creek.
Birds			
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Threatened	Riparian forest with dense deciduous trees and shrubs; there are no recent CNDDB occurrences in the vicinity of the program area, but migrant individuals are likely to pass through the area in transit to breeding sites along the Sacramento River north of Colusa.	Unlikely to occur. Although potential dispersal and foraging habitat is in the NSS Levee Improvements Project area, the action area is outside of the species' extant range.

Notes: CNDDB = California Natural Diversity Database; Delta = Sacramento–San Joaquin Delta; NSS = North Sacramento Streams

1 **Potential for Occurrence Definitions:**

No potential to occur: Potentially suitable habitat is not present.

Unlikely to occur: Potentially suitable habitat present but species unlikely to be present because of very restricted distribution.

Could occur: Suitable habitat is available; however, there are few or no other indicators that the species may be present.

Likely to occur: Habitat conditions, behavior of the species, known occurrences in the vicinity, or other factors indicate a relatively high likelihood that the species would occur.

Known to occur: The species, or evidence of its presence, was observed during reconnaissance-level surveys or was reported by others.

2 Action Area: The action area is defined here in accordance with ESA guidelines as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The action area includes all areas that would be directly or indirectly affected by the components of the NSS Levee Improvements Project. Areas downstream of the NSS Levee Improvements Project area may also be indirectly affected by the flood risk management component of the project through improved water quality and flood risk management conditions.

Sources: CDFW 2014; CNPS 2014; data collected and compiled by AECOM in 2014 CNDDB 2014, CNPS 2014, USFWS 2014; data compiled by AECOM and Stillwater Sciences in 2014

The following federally proposed and federally listed species are known to occur or have the potential to occur in the NSS Levee Improvements Project area:

- vernal pool fairy shrimp *(Branchinecta lynchi),*
- vernal pool tadpole shrimp *(Lepidurus packardii),*
- valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*),
- Central Valley steelhead distinct population segment (DPS) (*Oncorhynchus mykiss*), and
- giant garter snake (*Thamnophis giga*).

Central Valley fall- /late fall-run Chinook salmon ESU (*O. tshawytscha*) is not federally listed; however, EFH is present in the action area.

The other federally listed species identified in **Table 1** were eliminated from further consideration because they are not likely to occur in the NSS Levee Improvements Project area because of a lack of suitable habitat, local range restrictions, regional extirpations, or lack of connectivity between areas of suitable or occupied habitat, or because the action area is located outside of the extant range of the species (see "Action Area" section below). The USFWS-regulated species with the potential to occur on-site are discussed in more detail in this preliminary biological evaluation.

2.1 SPECIES HABITAT AND POTENTIAL FOR OCCURRENCE IN THE AREA

The following is a summary of relevant habitat conditions in the action area for species that could occur, are likely to occur, or are known to occur in the NSS Levee Improvements Project area. Full species accounts for federally listed species addressed in this preliminary biological evaluation are presented in the section titled "Species Accounts."

- **Vernal pool fairy shrimp** and **vernal pool tadpole shrimp:** Seasonal wetlands, which may provide suitable habitat for vernal pool invertebrates, occur at Borrow Site 3/ Robla woodland mitigation site A. There are documented occurrences of vernal pool fairy shrimp north of Dry Creek along the landside of the NEMDC/Steelhead Creek East Levee and there are documented occurrences of vernal pool fairy shrimp and vernal pool tadpole on the former McClellan Air Force Base, northeast of Arcade Creek (CDFW 2014).

- **Valley elderberry longhorn beetle:** Elderberry shrubs were not observed along Arcade Creek or NEMDC/Steelhead Creek during field surveys. Robla Creek has not been surveyed for elderberry shrubs, the obligate host plant for the valley elderberry longhorn beetle, but shrubs may occur amongst vegetation along the creek, adjacent to Borrow Site 3 and the proposed woodland mitigation sites north of Robla Creek. While there are no documented occurrences of valley elderberry longhorn beetle in the NSS Levee Improvements Project area, this species could occur in elderberry shrubs, if present along Robla Creek.

- **Central Valley Steelhead DPS:** Adult and juvenile Central Valley steelhead could occur in the action area during migrations along the Sacramento River and its tributaries. Central Valley steelhead are expected to occur in NEMDC/Steelhead Creek as adults, migrating upstream to their spawning habitat, and as juveniles and smolts, rearing and migrating toward the ocean. Central Valley steelhead would not typically occur in Arcade Creek, as this stream regularly lacks water quality conditions for spawning. There are no known runs within Robla Creek, similar to Arcade Creek. NEMDC/Steelhead Creek includes critical habitat for Central

Valley steelhead, which uses this locations for juvenile rearing, juvenile migration, and adult migration (NMFS 2014). There is no critical fish habitat designation for Arcade and Robla Creeks.

- **Central Valley fall-/late fall-run Chinook salmon:** Adult and juvenile Central Valley fall-run Chinook salmon could occur in the action area during migrations along the Sacramento River and its tributaries. They are not expected to occur in Arcade Creek or other tributaries to NEMDC/Steelhead Creek lacking suitable water quality conditions for spawning and rearing. EFH is also present in both streams for fall-run Chinook, which use these areas for juvenile rearing, juvenile migration, and adult migration. There is no EFH for Arcade and Robla Creeks.

- **Giant garter snake:** There are numerous occurrences of giant garter snake west of NEMDC/Steelhead Creek within the Natomas Basin; these records, which are located between NEMDC/Steelhead Creek and I-5/State Route (SR) 99/70, are all located north of Elkhorn Boulevard (CDFW 2014). The channel, water primrose wetlands, and hardstem bulrush marsh in NEMDC/Steelhead Creek, particularly north of Dry Creek, provide suitable aquatic habitat for giant garter snake; suitable upland habitat for this species is present where annual (wild oats) grasslands are within 200 feet of these aquatic features. However, there are no documented occurrences of this species in NEMDC/Steelhead Creek or in any of its eastside tributaries (CDFW 2014). The historic habitat conditions of NEMDC/Steelhead Creek and particularly its eastside tributaries were likely never suitable for this species (e.g., steeper elevational slope, rapid water runoff, lack of historical marsh [E. Hansen, pers. comm., 2015; B. Halstead, pers. comm., 2015]); a recent analysis suggests that this species' distribution is limited by dispersal distances associated with historic marsh habitats (Halstead et al. 2014). However, the quality of habitat for giant garter snake is better along the NEDMC/Steelhead Creek north of Dry Creek and giant garter snakes are known to occur in rice fields, associated canals, and managed marshes in the Natomas Basin west of this portion of NEMDC/Steelhead Creek; thus, there is potential for the species to occur, at least occasionally, in this portion of NEMDC/Steelhead Creek.

2.2 CRITICAL HABITAT

"Critical habitat" is defined in Section 3(5)A of the ESA as the specific areas in the geographical area occupied by the species where physical or biological features are found that are essential to the conservation of the species and that may require special management considerations or protection. Specific areas outside of the geographical area occupied by the species may also be included in critical-habitat designations, based on a determination that such areas are essential for the conservation of the species.

The proposed action addressed in this preliminary biological evaluation falls within designated critical habitat for Central Valley steelhead DPS. Critical habitat for the Central Valley steelhead DPS was designated on August 12, 2005; a final designation was published on September 2, 2005 (70 FR 52604), with an effective date of January 2, 2006 (70 FR 52487). Critical habitat is designated to include select waters in the Sacramento and San Joaquin River basins, including the segment of the NEMDC/Steelhead Creek in the action area (see "Action Area" section below).

The action area is not within designated critical habitat for the remaining species listed in **Table 1** for which such a designation has been made: Conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, VELB, Sacramento River winter-run Chinook salmon ESU, Central Valley spring-run Chinook salmon ESU, and California red-legged frog. Critical habitat has not been designated for Central Valley fall-/late fall–run Chinook salmon ESU, giant garter snake, or western yellow-billed cuckoo.

3.0 CONSULTATION TO DATE

[No information to input yet.]

4.0 DESCRIPTION OF THE PROPOSED ACTION

4.1 PROJECT LOCATION

The proposed project includes Levee Accreditation improvements that would be implemented in the North Sacramento Streams area. Approximately 4 miles of levee along the Natomas East Main Drainage Canal (NEMDC)/Steelhead Creek East Levee and Arcade Creek North and South Levees would be improved (**Exhibit 1**). These levee reaches require substantial work to mitigate seepage, meet embankment and foundation stability requirements, and remove high-hazard encroachments and vegetation. This work requires use of proposed borrow sites (located along either side of NEMDC/Steelhead Creek, just north of Dry Creek and along the north side of Robla Creek) and staging areas (located along the levee improvement areas).

4.2 PROJECT SCHEDULE

SAFCA's NSS Levee Improvements Project would start construction in 2016. The proposed project is anticipated to take 1 to 2 years to complete.

4.3 DESCRIPTION OF PROPOSED PROJECT ELEMENTS

The NSS Levee Improvements Project consists of four project elements: levee improvements, high-hazard levee encroachment and vegetation removal, and conservation strategy. These four project elements are summarized in **Table 2** below.

Table 2. Summary of Locations of Proposed Project Elements in NSS Levee Improvements Area

Portion of Project Study Area	Levee Improvements	Encroachment Removal	Vegetation Management	Conservation Strategy[1]
Arcade Creek Levees	X	X	X	X
NEMDC/Steelhead Creek East Levee	X	–	–	X
Robla Creek South Levee	–	X	–	X
Borrow Sites	X	–	–	X
Robla Creek Tree Mitigation Sites (A and B)	–	–	–	X

Notes: NEMDC = Natomas East Main Drainage Canal

[1] In addition to providing mitigation for levee improvements, the Conservation Strategy includes an extensive list of avoidance and minimization measures that would be implemented throughout the project study area, where applicable

Source: Data compiled by AECOM in 2014

4.3.1 NORTH SACRAMENTO STREAMS LEVEE IMPROVEMENTS

DESCRIPTION OF THE NORTH SACRAMENTO STREAMS LEVEE IMPROVEMENTS AREA

This section discusses specific levee improvements proposed for each reach along NEMDC/Steelhead Creek and Arcade Creek in the NSS Levee Improvements area. To identify and describe the levee improvements proposed for the NSS Levee Improvements area, the area has been divided into eight levee reaches (**Exhibit 1**): two along the east side of NEMDC/Steelhead Creek and three along each side of Arcade Creek. These levee reaches and associated improvements are described below.

NEMDC A

Reach A of the NEMDC/Steelhead Creek East Levee is about 1,700 feet long and extends from Station 3028+00 to Station 3051+00. The levee height ranges from 22.7–25.7 feet, with a crown width ranging from 14–26 feet. This reach is located along the eastern boundary of the Natomas Basin, just south of the confluence with Arcade Creek. A railroad embankment that pre-dates the construction of the NEMDC/Steelhead Creek East Levee is present along the entirety of the landside embankment slope of this reach and is integral with the NEMDC/ Steelhead Creek levee.

The levee embankment consists of clay materials with a fine-grained blanket layer of clay and silt, and occasional instances of clayey sand at the ground surface. This reach contains riparian habitat, ruderal land, and stream channels within the construction footprint of the proposed improvements. Preliminary analysis indicates that this reach does not meet 100-year water surface elevation (WSE) criteria or Urban Levee Design Criteria (ULDC) for potential underseepage. The underseepage may be due to high hydraulic head in the stormwater collector channel along the landside levee toe that leads to a pump station within the reach.

Construction of a cement-bentonite (CB) slurry cutoff wall at the waterside toe of the levee was selected as the preferred levee improvement.

ACS A

Reach A of the Arcade Creek South (ACS) Levee is about 1,300 feet long and extends from Station 4000+00 to Station 4013+00. This reach was originally constructed in the 1930s, but specific construction details and documentation are unavailable. The levee crest was widened and the waterside slope liner was constructed in the 1950s by USACE. The levee ranges between 19.4 and 22.0 feet high, with a crown width ranging from 10–26 feet. A railroad crossing occurs at the downstream boundary of the levee, with a stoplog structure across the rail used to block this crossing during high-water events.

The levee embankment consists of clay, silt, and sand materials, and contains a fine-grained blanket layer comprised of clay and silt. The reach contains riparian habitat, creek, and ruderal land within the construction footprint of proposed levee improvements. Preliminary analysis indicates that this reach does not meet 100-year WSE criteria or ULDC for potential underseepage and stability.

Construction of a soil-bentonite (SB) cutoff wall at the centerline of the levee was selected as the preferred levee improvement.

ACS B

Reach B of the Arcade Creek South Levee is about 3,727 feet long and extends from Station 4031+18 to Station 4068+45. This reach was originally constructed in the 1930s, but specific construction details and documentation are unavailable. The levee crest was widened and the waterside slope liner was constructed in the 1950s by USACE. The levee ranges between 11 and 17 feet high, with a crown width ranging from 17–28 feet.

The levee embankment consists of clay, silt, and sand materials, and contains a fine-grained blanket layer comprised of clay and silt. This reach contains riparian habitat, creek, and ruderal land within the construction footprint of the proposed levee improvements. Preliminary analysis indicates that this reach does not meet 100-year WSE criteria or ULDC for potential underseepage and stability.

Construction of an SB cutoff wall at the centerline of the levee was selected as the preferred levee improvement.

ACS C

Reach C of the Arcade Creek South Levee is about 4,155 feet long and extends from Station 4068+45 to Station 4110+34. The levee was constructed in the 1930s, but the original construction documentation is unavailable. Subsequent improvements to the levee (i.e., crest raise and floodwall) were completed by SAFCA in the 1990s. The downstream (western) boundary of this reach occurs at the intersection of the levee reach with Rio Linda Boulevard. The upstream (eastern) boundary is located at the intersection of the levee and Marysville Boulevard. The levee ranges between 19.4 and 22.0 feet high, with a crown width ranging from 10–26 feet. A low concrete flood wall curb extends along the waterside of the levee crest from Rio Linda Boulevard to Marysville Boulevard.

The levee embankment consists of clayey and silty sand materials, with a foundation layer comprised of silty and clayey sand over silt. The reach contains riparian habitat, creek, and ruderal land within the construction footprint of proposed levee improvements. Preliminary analysis indicates that this reach does not meet 100-year WSE underseepage and stability criteria, as well as ULDC for underseepage, through-seepage or stability.

Construction of a CB slurry cutoff wall at the waterside toe combined with waterside slope replacement was selected as the preferred levee improvement.

ACN A

Reach A of the Arcade Creek North Levee is about 1,050 feet long and extends from Station 5023+00 to Station 5033+50. This levee reach was originally constructed in the 1950s by USACE. Subsequent improvements to the levee’s landside and waterside slopes, in conjunction with a levee raise, were completed in the 1990s by SAFCA. A concrete-lined ditch owned by the City of Sacramento at Drainage Pumping Plant No. 158 is located approximately 30 feet from the landside toe up to Station 5031+00. From there, this concrete-lined toe ditch descend into the pump station sump. This reach includes the lined channel and the concrete paved pump station sump area. The levee ranges between 15 and 28 feet high, with a crown width ranging from 8–16 feet.

The levee embankment consists of silty and clayey sand materials. Preliminary analysis indicates that this reach does not meet 100-year WSE underseepage and stability criteria, as well as ULDC for underseepage, through-seepage, or stability.

Installation of pressure relief wells along the landside of the levee was selected as the preferred levee improvement.

ACN B

Reach B of the Arcade Creek North Levee is about 3,700 feet long and extends from Station 5038+00 to Station 5075+00. The upstream (eastern) boundary of this reach occurs at the beginning of the concrete floodwall that runs along the levee crest between Stations 5068+10 and Marysville Boulevard. The levee ranges between 10 and 18 feet high, with a crown width ranging from 8–23 feet. This levee reach was originally constructed in the 1950s by USACE. Subsequent improvements to the levee’s landside and waterside slopes, in conjunction with a levee raise, were completed in the 1990s by SAFCA.

The levee embankment consists of silty and clayey sand materials. The downstream blanket layer is comprised of silty and clayey sand, while the upstream blanket layer is comprised of clay and silt. This reach contains riparian habitat, creek, and ruderal land within the construction footprint of proposed levee improvements. Preliminary analysis indicates that this reach does not meet 100-year WSE criteria or ULDC for underseepage and stability.

Construction of an SB cutoff wall at the centerline of the levee was selected as the preferred levee improvement.

ACN C

Reach C of the Arcade Creek South Levee is about 3,743 feet long and extends from Station 5075+00 to Station 5112+3. This levee reach was originally constructed in the 1950s by USACE. The floodwall that runs along the waterside of the levee crest was constructed in the 1990s by SAFCA. The downstream (western) boundary of this reach is located at the beginning of the concrete floodwall that runs along the levee crest between Stations 5075+00 and Marysville Boulevard. The upstream (eastern) boundary of this reach is located at the intersection of the levee and Marysville Boulevard. The levee ranges between 1 and 9 feet high, with a crown width ranging from 5–17 feet.

The levee embankment consists of silty and clayey sand materials, with a coarse-grained blanket layer comprised of silty and clayey sand. This reach contains riparian habitat, creek, and ruderal land within the construction footprint of proposed levee improvements. Preliminary analysis indicates that this reach does not meet 100-year WSE criteria or ULDC for underseepage and stability.

Construction of a CB cutoff wall at the waterside toe combined with waterside slope replacement from Station 5075+00 to Station 5100+00, and construction of a sheet pile cutoff wall at the centerline of the levee from Station 5100+00 to Marysville Boulevard was selected as the preferred levee improvement.

BORROW AREAS AND HAUL ROUTES

Based on proximity to the improvement areas, SAFCA has identified three preferred borrow sites to provide suitable material for levee improvements for the NSS Levee Improvements area. The preferred borrow sources are illustrated in **Exhibit 2** and their locations are briefly described below.

- **Site 1 -** Three soil stockpiles located on the grounds of a new high school, near Sorento Road and East Levee Road.
- **Site 2 -** Site 2K **-** Up to 35,000 cubic yards (cy) available above the water table.
- **Site 3 -** Area north of Robla Creek and the Dry Creek South Levee, east of Rio Linda Boulevard.

The most likely sources for borrow currently under consideration are Sites 1 and 2. While Site 3 is a possible source, the suitability and available quantities of borrow material from each source must be investigated further and confirmed as part of project design.

The goal in selecting haul routes is to use existing levee crowns for hauling wherever possible (**Exhibit 3**). However, there are locations where hauling on paved public roads is the best available option because the levee crown is already paved for public use or because there is inadequate room on the waterside of the levee to develop a temporary toe road without affecting standing water or low flow channels. Final haul routes would be selected based on constraints, the construction schedule, and in coordination with the City.

Borrow site strippings would either be reused as part of post-borrow reclamation or hauled off-site. Borrow sites would be returned to pre-project conditions following construction activities.

POTENTIAL STAGING AREAS

Four potential staging areas have been identified for potential use to support construction of of the NSS Levee Improvements Project (see **Exhibit 3 4**). Several of these areas have been used previously to support levee improvements along Arcade Creek. The areas would require little preparation other than surface stripping, and temporary connection roads and ramps to the levee crown.

The primary use for the staging areas would be for temporary trailers, parking, and material staging and for stockpiling and blending of excavated soils with imported borrow to make the excavated soils suitable for use in levee reconstruction. This would involve stockpiles of material to be processed, a processing area where excavated soils and imported soils would be spread out and processed to mix and moisture condition the material, and stockpiles of processed material. Importing, processing, and exporting material for levee reconstruction would all be continuous activities once the work flow is established during the start of the construction season. Other disturbed areas would be also be stabilized. Staging areas would be returned to pre-project conditions following construction activities unless the owner agrees to some grade raising to help dispose of excess construction soils.

ADDITIONAL LEVEE IMPROVEMENTS COMPONENTS

Erosion Protection

The only erosion protection currently envisioned includes placement of rip rap on waterside benches where waterside toe slurry walls are constructed. Following construction, levee slopes and other areas disturbed by construction would be revegetated and brought back to pre-project conditions.

Locations where erosion is identified along the waterside levee slope and riverbank have been evaluated to determine whether levee integrity or stability may be affected. Insufficient embankment protection may cause a levee to be undermined by erosive forces due to wave action and/or high flow velocities along the levee bank. In many cases, the placement of embankment protection material, such as engineered armoring (rip-rap), would dissipate wave and velocity forces and reduce the potential for erosion to occur. Other factors to be considered prior to installing embankment protection material include grading the levee waterside slope to address stability issues, and environmental impacts within the vicinity of the embankment repair site.

Utility Relocation

SAFCA prepared an inventory and assessment of existing encroachments and penetrations within the NSS Levee Improvements Project area. Known utilities that cross or are adjacent to the levee include gas pipelines; storm drainage and pump station discharge pipes; and numerous water supply mains, culverts, electrical conduits, and sanitary sewers. The construction contractor can work around many of these utilities. However, some utilities may need to be temporarily removed or relocated prior to construction. Temporary bypass pumping may be required for sanitary sewers. SAFCA and the construction contractor would coordinate closely with utility owners to manage the utilities in advance of construction. Disturbed utilities would be restored after construction consistent with CVFPB requirements. Coordination between SAFCA and the utility owner would be required for those utilities that do not currently have CVFPB encroachment permits.

Stormwater Pollution Prevention

Temporary erosion/runoff best management control measures would be implemented during construction to minimize stormwater pollution resulting from erosion and sediment migration from the construction, borrow, and staging areas. These temporary control measures may include implementing construction staging in a manner that minimizes the amount of area disturbed at any one time; secondary containment for storage of fuel and oil; and the management of stockpiles and disturbed areas by means of earth berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures would be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and would be included in a Stormwater Pollution Prevention Plan (SWPPP).

After completion of construction activities, the temporary facilities (construction trailers and batch plants) would be removed and the site would be restored to pre-project conditions. Site restoration activities for areas disturbed by construction activities, including borrow areas and staging areas, will include a combination of regrading, reseeding, constructing permanent diversion ditches, using straw wattles and bales, and applying straw mulch and other measures deemed appropriate.

PROPOSED SEQUENCE OF PROJECT CONSTRUCTION

It is anticipated that the North Sacramento Streams levee improvements would be implemented in one construction season (2016). The construction season would take place from April 15 to November 1. An approximate construction sequence includes the following:

- **Mobilization:** Mobilization would include setting up construction offices and the slurry batch plant and transporting heavy earthmoving equipment to the site. These activities may take up to 1 month.
- **Vegetation and encroachment removal:** Trees and other encroachments that impact remedial measures would be removed consistent with established SAFCA policies regarding vegetation and encroachments. These activities may take 1–4 weeks depending upon the reach being remediated.
- **Levee degradation for cutoff wall installation:** Beginning of levee degradation would follow vegetation and encroachment removal and precede cutoff wall installation. Degradation would take a total of about 4 months but it would not likely be conducted in one simultaneous operation. Rather, levee reaches would be degraded for specific lengths of cutoff wall to minimize the total length of degraded levee at any one time. Construction would take approximately 3 months.
- **Cutoff wall installation:** This activity would begin with construction of the work pad once a sufficient length of levee was degraded and was available for construction. Assuming four headings, construction would take approximately 4 months.
- **Drainage blanket construction:** Drainage blanket would be constructed prior to placing overlying slope reconstruction fill. Portions of drainage blanket extending up levee cut slopes would be placed as the adjacent slope reconstruction material is placed. Construction would take approximately 1 month since such construction is a small part of the proposed project.
- **Toe cutoff wall erosion protection:** Toe cutoff wall rip rap erosion protection would be placed after the toe cutoff wall bench has been completed to final lines and grades. Construction would take approximately 2 months.
- **Utility relocation:** Any required utility relocation would be conducted concurrent with the levee degradation, toe cutoff wall bench construction, and reconstruction operations. Construction would take approximately 4 months.
- **Levee reconstruction:** Levee reconstruction would begin once there was sufficient length completed cutoff wall to efficiently begin reconstructing the levee embankment. Total time estimated for levee reconstruction is about 6 months.
- **Seepage Wells:** Seepage wells can be installed at any time during the construction season. Installation and development of relief wells and reconstruction of paved channel and basin inverts would likely take about 2 month.

- **Site restoration and demobilization:** Upon completion of the main construction activities, the levee patrol road would be resurfaced, disturbed areas would be revegetated, staging and borrow areas would be restored, and the contractor would demobilize the site(s). These activities are expected to take about 2 months.

Construction would be staged and sequenced with the appropriate stakeholders: the City, County, Reclamation District, utility and service providers, biological resource construction work windows, and other environmental and land use/real estate constraints, to the greatest extent practical to minimize impacts and effects on the community.

4.3.2 HIGH HAZARD LEVEE ENCROACHMENT AND VEGETATION REMOVAL

ENCROACHMENT MANAGEMENT

The National Flood Insurance Program (NFIP) standards for levee accreditation and the State's ULDC both require removal or modification of encroachments that pose an unacceptably high risk to the performance and safety of a levee either by undermining its structural integrity or by interfering with necessary inspection, operation, and maintenance activities. To address this requirement, SAFCA has identified and evaluated all of the encroachments in the NSS Levee Improvements area. Each of these encroachments has been evaluated to determine whether it constitutes an unacceptably high risk to the performance of the levee either by undermining the stability of the levee or by interfering with necessary patrolling, operation, and maintenance activities. Based on this evaluation, the encroachments have been classified as either:

- High-risk – poses a threat to levee integrity, removable prior to the levee being accredited;
- High-risk – impedes operation, maintenance, and inspection, removable within 3 years after the levee is accredited; or
- Low-risk – not identified as high hazard.

In the NSS Levee Improvements area, high-risk encroachments to be removed are limited to residential landscaping located at approximately 10 locations along the landside of the south and north levees of Arcade Creek (mainly between Marysville Boulevard and Rio Linda Boulevard) and along the Robla Creek South Levee, east of Rio Linda Boulevard.

VEGETATION MANAGEMENT

The levee accreditation element of the proposed project also includes a vegetation management component. Although the NFIP does not identify specific standards for managing vegetation on levees, ULDC provides criteria that reflect the underlying risk management objectives of the NFIP. Under these criteria, vegetation on levees must be modified or removed if it presents an unacceptable risk to the structural integrity or impedes operation and maintenance of the levee.

In the NSS Levee Improvements area, approximately 8 high-risk trees along Arcade Creek have been identified for removal. All of the trees are either nonnative (7) or snags (3). Five are located on the waterside of the levees. These trees are in addition to any trees that would be removed as a result of implementation of levee improvements in the NSS Levee Improvements area.

4.3.3 CONSERVATION STRATEGY

Implementation of the NSS Levee Improvements Project would result in impacts on sensitive biological resources such as riparian woodland, near-shore aquatic, and special-status species habitat on the NEMDC/Steelhead Creek and Arcade Creek. The measures outlined in the Conservation Strategy would avoid and reduce some of these impacts. However, even with implementation of avoidance and minimization measures and with self-mitigating projects, impacts on sensitive biological resources would require compensatory mitigation to reduce impacts to less-than-significant levels, and to comply with permit conditions. These compensatory mitigation actions and potential mitigation sites are described below. Mitigation sites would be planned, designed and constructed to avoid impacts to sensitive biological and cultural resources, and if further analysis indicates potential impacts would be unavoidable, the site would be removed from further consideration.

AVOIDANCE AND MINIMIZATION MEASURES

A key element of the Conservation Strategy is to avoid and/or minimize impacts on sensitive habitats and special-status species during implementation of the NSS Levee Improvements Project. The following general and resource-specific conservation measures will be incorporated by SAFCA during construction (which also includes demolition), operation, and maintenance.

General Conservation Measures

- **CM-1: Limit Ground Disturbance to Construction Areas and Avoid and Limit Disturbance to River and Creek Banks and Habitats when Feasible.** Ground disturbance shall be limited to construction areas, including necessary access routes and staging areas. The number of access routes, size of staging areas, and total area of the project activity shall be limited to the minimum necessary. When possible, existing access routes and points shall be used. All roads, staging areas, and other facilities shall be placed to avoid and limit disturbance to river and creek banks and habitat when feasible.

- **CM-2: Clearly Mark Project Construction Limits.** To minimize ground and vegetation disturbance during project construction, project limits shall be clearly marked, including the boundaries of designated equipment staging areas; ingress and egress corridors; stockpile areas for spoils disposal, soil, and materials; and equipment exclusion zones.

- **CM-3: Observe 20-Mile-Per-Hour Speed Limits within Construction Areas on City, Private, and Levee Roads.** Project-related vehicles shall observe a 20-mile-per-hour speed limit within construction areas, except on County roads and on State and Federal highways.

- **CM-4: Avoid Disturbing or Exceeding the Minimum Vegetation Removal Necessary.** Disturbance or removal of vegetation by machinery shall not exceed the minimum necessary to complete project construction and operations.

- **CM-5: Replant or Reseed with Native Species and Monitor and Maintain Growth to Ensure Success for Areas Requiring Vegetation Removal.** When vegetation removal is required, the disturbed areas shall be replanted or reseeded with native species and monitored and maintained to ensure the revegetation effort is successful. If erosion control fabrics are used in revegetated areas, they shall be slit in appropriate locations as necessary to allow for plant root growth.

- **CM-6: Limit Rock Riprap for Erosion Protection.** The amount of rock riprap and other materials used for bank protection shall be limited to the minimum needed for erosion protection and establishment of planting benches.

- **CM-7: Destroy and Dispose of Invasive Species using Approved Protocols and Disposal Sites.** Invasive species that are removed shall be destroyed using approved protocols and disposed of in an appropriate disposal area out of the stream channel.

- **CM-8: Use All Pesticides in Accordance with Laws and Regulations.** All pesticides/herbicides (pesticides) used to control nonnative vegetation shall be used in accordance with label directions. Methods and materials used for herbicide application shall be in accordance with DWR's most current guidelines on herbicide use and with laws and regulations administered by the California Department of Pesticide Regulation.

- **CM-9: Store All Construction Materials at Designated Construction Staging Areas.** Construction materials such as portable equipment, vehicles, and supplies, including chemicals, shall be stored at designated construction staging areas.

- **CM-10: Prepare and Implement a Storm Water Pollution Prevention Plan.** A SWPPP that identifies specific best management practices to avoid and minimize impacts on water quality during construction activities shall be prepared and implemented.

- **CM-11: Install, Monitor, and Maintain Erosion Control Measures that Minimize Soil or Sediment from Entering Waterways or Wetlands.** Erosion control measures that minimize soil or sediment from entering waterways and wetlands shall be installed, monitored for effectiveness, and maintained throughout construction operations.

- **CM-12: Use Acceptable Erosion Control Materials to Minimize Potential for Small Animals to Become Entangled.** If use of erosion control fabrics is necessary, tightly-woven fiber netting (mesh size less than 0.25-inch) or similar material shall be used to minimize potential for small animals to become entangled. Coconut coir matting is an acceptable erosion control material, but no plastic mono-filament matting shall be used. The edge of the material shall be buried in the ground to prevent animals from crawling underneath the material.

- **CM-13: Avoid Use of Materials in Locations Where it can Erode from Normal or Expected High Flows.** No material shall be placed in a manner or location where it can be eroded by normal or expected high flows. Jute netting or another non-monofilament erosion control fabric shall be used to cover soil that is placed over or mixed into riprap or other revetment materials.

- **CM-14: Implement Precautionary Measures to Minimize Turbidity/Siltation during Construction.** Precautions to minimize turbidity/siltation shall be implemented during construction. This may require placing barriers (e.g., silt curtains) to prevent silt and/or other deleterious materials from entering downstream reaches.

- **CM-15: Inspect Sediment and Turbidity Control Barriers Daily during Construction for Proper Function and Replace Immediately if Not Functioning Effectively.** Performance of sediment and turbidity control barriers shall be inspected at least once each day during construction to check that they are functioning properly. Should a control barrier not function effectively, it shall be immediately repaired or replaced. Additional controls shall be installed as necessary.

- **CM-16: Remove Sediment from Sediment Controls and Dispose of Properly.** Sediment shall be removed from sediment controls once the sediment has reached 1/3 of the exposed height of the control. Sediment collected in these devices shall be disposed of away from the collection site at designated upland disposal sites.

- **CM-17: Treat Water with Silt or Mud from Construction Activities to Prevent it from Entering Live Waterways.** Water containing mud or silt from construction activities shall be treated by filtration, or retention in a settling pond, adequate to prevent muddy water from entering live waterways.

- **CM-18: Treat All Disturbed Soils with Appropriate Erosion Control.** All disturbed soils shall undergo appropriate erosion control treatment (e.g., sterile straw mulching, seeding, planting) prior to the end of the construction season, or prior to November 1, whichever comes first.

- **CM-19: Dispose of All Construction Materials at an Approved Disposal Site.** All debris, sediment, rubbish, vegetation, or other material removed from the construction areas shall be disposed of at an approved disposal site.

- **CM-20: Dispose Daily all Construction-related Materials and Equipment that Cannot be Secured at an Appropriate Disposal/Storage Site.** All litter, debris, unused materials, equipment, and supplies that cannot reasonably be secured shall be removed daily from the project work area and deposited at an appropriate disposal or storage site.

- **CM-21: Remove Immediately All Construction-Related Pads/Debris from Work Sites Upon Completion.** All work pads and construction debris shall be removed from work sites immediately when work is completed at each site.

- **CM-22: Use Safer Alternative Products to Protect Streams and Other Waters.** Every reasonable precaution shall be exercised to protect streams and other waters from pollution with fuels, oils, and other harmful materials. Safer alternative products (such as biodegradable hydraulic fluids) shall be used where feasible.

- **CM-23: Prevent Any Contaminated Construction By-Products from Entering Flowing Waters; Collect and Transport Such By-Products to An Authorized Disposal Area.** Petroleum products, chemicals, fresh cement, and construction by-products containing, or water contaminated by, any such materials shall not be allowed to enter flowing waters and shall be collected and transported to an authorized upland disposal area.

- **CM-24: Prevent Hazardous Petroleum or Other Hazardous Substances to Aquatic Life from Contaminating the Soil or Entering Waters of the State or U.S.** Gas, oil, other petroleum products, or any other substances that could be hazardous to aquatic life and resulting from project-related activities, shall be prevented from contaminating the soil and/or entering waters of the State and/or waters of the U.S.

- **CM-25: Prepare and Implement a Spill Prevention and Control Plan.** A written spill prevention and control plan (SPCP) shall be prepared and implemented. The SPCP and all material necessary for its implementation shall be accessible on-site prior to initiation of project construction and throughout the construction period. The SPCP shall include a plan for the emergency cleanup of any spills of fuel or other material. Employees/construction workers shall be provided the necessary information from the SPCP to prevent or reduce the discharge of pollutants from construction activities to waters and to use the appropriate measures should a spill occur. In the event of a spill, work shall stop immediately and the California Department of Fish and Wildlife (CDFW), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Central Valley Regional Water Quality Control Board (RWQCB), and USACE shall be notified within 24 hours.

- **CM-26: Properly Maintain All Construction Vehicles and Equipment and Inspect Daily for Leaks; Remove and Repair Equipment/Vehicles with Leaks.** Construction vehicles and equipment shall be properly maintained to prevent contamination of soil or water from external grease and oil or from leaking hydraulic fluid, fuel, oil, and grease. Vehicles and equipment shall be checked daily for leaks. If leaks are found, the equipment shall be removed from the site and shall not be used until the leaks are repaired.

- **CM-27: Refuel and Service Equipment at Designated Refueling and Staging Areas.** Equipment shall be refueled and serviced at designated refueling and staging sites located on the crown or landside of the levee and at least 50 feet from active stream channels or other water bodies. All refueling, maintenance, and staging of equipment and vehicles shall be conducted in a location where a spill shall not drain directly toward aquatic habitat. Appropriate containment materials shall be installed to collect any discharge, and adequate materials for spill cleanup shall be maintained on-site throughout the construction period.

- **CM-28: Store Heavy Equipment, Vehicles, and Supplies at Designated Staging Areas.** All heavy equipment, vehicles, and supplies shall be stored at the designated staging areas at the end of each work period.

- **CM-29: Install an Impermeable Membrane Between the Ground and Any Hazardous Material in Construction Storage Areas.** Storage areas for construction material that contains hazardous or potentially toxic materials shall have an impermeable membrane between the ground and the hazardous material and shall be bermed as necessary to prevent the discharge of pollutants to groundwater and runoff water.

- **CM-30: Use Water Trucks to Control Fugitive Dust during Construction.** Water (e.g., trucks, portable pumps with hoses) shall be used to control fugitive dust during temporary access road construction.

- **CM-31: Use Only Nontoxic Materials and Materials Placed in Any Waters with No Coatings or Treatments Deleterious to Aquatic Organisms.** All materials placed in streams, rivers, or other waters shall be nontoxic and shall not contain coatings or treatments or consist of substances deleterious to aquatic organisms that may leach into the surrounding environment in amounts harmful to aquatic organisms.

- **CM-32: Clean Construction Vehicles and Equipment Used Within the Stream Channel Before Arrival at the Project Construction Areas, and Inspect Vehicles/Equipment to Ensure They Are Free of Soil, Debris, and Nonnative Aquatic Species.** Construction vehicles and equipment operated within the channel margins (high water line) shall be cleaned of mud and other debris with a scrub brush and dry, or pressure-washed with hot (>140°F) water, before arrival at the project construction areas and prior to transporting the equipment to another stream or watershed. All equipment operated within the channel margins shall be carefully inspected for signs of aquatic invasive species (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=4958&inline), including mussels and plant materials, with special attention paid to shaded, sheltered, and protected areas which might contain standing water and areas that form ‘edges’ or ‘right angles,’ such as tracks, feet, and/or tires. If vehicles or equipment are found to be contaminated with non-native invasive species, vehicles and equipment shall be stored in a dry location for at least one week prior to transport to a different stream or watershed, or alternatively, will be pressure-washed with hot (>140°F) water after each use. All water shall be drained from watercraft, including motor cooling system and bilge, and allow to dry as thoroughly as possible prior to entering a new stream or watershed. Large vessels and barges transported via the stream channel shall be contracted from nearby locations or shall undergo similar hull-cleaning prior to use for the project. Watercraft transported from distant areas, including barges, shall not release bilge water into the project area, unless screened to prohibit fish, plant, or other animal transport.

Resource-Specific Conservation Measures

Sensitive Biological Resources

- **SBR-1: Conduct Environmental Awareness Training.** A qualified biologist shall provide environmental awareness training to workers before project construction activities begin, and as needed when new personnel begin work on the project. The environmental awareness training shall inform all construction personnel about the relevant species and habitats that are known to occur in the project study area and vicinity, the need to avoid damaging these resources and causing mortality, measures to avoid and minimize impacts on the sensitive biological resources, the conditions of relevant regulatory permits, and the possible penalties for not complying with these requirements.

- **SBR-2: Erect High-Visibility Fencing to Protect Sensitive Biological Resource Areas, Inspect Fencing Daily, and Incorporate Sensitive Habitat Information into Bid Specifications.** Before the commencement of construction activities, high-visibility fencing shall be erected to protect areas of sensitive biological resources that are located adjacent to construction areas, but can be avoided, from encroachment of personnel and equipment. The fencing shall be inspected before the start of each work day and shall be removed only when the construction within a given area is completed. Sensitive habitat information shall be incorporated into project bid specifications, along with a requirement for contractors to avoid these areas.

- **SBR-3: Monitor Construction Activities in Sensitive Biological Resource Areas and Stop Work if Unauthorized Project Impacts Occur.** A qualified biologist shall monitor all construction activities in sensitive biological resource areas to ensure that avoidance and minimization measures are being properly implemented and no unauthorized activities occur. The biological monitor shall be empowered to stop construction activities that threaten to cause unanticipated and/or unauthorized project impacts. Project activity shall not resume until the conflict has been resolved.

- **SBR-4: Conduct Vegetation Removal Between September 16 and January 31 to the Extent Feasible.** Vegetation removal, particularly tree removal, shall be conducted between September 16 and January 31, to the extent feasible, to minimize potential loss of active bird nests and bat maternity roosts.

Vernal Pool Crustaceans

- **VPC-1: Provide Suitable Vernal Pool Crustacean Habitat with Protective Buffers, to the Extent Feasible, and Temporarily Fence and Designate the Buffers as Environmental Sensitive Areas.** Suitable habitat for vernal pool crustaceans shall be provided with protective buffers, to the extent feasible. The size and shape of the buffers shall depend on the local topography and potential for project activities to affect hydrology of the habitat. All buffers shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel.

- **VPC-2: Monitor All Construction Activities in Sensitive Biological Resources to Ensure that Avoidance and Minimization Measures Are Being Properly Implemented and Stop Construction Activities that Threaten Unauthorized Project Impacts.** A qualified biologist shall monitor all construction activities in sensitive biological resource areas to ensure that avoidance and minimization measures are being properly implemented and no unauthorized activities occur. The biological monitor shall be empowered to stop construction activities that threaten to cause unanticipated and/or unauthorized project impacts. Project activity shall not resume until the conflict has been resolved.

Valley Elderberry Longhorn Beetle

- **VELB-1: Temporarily Fence All Elderberry Shrubs Adjacent to Construction Areas and Designate the Area as Environmentally Sensitive.** All elderberry shrubs that are located adjacent to construction areas, but can be avoided, shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel. Fencing shall be placed at least 20 feet from the dripline of each shrub, unless otherwise approved by USFWS.

- **VELB-2: Prohibit Use of Pesticides or Chemicals within 100 Feet of Elderberry Shrubs.** No insecticides, herbicides, or other chemicals that might harm the beetle or its host plant shall be used within 100 feet of the elderberry shrubs.

- **VELB-3: Transplant Elderberry Shrubs Requiring Removal to Riparian Habitat Creation Areas, or Alternative Transplant Areas.** Elderberry shrubs that require removal shall be transplanted to the riparian habitat creation areas. If none of the areas of suitable habitat to be created as part of the proposed project would be available before the impact would occur, alternative transplant locations shall be identified. Transplant activities shall be conducted in accordance with USFWS guidelines.

Special-Status Fish

- **SSF-1: Conduct In-Water Construction Work Within In-Water Work Windows (June-October).** In-water construction activities shall be conducted within in-water work windows to avoid impacts to critical salmonid life stages (juvenile rearing, and juvenile and adult passage), typically from June through October.

- **SSF-2: Avoid SRA Habitat to the Maximum Extent Practicable and Temporarily Fence and Designate SRA Habitat as Environmentally Sensitive.** Natural woody riparian and/or SRA habitat shall be avoided to the maximum extent practicable. Habitat to be avoided shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel.

- **SSF-3: Install Screens on Any Construction-Related Water Pump Intakes Located on Waterways with Salmonids.** Screens shall be installed on any construction-related water pump intakes located on waterways with salmonids in accordance with current salmonid screening specifications of NMFS and CDFW.

Giant Garter Snake

- **GGS-1: Avoid Construction Activities within 200 Feet from the Banks of Suitable Giant Garter Snake Habitat and Confine Movement of Heavy Equipment to Existing Roadways, Where Feasible in These Areas.** To the extent possible, construction activities shall be avoided within 200 feet from the banks of suitable giant garter snake habitat. Movement of heavy equipment in these areas shall be confined to existing roadways, where feasible, to minimize habitat disturbance.

- **GGS-2: Temporarily Fence and Designate Suitable Giant Garter Snake Habitat to be Avoided as an Environmentally Sensitive Area.** Suitable giant garter snake habitat to be avoided within or adjacent to construction areas shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel.

- **GGS-3: Limit Ground Disturbance within 200 Feet of Suitable Giant Garter Snake Habitat and Conduct Activities Between May 1 and October 1, Unless Authorized by USFWS.** Unless authorized by USFWS, construction and other ground-disturbing activities within 200 feet of suitable aquatic habitat for the giant garter snake shall not commence before May 1, with initial ground disturbance expected to correspond with the snake's active season (as feasible in combination with minimizing disturbance of nesting Swainson's hawks). Initial ground disturbance shall be completed by October 1.

- **GGS-4: Ensure that Suitable Giant Garter Snake Aquatic Habitat that is Dewatered Remains Dry for 15 Consecutive Days after April 15 and if Not Possible, Potential Snake Prey is Removed.** Any suitable giant garter snake aquatic habitat that is dewatered shall remain dry for at least 15 consecutive days after April 15 and before excavating or filling of the dewatered habitat. If complete dewatering is not possible, potential snake prey (e.g., fish and tadpoles) shall be removed so that snakes and other wildlife are not attracted to the construction area.

- **GGS-5: Conduct a Preconstruction Survey within 200 Feet of Suitable Giant Garter Snake Habitat Within 24 Hours Before Commencement of Ground-Disturbing Activities.** Within 24 hours before the commencement of ground-disturbing activities, areas within 200 feet of suitable giant garter snake habitat shall be surveyed for giant garter snakes by a qualified biologist. The biologist shall provide USFWS with written documentation of the monitoring efforts within 48 hours after the survey is completed. The project area shall be reinspected by a qualified biologist whenever a lapse in construction activity of 2 weeks or greater has occurred.

- **GGS-6: Allow Snakes to Leave the Construction Area on Their Own and Notify USFWS and CDFW Immediately if a Giant Garter Snake is Found On Site.** No snakes shall be harassed, harmed, or killed, and they shall be allowed to leave the construction area on their own volition. If any snake is observed retreating into an underground burrow within the project limits, a 50-foot radius nondisturbance buffer zone shall be established until a qualified biologist determines that the snake is not a giant garter snake or the snake has left the area. The biologist shall notify USFWS and CDFW immediately if a giant garter snake is found on-site, and shall submit a report, including date(s), location(s), habitat description, and any corrective measures taken to protect the snake.

- **GGS-7: Restore All Suitable Giant Garter Snake Habitat Subject to Temporary Ground Disturbance to Preproject Conditions.** After construction activities are complete, all suitable giant garter snake habitat subject to temporary ground disturbances, including storage and staging areas and temporary roads, shall be restored to preproject conditions. These areas shall be recontoured, if appropriate, and revegetated with appropriate native plant species to promote restoration of the area to preproject conditions. Appropriate methods and plant species used to revegetate such areas shall be determined on a site-specific basis in consultation with USFWS and CDFW.

- **GGS-8: Maintain and Monitor Temporarily-Disturbed Areas of Suitable Giant Garter Snake Habitat Following Completion of Construction and Restoration Activities.** Temporarily-disturbed areas of suitable giant garter snake habitat shall be maintained and monitored for 1 year following the completion of construction and restoration activities. Monitoring reports documenting restoration of these areas shall be submitted to USFWS and CDFW upon the completion of the restoration implementation and 1 year after the restoration implementation.

COMPENSATION MEASURES

To mitigate for impacts to riparian habitat caused by levee improvements along Arcade Creek, and for removal of high-hazard trees that may affect the performance and reliability of existing levees on the Arcade Creek, SAFCA has identified some locations where native riparian vegetation could be established. Planting locations were selected to increase the patch size, improve habitat connectivity, and expand age class and species diversity of woodland habitat. These improvements would enhance nesting opportunities for native bird species, and, if necessary, could provide opportunities to satisfy VELB compensation.

- **Arcade Creek Habitat Improvements:** Impacts caused by levee improvements and high-hazard tree removal along Arcade Creek would be mitigated on-site to the extent feasible by improving and expanding native wetland and riparian habitat adjacent to the low-flow channel within the reach between Rio Linda Boulevard and Marysville Boulevard, which is currently dominated by nonnative annual grasses and broadleaf weeds. Following construction, native wetland vegetation (e.g., Santa Barbara sedge, Baltic rush) would be planted along the banks of Arcade Creek, and one row of large riparian tree species (e.g., valley oak) would be planted along each bank of the low-flow channel. The tree spacing would be determined by the capacity of the floodplain to accommodate vegetation without impacting the desired flood performance. The dense, high overhead canopy of the trees as they mature would provide important shade to the low-flow channel and bank, cover for small mammals and a connected migration corridor for flying and gliding animals (both vertebrates and invertebrates). The SRA habitat along the active channel would benefit water quality by keeping temperatures lower (cooler water retains higher levels of dissolved oxygen needed to sustain native fish and aquatic invertebrates), and provide leaf drop and other organic material to support aquatic food webs. In addition, shade from streamside trees would help suppress some growth of dense red sesbania and willows in the understory, and prevent new colonization of invasive species.

- **Robla Creek Habitat Improvements:** Replacement riparian woodlands are proposed either on Robla Creek Mitigation Site A (which is also Borrow Site 3, approximately 6 acres north of Rio Linda Boulevard) or on Robla Creek Mitigation Site B (approximately 7.1 acres south of Rio Linda Boulevard). Both sites are adjacent to and west of Robla Creek, (see **Exhibit 5**). Site A is a previous borrow site and is at a lower elevation making this area better suited for wetland mitigation. Site B is connected to the Robla Creek floodplain and is the site of a future multi-use recreational trail. SAFCA would provide right-of-way for future construction of the trail.

5.0 ACTION AREA

The action area is defined here in accordance with ESA guidelines as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR] 402.02). The action area includes all areas that would be directly or indirectly affected by the components of the NSS Levee Improvements Project. Areas downstream of the NSS Levee Improvements Project area might also be indirectly affected by the flood risk management component of the project through improved water quality and flood risk management conditions. The extent of this potential effect is difficult to quantify.

For the purpose of the proposed project, project activities would occur in the following areas, which collectively comprise the action area:

- The section of NEMDC/Steelhead Creek that extends approximately 0.5-mile south from the confluence of Arcade Creek.
- The section of Arcade Creek between NEMDC/Steelhead Creek and Marysville Boulevard.
- A small section along the Robla Creek south levee, east of Rio Linda Boulevard near Dry Creek Road.
- The 3 borrow sites.
- The 4 potential staging areas.
- The one woodland mitigation site along Robla Creek.

6.0 ENVIRONMENTAL BASELINE

The NSS Levee Improvements Area includes NEMDC/Steelhead Creek and two of its tributaries: Arcade and Robla Creeks, as well as the borrow sites, potential staging areas, and tree mitigation site.

6.1 VEGETATION AND HABITAT

6.1.1 NEMDC/STEELHEAD CREEK

NEMDC/Steelhead Creek is an approximately 13.3-mile, human-made, partially leveed drainage channel that provides drainage from Sankey Road and connects streams of the American Basin (Dry, Robla, and Arcade Creeks) to the American River. The NEMDC/Steelhead Creek forms a portion of the eastern boundary of the Natomas Basin and under high flows connects to the Pleasant Grove Creek Canal which drains into the Natomas Cross Canal and carries flows to the Sacramento River. For the purpose of the proposed project, levee improvements would occur on a portion of the NEMDC/Steelhead Creek levee that extends approximately 0.5-mile south from the confluence of Arcade Creek. The East Levee Road extends along the crown of the west levee, and a levee road and railroad tracks extend along the crown of the east levee.

South of the confluence with Arcade Creek, the east and west levees of NEMDC/Steelhead Creek are dominated by wild oats grasslands, while the channel of NEMDC/Steelhead Creek is characterized by Fremont cottonwood forest, with smaller amounts of valley oak woodland, smart-weed cocklebur patches, and perennial rye grass fields.

6.1.2 ARCADE CREEK

The approximately 16.2-mile-long channel of Arcade Creek extends east-to-west from Orangevale to the American River, via NEMDC/Steelhead Creek. Levee improvements, as well as components of the Conservation Strategy, would occur on the section of Arcade Creek between NEMDC/Steelhead Creek and Marysville Boulevard, and encroachment removal and vegetation management would occur mainly in the section between Rio Linda and Marysville Boulevards.

The north and south levees are dominated by wild oats grasslands, with a paved or gravel road along the levee crowns and the landside levee toe. Developed areas along Arcade Creek include the four bridges that cross the channel; from east to west, these are: Norwood Avenue, the Sacramento Northern Bike Trail, Rio Linda Boulevard, and Marysville Boulevard. Residential developments and Gateway Park, located north of Arcade Creek and respectively east and west of Norwood Avenue, and Hagginwood Park, located north Arcade Creek east of Marysville Boulevard, include landscaped areas. Valley oak woodland is the main riparian vegetation type along Arcade Creek, but Fremont cottonwood forest occurs in small patches along the easternmost reach of Arcade Creek near NEMDC/Steelhead Creek. Hardstem bulrush marsh is found within Arcade Creek near Norwood Avenue while water primrose wetlands are predominant within the channel of Arcade Creek from approximately the confluence with NEMDC/Steelhead Creek to Norwood Avenue. East of Norwood Avenue, the creek channel becomes narrower, and dominated by a shaded canopy of valley oak woodland.

6.1.3 ROBLA CREEK

Robla Creek is a perennial stream located just south of Dry Creek, extending east-to-west from near McClellan Air Force Base to the American River (via NEMDC/Steelhead Creek). In the 1970s, a reach of Robla Creek between Dry Creek Road and the Sacramento Northern Bike Trail was relocated to facilitate the construction of a housing development and recreational lakes. This channelized section of Robla Creek was restricted to a very narrow corridor that contained low-quality habitat and did not provide adequate room for flood flows (SAFCA 2014). In 1993, SAFCA constructed a new Rio Linda Creek channel west of Dry Creek Road. A section of the Robla Creek channel west of Dry Creek Road was filled in 2002 to accommodate the Robla Creek north levee, and a new channel was built to replace it. This new creek section provides a sinuous, meandering channel with improved flood flow capabilities and increased habitat values (SAFCA 2014). The area adjacent to NEMDC/ Steelhead Creek is characterized as seasonal wetlands, while further east, the creek channel is surrounded by, invasive red sesbania, wild oats grasslands with some clusters of valley oak woodland. For the purposes of the proposed project, a limited amount of encroachment removal would occur in a small footprint along the Robla Creek south levee, east of Rio Linda Boulevard near Dry Creek Road.

6.1.4 BORROW AND STAGING AREAS

Three potential borrow sites have been identified to support levee improvements in the North Sacramento Streams Levee Improvements area. The environmental effects that would result from use of borrow materials from Borrow Site 1 were evaluated in the Phase 3 FEIS/FEIR (USACE and SAFCA 2009).

Borrow Site 2 is a narrow site dominated by yellow star thistle and nonnative grasslands, located between the NEMDC/Steelhead Creek levees (East Levee Road and Sorrento Road), immediately east of the channel. Just east of the southern portion of this borrow site is the approximately 60-acre Wolf Ranch Wildlife Sanctuary, on which SAFCA created mitigation wetland and upland habitats after using the site as a borrow source for a previous levee improvement project (SAFCA 2014).

Borrow Site 3 is located north of Robla Creek and the Robla Creek South Levee, east of Rio Linda Boulevard on a site that is comprised of ruderal fields. This site would also serve as a potential tree mitigation site for the North Sacramento Streams Levee Improvements.

Four potential staging areas have been identified to support the levee improvements in the North Sacramento Streams Levee Improvements area. As depicted in **Exhibit 4.6-1**, three of these occur adjacent to, but not within the levee improvement footprint; thus, these areas are considered additional impacts. Staging Area 1 is considered developed. Staging Areas 2 and 4 are primarily wild oats grassland with some developed. Staging Area 3 is primarily developed with some wild oats grasslands. Staging within these areas would be located to avoid the removal of sensitive vegetation and trees. Wild oats grasslands are found in the levee maintenance easements.

6.1.5 WOODLAND MITIGATION SITES

Two areas have been identified where riparian woodlands could replaced as off-site mitigation for tree removal associated with levee improvements along Arcade Creek and NEMDC/Steelhead Creek. These two sites are located north of and immediately adjacent to Robla Creek, distributed along both sides of Rio Linda Boulevard. Both sites are owned by SAFCA and are currently ruderal grassland. The approximately 6-acre Site A is also the potential Borrow Site 3. Site B is an approximately 7.1-acre area.

6.2 WILDLIFE

The NSS Levee Improvements area provides a variety of wildlife habitats associated with the various creeks that are present. The NEMDC/Steelhead Creek habitat corridor and downstream portion of the Arcade Creek corridor generally provide higher-quality wildlife habitat than the upper portions of Arcade Creek, because they are wider and support more diversity of habitat types. A variety of common wildlife species are anticipated to be resident in the North Sacramento Streams Levee Improvements area, and additional species are likely to use the channels on a seasonal or other irregular basis as movement corridors between upstream and downstream areas.

7.0 SPECIES ACCOUNTS

[Refer to the USACE GRR BA.]

8.0 EFFECTS

8.1 DIRECT AND INDIRECT EFFECTS ON SPECIES IN THE ACTION AREA

Under the ESA, direct effects are those that are caused by the project and that occur at the same time as the action (see, e.g., construction-related effects). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur (e.g., operational effects). Avoidance and minimization measures for both direct and indirect effects are presented in the "Conservation Strategy" section above.

8.1.1 VERNAL POOL INVERTEBRATES

Seasonal wetland habitat is present in annual grassland north of Robla Creek, including in the eastern portion of Borrow Site 3/Robla woodland mitigation site A. Although borrow extraction and riparian planting activities associated with levee improvements and the Conservation Strategy in the NSS Levee Improvements area would not directly affect the seasonal wetland habitat, these activities could indirectly affect potentially suitable habitat for vernal pool invertebrates in this area by altering hydrology and/or degrading water quality. These effects could result in temporary loss of individuals, but the population could persist if the habitat is restored to its prior condition.

However, implementation of the Conservation Strategy avoidance and minimization measures, and specifically VPC-1, "Provide Suitable Vernal Pool Crustacean Habitat with Protective Buffers, to the Extent Feasible, and Temporarily Fence and Designate the Buffers as Environmental Sensitive Areas," and VPC-2, "Monitor All Construction Activities in Sensitive Biological Resources to Ensure that Avoidance and Minimization Measures Are Being Properly Implemented and Stop Construction Activities that Threaten Unauthorized Project Impacts," would avoid and minimize the potential for indirect effects on suitable habitat for vernal pool invertebrates through the establishment of appropriate buffers.

8.1.2 VALLEY ELDERBERRY LONGHORN BEETLE

Blue elderberry shrubs (Sambucas mexicana), the host plant for valley elderberry longhorn beetle larvae, are sparsely scattered throughout the action area. There are no known documented occurrences of VELB in the NSS Levee Improvements Project area, but the species could use elderberry shrubs in the action area.

Elderberry shrubs were not observed along Arcade Creek or NEMDC/Steelhead Creek during field surveys and are not expected to occur at Borrow Sites 2 and 3. Encroachment removal along Robla Creek would be limited to trimming back residential landscaping from a fence line and would have no potential for adverse impact to any elderberry shrubs, if present nearby. Elderberry shrubs could be present adjacent to potential woodland mitigation sites, including along Robla Creek. However, the Conservation Strategy would focus tree mitigation efforts on open grassland areas and avoid disturbance of elderberry shrubs that may be nearby. Further, implementation of the Conservation Strategy avoidance and minimization measures, and specifically VELB-1 "Temporarily Fence All Elderberry Shrubs Adjacent to Construction Areas and Designate the Area as Environmentally Sensitive," would avoid the potential for direct and indirect effects on elderberry shrubs through the establishment of appropriate buffers. Other Conservation Strategy avoidance and minimization measures, such as VELB-2, "Prohibit Use of Pesticides or Chemicals within 100 Feet of Elderberry Shrubs,"

8.1.3 SPECIAL-STATUS FISH SPECIES [PLACEHOLDER]

8.1.4 GIANT GARTER SNAKE

Giant garter snakes have not been documented in NEMDC/Steelhead Creek or its eastside tributaries (CDFW 2014), and historical habitat conditions are thought to have limited dispersal of the species east of NEMDC/ Steelhead Creek (Halstead et al. 2014; B. Halstead, pers. comm., 2015; E. Hansen, pers. comm., 2015). Based on these factors and current habitat conditions, such as close proximity to urban development, high levels of human disturbance, scarcity of upland habitat, and riparian vegetation along the banks of most channel reaches, giant garter snakes are unlikely to occur in the eastside tributaries and the southern portion of NEMDC/Steelhead Creek. Therefore, all proposed project elements that would occur in these areas, including encroachment removal and levee improvements along Arcade Creek and levee improvements along the adjacent portion of the NEMDC/ Steelhead Creek east levee, are unlikely to directly or indirectly impact giant garter snakes or adversely affect habitat occupied by the species.

The quality of habitat for giant garter snake improves along NEDMC/Steelhead Creek north of Dry Creek, where aquatic habitat is more extensive, very little riparian vegetation is present, urban development is less extensive, and large areas of open grasslands are present landside of the levees. Giant garter snakes are known to occur in rice fields, associated canals, and managed marshes in the Natomas Basin. An occurrence was documented along Elkhorn Boulevard, approximately 0.7 mile northwest of Borrow Site 2, and the species occurs at the complex of TNBC reserves immediately west of NEMDC/Steelhead Creek, approximately 3.5 miles farther north (CDFW 2014). Based on habitat conditions and known occurrences of giant garter snake, there is potential for the species to occur, at least occasionally, in nearby portions of NEMDC/Steelhead Creek. Borrow Site 2 is located immediately east of NEMDC/Steelhead Creek and may support potentially suitable upland habitat for the species. If giant garter snakes are present during borrow activities, these activities would result in direct and indirect effects to this species.

Ground disturbing activities at Borrow Site 2, where uplands adjacent to suitable aquatic habitat would be disturbed, could result in direct displacement, injury, or death of snakes if the habitat is used for basking, hibernating, or aestivating. Indirect effects could occur if snakes are displaced from occupied habitat or disturbed by nearby construction activities. Displacement and disturbance resulting from human activity, construction noise, and equipment vibrations could affect the ability of snakes to conduct essential life history functions, such as dispersal, movement, or foraging, and could result in increased competition for food and space and vulnerability to predation. Construction activities could temporarily degrade aquatic habitat, but the overall result of implementing the Conservation Strategy would be an enhancement of habitat quality.

All project-related impacts at Borrow Site 2 would occur within one active season and, therefore, are considered temporary. Borrow Site 2 would be restored /enhanced and re-graded to a condition that exceeds the pre-project condition by lowering the land surface closer to the low flow channel elevation and through establishment of a more diverse mosaic of aquatic and wetland habitat components.

9.0 CUMULATIVE EFFECTS

[Refer to the USACE GRR BA.]

10.0 CONCLUSIONS AND DETERMINATION

In conclusion, based on the biology and ecology of the federally listed species that have the potential to occur in the NSS Levee Improvements Project area, the environmental baseline for the action area, and the effects of the proposed action and its cumulative effects, implementing the NSS Levee Improvements Project may affect and is likely to adversely affect giant garter snake and would result in no effect on listed vernal pool invertebrates, valley elderberry longhorn beetle, and Central Valley steelhead. Designated critical habitat in the action area has been designated for Central Valley steelhead; however, none would be adversely modified or destroyed.

- **Vernal pool invertebrates:** The NSS Levee Improvements Project would result in no effect on federally listed vernal pool invertebrates considered in this preliminary biological evaluation. Effects are not expected to occur because of the avoidance and minimization measures incorporated into the NSS Levee Improvements Project. The NSS Levee Improvements Project includes several measures that would avoid potential direct and indirect environmental effects during project construction. The potential indirect effects impacts of altered hydrology or degraded water quality, would be avoided and minimized through the use of best management practices (e.g., establishment and maintenance of appropriate buffers, erosion control, and revegetation).

- **Valley elderberry longhorn beetle:** The NSS Levee Improvements Project would result in no effect to VELB. Any elderberry shrubs located in the NSS Levee Improvements Project area would be avoided (see VELB-1 "Temporarily Fence All Elderberry Shrubs Adjacent to Construction Areas and Designate the Area as Environmentally Sensitive"), thereby avoiding direct effects to VELB. Additional conservation measures (VELB-2, "Prohibit Use of Pesticides or Chemicals within 100 Feet of Elderberry Shrubs.".

- **Federally listed fish species:** [Placeholder]

- **Giant garter snake:** The NSS Levee Improvements Project may affect and is likely to adversely affect giant garter snake through the implementation of activities at Borrow Site 2. Ground disturbing activities at Borrow Site 2 could result in direct displacement, injury, or death of snakes and indirect displacement of snakes. These direct and indirect effects, which could affect the ability of snakes to conduct essential life history functions, such as dispersal, movement, or foraging, would be temporary (occurring during one active season). Construction activities could temporarily degrade aquatic habitat, but the overall result of implementing the Conservation Strategy would be an enhancement of habitat quality.

11.0 ESSENTIAL FISH HABITAT ASSESSMENT

The Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 USC 1801), requires that EFH be identified and described in federal fishery management plans. Federal agencies must consult with NMFS on any activity that they fund, permit, or carry out that may adversely affect EFH. The EFH regulations require that federal agencies obligated to consult on EFH also provide NMFS with a written assessment of the effects of any action on EFH (50 CFR 600.920). NMFS is required to provide EFH conservation and enhancement recommendations to federal agencies. The statute also requires federal agencies receiving NMFS EFH conservation recommendations to provide a detailed written response to NMFS within 30 days of receipt, detailing how they intend to avoid, mitigate, or offset the impact of activity on EFH (Section 305[b][4][B]).

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

The Pacific Fishery Management Council has identified and described EFH, adverse impacts, and recommended conservation measures for salmon in Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 2003). Freshwater EFH for Pacific salmon in the Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem, as described in Myers et al. (1998), and includes the segment of the NEMDC/Steelhead Creek in the action area. Central Valley fall-/late fall–run Chinook salmon is a species managed under the *Pacific Coast Salmon Plan* that occur in the NEMDC/Steelhead Creek.

THE PROPOSED ACTION

The proposed action is described in detail in the "Description of the Proposed Action" section of this preliminary biological evaluation. The action area, environmental baseline, and species accounts, respectively, are described in the "Action Area," "Environmental Baseline," and "Species Accounts" sections of this preliminary biological evaluation.

ESSENTIAL FISH HABITAT DESIGNATION IN THE ACTION AREA [PLACEHOLDER]

EFFECTS OF THE PROPOSED ACTION [PLACEHOLDER]

PROPOSED CONSERVATION MEASURES [PLACEHOLDER]

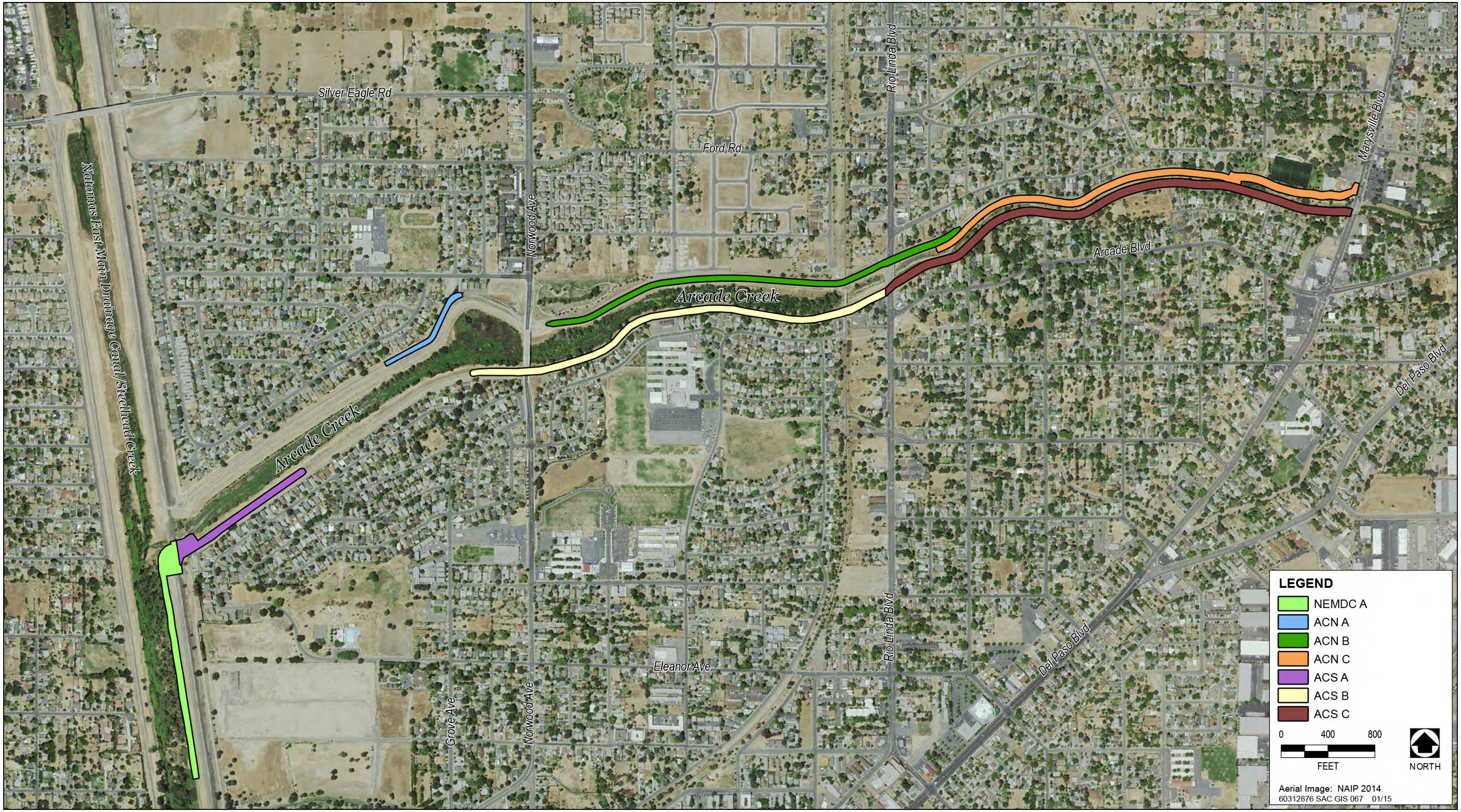
CONCLUSIONS [PLACEHOLDER]

12.0 REFERENCES

[To be provided].

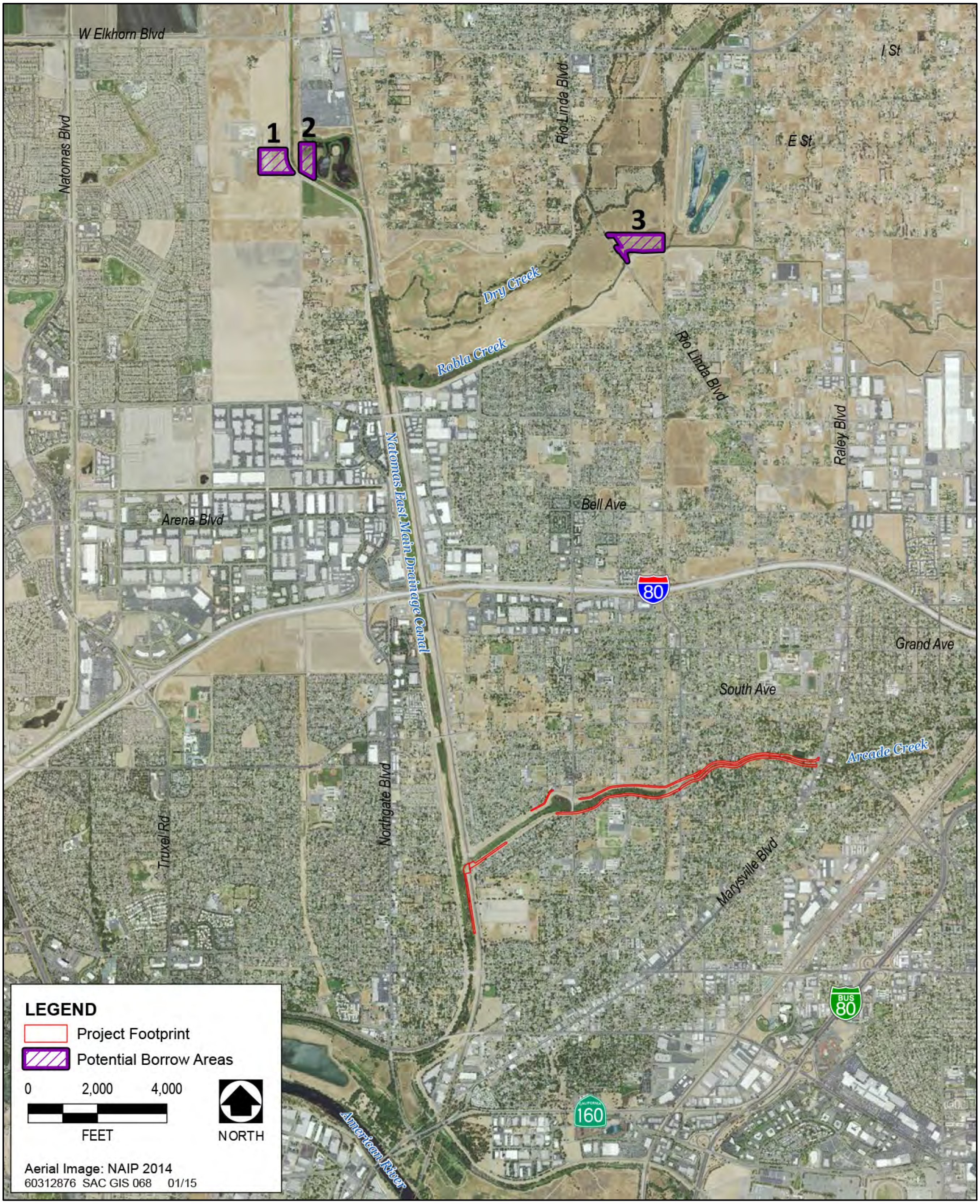
APPENDIX A

Exhibits



Source: MBK Engineers 2014, adapted by AECOM in 2014

Exhibit 1. **North Sacramento Streams Levee Improvements Area Reaches**

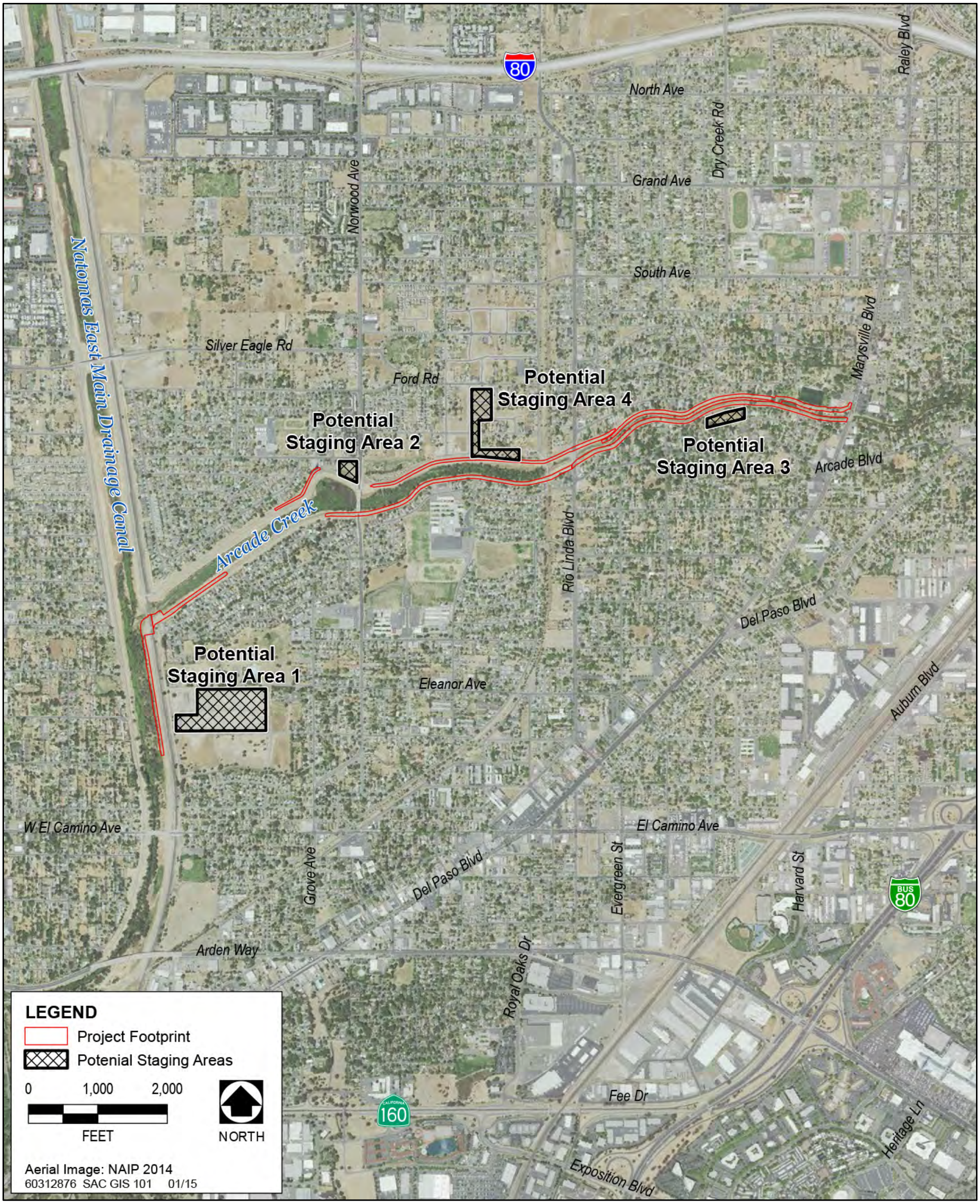


Source: SAFCA 2014, adapted by AECOM in 2014

Exhibit 2. North Sacramento Streams Borrow Areas

Source: URS Corporation 2014, adapted by AECOM in 2014

Exhibit 3. North Sacramento Streams Haul Routes



Source: URS Corporation 2014, adapted by AECOM in 2014

Exhibit 4. North Sacramento Streams Staging Areas

Source: AECOM 2014

Exhibit 5. **Potential Mitigation Sites – Robla Creek**

Appendix E

Magpie Creek Flood Control Project

Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
1-1-04-F-0132

SEP 15 2004

Mr. Mark Charlton
Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: Review of the Proposed Magpie Creek Flood Control Project, Sacramento County, California, for Inclusion with the Vernal Pool Crustaceans Programmatic Consultation (File Number 1-1-96-F-0001) and a Separate Formal Consultation for the Giant Garter Snake

Dear Mr. Charlton:

This letter responds to your March 25, 2004, letter requesting formal consultation with the U. S. Fish and Wildlife Service (Service) and concurrence to append the U. S. Army Corps of Engineers' (Corps) proposed Magpie Creek Flood Control Project (project) in Sacramento, California, to the programmatic formal consultations for the threatened giant garter snake (*Thamnophis gigas*), and the endangered vernal pool tadpole shrimp (*Lepidurus packardi*) and the threatened vernal pool fairy shrimp (*Branchinecta lynchi*) (File Numbers 1-1-F-97-149 and 1-1-96-F-1, respectively).

As explained below, we determined during our review of your request that the proposed project qualifies for inclusion under the programmatic consultation for vernal pool crustaceans only. Accordingly, a separate consultation for giant garter snake was deemed necessary and is provided in this letter. The findings in this consultation are based on information provided in your March 25, 2004, letter and attached *Draft Environmental Assessment* (DEA), dated January 2004; your *Draft Detailed Project Report/Environmental Assessment* dated January 14, 2004; a *Second Revised Draft Fish and Wildlife Coordination Act* (FWCA) *Report*, dated May 8, 2003, prepared by the Service; site visits on April 27 and May 20, 2004, with the Corps and Sacramento Area Flood Control Agency (SAFCA), the project local sponsor; electronic mail (e-mail) communications to the Service from the Corps dated May 17 and June 9, 2004, providing project description language pertaining to preservation of purchased land; and our review of earlier FWCA Reports, numerous other file documents, and meeting and site visit notes during the 1993-2004 period of Service coordination and consultation activity on this project.

CONSULTATION HISTORY

In the early 1990s, the Corps investigated flood protection needs in the Magpie Creek area, compared detention basin and channel widening (channel plan) alternatives that included the former McClellan Air Force Base (currently known as McClellan Business Park), and recommended the channel plan. The Service's biological opinion dated September 20, 1995 (File Number 1-1-95-F-30) determined that the channel plan would have direct and indirect effects on vernal pools and other wetlands that would involve significant compensation for impacts. The opinion did not address effects on giant garter snake. The Service met with the local sponsor on November 20, 1997, regarding the potential for use of habitat within the lower Dry Creek corridor for mitigation of project impacts, but did not reach agreement. In late 1999 to early 2000, the channel plan was redesigned with an upstream terminus just east of Raley Boulevard. This plan provided for reduced effects to seasonal wetlands and increased vegetation allowance (with reduced maintenance) within the widened Magpie Creek Diversion Channel (MCDC), with raising of Raley Boulevard and relocation of a portion of Don Julio Creek. On February 27, 2001, Service and Corps staff met and discussed effects of the project on floodplain development. Beginning June 2001, the project was again redesigned based on additional hydraulic analysis and preliminary alternatives developed by David Ford Consulting Engineers (Magpie Creek Floodplain Analysis, dated November 19, 2001). The selected alternative which is described in more detail below, would accomplish flood protection using modest levee and culvert improvements together with purchase of land primarily east of Raley Boulevard for the purpose of peak flood detention, and would not involve widening or other modification of the existing MCDC channel.

Recent consultation activities directly related to this proposed project are as follows:

March 26, 2004: Service received letter from the Corps (Mark Charlton) dated March 25, 2004, and draft Environmental Assessment dated January 2004, requesting appendage of the proposed project to the programmatic biological opinions for giant garter snake and vernal pool crustaceans.

April 29, 2004: Service, Corps, and SAFCA staff met in the field to review proposed project features and confirm type of disturbance associated with Robla Creek bikeway trail culvert.

May 7, 2004: Service staff (Steve Schoenberg) submitted an e-mail request to Corps staff (Ed Stewart) to clarify protective mechanism by which purchased lands would be preserved in perpetuity.

May 17, 2004: Service received an e-mail response from Corps staff (Ed Stewart), forwarding language from SAFCA (Grant Kreinberg) that it would place a flood control easement on the land in addition to purchase and would request purchased land be re-zoned as open space.

May 18, 2004: Service informed Corps by an e-mail of the need for a second site visit to verify vernal pool indirect effects near Kelly-Moore Paint Store, and assess status of vernal pools south of MCDC between Vinci Avenue and Dry Creek Road previously mapped in 1993.

May 19, 2004: Service faxed the Corps additional information on locations of vernal pool crustacean habitat which required confirmation.

May 20, 2004: Service and Corps staff met in field, concluded that pool impacts near the Kelly-Moore Paint Store were at most no greater in size than indicated in the March 25, 2004, biological assessment, and the pool areas between Vinci Avenue and Dry Creek Road were no longer present, possibly due to recent grading from an unrelated project.

May 22, 2004: Service requested via an e-mail to the Corps, clarification as to whether unrelated grading/construction activity between Vinci Avenue and Dry Creek Road would require modification of the proposed flood control project, specifically, the location of the maintenance road.

June 8, 2004: Corps (Charles Rairdan) replied via an e-mail that the Corps had contacted the developer who had conducted subject unrelated grading, and confirmed that the maintenance road element of the proposed flood control project would be constructed in the location as originally planned.

June 9, 2004: Corps (Charles Rairdan) e-mailed Service revisions to proposed project description language.

July 30, 2004: Service requested via an e-mail to the Corps to confirm areas of habitat disturbance and loss.

August 3, 2004: Corps (Ed Stewart) replied via an e-mail to the Service confirming habitat disturbance and loss areas.

PROJECT DESCRIPTION

The proposed project would be located in Sacramento County north of Interstate 80 and west of McClellan Business Park, and would provide for improved flood protection within the historic Magpie Creek floodplain between Raley Boulevard and the Natomas East Main Drainage Canal. Currently, drainage is provided by the MCDC, an existing artificial channel which spans between

Raley Boulevard and the confluence of Robla Creek with the MCDC. The MCDC includes existing sections of levees between Raley Boulevard and Vinci Avenue, and between Dry Creek Road and the Robla Creek confluence. Proposed project features include:

- raising the MCDC levee between Raley Boulevard and Vinci Avenue;
- constructing maintenance roads - for the 2,100 feet between Raley Boulevard and Vinci Avenue, the existing road on top of the levee would be reconstructed and a second new road would be built land side of the levee base; for the 2,700 feet between Vinci Avenue and Dry Creek Road, a new maintenance road would be constructed immediately adjacent to the top of slope of the MCDC;
- constructing a new 1,000-foot-long levee along the west side of Raley Boulevard between the existing MCDC crossing and Santa Ana Avenue to prevent outflanking flows (with floodgates at the entrance to the Kelly-Moore Paint Store);
- excavating a new overflow channel and installing culverts under the bike trail bridge near the Robla Creek confluence with the MCDC;
- relocating and replacing the existing slide gate outlet between the MCDC and historic Magpie Creek;
- disposing of abandoned tanks between the MCDC and Raley Boulevard, and;
- acquiring and preserving in perpetuity 79 acres (76.5 acres excluding roadways and channels) between Raley Boulevard, McClellan Business Park, and Magpie and Don Julio Creeks.

The MCDC levee raise and new Raley Boulevard levee segment are designed to detain the 250 year flood within the 79-acre area which would be acquired (hereafter termed "preservation area"). The raise would range from about five feet at Raley Boulevard and taper to existing ground a short distance south of Vinci Street. The Raley Boulevard levee would be about five feet high where it meets the MCDC levee, tapering to existing ground near Santa Ana Avenue. The bike trail culvert is sized to result in no change in peak flood stage on the MCDC upstream of Dry Creek Road. The maintenance roads allows the full length of proposed project features (both levee and channel) to be maintained. The 20-foot-wide overflow channel near the bike bridge would be above the invert of the MCDC and configured to avoid existing oak trees. The new slide gate outlet to historic Magpie Creek would retain the flexibility to release flows into the historic channel.

Construction will take one season. Two staging areas have been designated, an existing borrow storage and disposal location near Dry Creek Road and Ascot Avenue, and a section of Vinci Avenue just west of the MCDC. The bike trail culvert and overflow channel would be constructed first, and suitable material stockpiled for use in subsequent construction of the new Raley Boulevard levee or MCDC levee raise work described above. Remaining material would be obtained from the existing borrow storage area. After the levee work is completed, the maintenance roads would be built with an aggregate base. All soils exposed by grading would be revegetated by seeding and mulching.

The action area includes the MCDC and adjacent lands where levee, channel, culvert, or road construction would occur, a small area along Raley Boulevard where levee construction would occur, the preservation area, and the historic Magpie Creek floodplain. These areas are dominated by uplands, primarily herbaceous, non-native grasslands, with scattered houses and a few light industries near Raley Boulevard. Most areas are relatively undisturbed, but other areas near residences are more frequently disturbed by tilling, and ongoing activities such as grazing, storage of a variety of items, and off-road vehicle travel. Magpie and Don Julio Creeks, and the MCDC, have both wetland and primarily young woody vegetation within the channel banks. Larger and more dense woody vegetation is present around some sections of Don Julio Creek, and several mature oaks are in the vicinity of the bike trail culvert element. The preservation area as well as portions of the historic Magpie Creek floodplain have a variety of seasonal and permanent wetlands. The MCDC currently is subject to occasional maintenance of vegetation. The proposed work would occur outside of the channels and no change in channel maintenance is proposed. Approximately 0.25 acres of wetland that is potential vernal pool crustacean habitat near the MCDC would be indirectly affected by elimination of outflanking flows. About 6.1 acres of lands adjacent to the MCDC that are potential giant garter snake habitat, would be disturbed by the proposed project (upland plus the existing maintenance road), of which 1.4 acres would be a permanent conversion of upland to additional maintenance road surface.

The Corps has recommended fee title acquisition of the preservation area and SAFCA has indicated it will purchase the property in fee and also place a flood control easement on the title. The intention of these actions is to prohibit construction of any structures on the properties and to permanently prevent the properties from being developed. Although conservation areas in accordance with programmatic formal consultations are typically protected by a conservation easement, the Corps can only require a flowage easement to fulfill the proposed project's flood control purpose. However, the restrictiveness and compensation for such an easement has been determined by the Corps to be tantamount to fee title. Following purchase, SAFCA will request the City of Sacramento to change the land use and zoning designation on the property to reflect the permanent preservation of the properties as open space. SAFCA has further indicated it will develop, separate from the proposed flood control project, a habitat management plan for the properties with a view toward enhancing the habitat, such as by native tree planting adjacent to Magpie and Don Julio Creeks, and has stated its intention to coordinate such enhancement activity with appropriate regulatory agencies, which would include the Service.

Proposed Minimization and Compensation Measures: The Corps has proposed to acquire 0.5 mitigation credits from a Service-approved mitigation bank for preservation of vernal pool habitat. As it concerns measures to protect the giant garter snake, the Corps states that it will limit such construction to between May 1 and October 1, instruct personnel in awareness training by a Service-approved biologist, confine construction equipment to existing roads and levee surfaces, conduct pre-construction surveys and re-surveys between construction lapses, report any giant garter snake sitings and, upon any siting, halt construction until such time avoidance measures are developed in consultation with the Service. These are consistent with the standard avoidance and minimization measures 1-7 of the Service's *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties* (Snake Programmatic Consultation) (Appendix C, attached).

APPENDMENT TO VERNAL POOL FAIRY SHRIMP PROGRAMMATIC OPINION

With respect to listed vernal pool crustaceans, indirect effects of the proposed project could result from elimination of outflanking storm flows to pools within 250 feet of proposed project elements. Two wetlands totaling about 0.25 acre are present west of the Kelly Moore Paint Store. The Corps has proposed to acquire 0.5 mitigation credits from a Service-approved mitigation bank for preservation of vernal pool habitat to offset this impact. The proposed project will also have slight effects on flood depth and duration in the area proposed for purchase and preservation. Increasing the levee height of the MCDC levee would increase the depth of flooding of the area between Magpie and Don Julio Creeks by less than 1 foot for several hours during a 250-year flood event, and by much less (0.01-0.05 feet) during the average annual (2-year) flood event. The hydraulic changes in this area caused by the proposed project are determined by the Service to be of insufficient magnitude, frequency, and duration to cause an adverse effect to listed vernal pool crustaceans or their habitat.

The Service has determined that, based on the effects on listed vernal pool crustaceans described in your March 25, 2004, letter, it is appropriate to append the proposed Magpie Creek Flood Control Project to the Service's *Programmatic Formal Endangered Species Act Consultation on Issuance of 404 Permits for Projects with Relatively Small Effects on Listed Vernal Pool Crustaceans within the Jurisdiction of the Sacramento Field Office, California* (Vernal Pool Programmatic Consultation).

The Service is tracking losses of habitat permitted under the Vernal Pool Programmatic Consultation. We reevaluate the effectiveness of the Vernal Pool Programmatic Consultation at least every six (6) months to ensure that continued implementation will not result in unacceptable effects to the listed species.

The conservation measures identified in the Vernal Pool Programmatic Consultation include the following:

1. <u>Preservation component:</u> For every acre of habitat directly or indirectly affected, at least two vernal pool credits will be dedicated within a Service-approved ecosystem preservation bank or, based on Service evaluation of site-specific conservation values, three acres of vernal pool habitat may be preserved on the project site or another non-bank site as approved by the Service.

2. <u>Creation component:</u> For every acre of habitat directly affected, at least one vernal pool creation credit will be dedicated within a Service-approved habitat creation bank or, based on Service evaluation of site-specific conservation values, two acres of vernal pool habitat will be created and monitored on the project site or another non-bank site as approved by the Service.

3. Listed vernal pool crustacean habitat and associated uplands utilized as on-site compensation will be protected from adverse effects and managed in perpetuity or until the Corps, the applicant, and the Service agree on a process to exchange such areas for credits within a Service-approved conservation banking system. Off-site conservation at a Service-approved non-bank location will be protected and managed in perpetuity through a Service-approved conservation easement, Service-approved management plan, and a sufficient endowment fund to manage the site in perpetuity in accordance with the management plan

4. If habitat is avoided (preserved) on site, then a Service-approved biologist (monitor) will inspect any construction-related activities at the proposed project site to ensure that no unnecessary take of listed species or destruction of their habitat occurs. The biologist will have the authority to stop all activities that may result in such take or destruction until appropriate corrective measures have been completed. The biologist also will be required to immediately report any unauthorized impacts to the Service and the California Department of Fish and Game.

5. Adequate fencing will be placed and maintained around any avoided (preserved) vernal pool habitat to prevent impacts from vehicles.

6. All on-site construction personnel will receive instruction regarding the presence of listed species and the importance of avoiding impacts to these species and their habitat.

7. The applicant will ensure that activities that are inconsistent with the maintenance of the suitability of remaining habitat and associated on-site watershed are prohibited. This includes, but is not limited to: (i) alteration of existing topography or any other alteration or uses for any purposes, including the exploration for or development of mineral extraction; (ii) placement of any new structures on these parcels; (iii) dumping, burning, and/or burying of rubbish, garbage, or any other wastes or fill materials; (iv) building of any new roads or trails; (v) killing, removal, alteration, or replacement of any existing

native vegetation; (vi) placement of storm water drains; (vii) fire protection activities not required to protect existing structures at the project site; and (viii) use of pesticides or other toxic chemicals.

The proposed project will result in 0.25 acre of indirect effects to vernal pools/swales of potentially suitable vernal pool shrimp and vernal pool tadpole shrimp habitat. The applicant has identified and agreed to purchase 0.5 vernal pool preservation credits at a Service-approved conservation bank or Service-approved fund. Credits will be purchased prior to the effect on any vernal pool habitat.

The agreed upon conservation responsibilities of the applicant are as follows:

1. Prior to any earth-moving activities at the proposed project site, the applicant shall purchase at least 0.5 vernal pool preservation credits within a Service-approved ecosystem preservation bank or fund account.

SEPARATE BIOLOGICAL OPINION ON GIANT GARTER SNAKE

With respect to the giant garter snake, certain sections of Magpie and Don Julio Creeks and the MCDC contain suitable habitat for the giant garter snake. The DEA references a professional consultant's opinion that potential presence of giant garter snake cannot be discounted in these sections, and notes the connection between and proximity of the proposed project watercourses to the Natomas drainage system as well as a nearby siting of giant garter snake within McClellan Business Park at Robla Creek. Accordingly, the presence of giant garter snake in the proposed project area is assumed. Although no construction would occur in aquatic habitat, your March 25, 2004, letter which requested formal consultation incorrectly states that there would be no removal of upland habitat during channel modifications. In fact, the DEA states that construction would take place in uplands within 200 feet and/or adjacent to aquatic habitat, in the forms of: (1) 4,800 feet of a new 10-foot-wide maintenance road (and an additional one foot of shoulder on each side); and (2) approximately 200 feet of new 20-foot-wide channel excavation near the bicycle bridge in the vicinity of the Robla Creek Confluence. The total area of upland that would be adversely affected would be 6.1 acres, of which 1.4 acres of impact related to the construction of the new maintenance road would be permanent, as this road would be surfaced with aggregate stone and maintained free of vegetation (areas provided by an e-mail communication from the Corps (Ed Stewart) dated August 3, 2004). Snakes would be able to move across this surface but it would lack the vegetation of typical uplands that provide essential habitat functions. The construction of a culvert and associated channel near the bicycle bridge would be considered a temporary effect, as it would be earth-surfaced, and assumed to be lightly maintained by mowing and debris removal similar to what is currently done on the MCDC. The adjacent upland habitat at the proposed project site represents giant garter snake habitat because snakes prefer upland habitat that consists of grassy banks and openings in waterside vegetation such as occurs in the project site.

Under the Service's Snake Programmatic Consultation, "permanent impacts" are defined as those proposed project activities which result in a loss of essential habitat components, and upland habitat within a 200-foot radius is recognized within that definition of essential habitat and the determination of potential take. Regardless of whether the impact is upland or aquatic in nature, the compensation for all such permanent impact under the guidelines for the Snake Programmatic Consultation is replacement at a 3:1 ratio, with a 2:1 replacement ratio of upland to aquatic area. Applying this guidance to the subject proposed project, 1.40 acres of impact would require 4.20 acres of replacement habitat, which must meet all Terms and Conditions, guidelines, and criteria in Appendices A and C of the Snake Programmatic Consultation (attached).

We have reviewed the Corps' proposed purchase and preservation in perpetuity of 76.5 acres of upland-wetland habitat near the proposed project site. This type of preservation and purchase proposed is not in accordance with Appendix A (replacement guideline #1) and Appendix C (avoidance and minimization measure #8), and is atypical of the protective covenant description in Term and Condition 2D of the Snake Programmatic Consultation. Therefore, the Service has determined that appending this proposed project to the Snake Programmatic Consultation is not appropriate, and a separate biological opinion is required for consultation for this species and consideration of the merits of the proposed preservation area. Despite the inconsistencies with the Snake Programmatic Consultation, the 76.5 acres of habitat that would be protected as part of the proposed project description far exceed the 4.20 acres which would be required if compensation were deemed necessary.

STATUS OF THE SPECIES

The Service published a proposal to list the giant garter snake as an endangered species on December 27, 1991 (56 **FR** 67046). The Service re-evaluated the status of the snake before adopting the final rule. The snake was listed as a threatened species on October 20, 1993 (58 **FR** 54053).

Description. The giant garter snake is one of the largest garter snakes and may reach a total length of at least 64 inches. Females tend to be slightly longer and proportionately heavier than males. The weight of adult female snakes is typically 500-700 grams (1.1-1.5 pounds). Dorsal background coloration varies from brownish to olive with a checkered pattern of black spots, separated by a yellow dorsal stripe and two light-colored lateral stripes. Background coloration and prominence of a black-checkered pattern and the three yellow stripes are geographically and individually variable (Hansen 1980). The ventral surface is cream to olive or brown and sometimes infused with orange, especially in northern populations.

Historical and Current Range. This species formerly occurred throughout the wetlands that were extensive and widely distributed in the Central Valley. Fitch (1941) described the historical range of the snake as extending from the vicinity of Sacramento and Contra Costa Counties southward to Buena Vista Lake, near Bakersfield, in Kern County. Prior to 1970, the snake was recorded historically from 17 localities (Hansen and Brode 1980). Five of these localities were clustered in and around Los Banos, Merced County. The paucity of information makes it difficult to determine precisely the species' former range. Nonetheless, these records coincide with the historical distribution of large flood basins, fresh water marshes, and tributary streams. Destruction of wetlands for agriculture and other purposes apparently extirpated the species from the southern one-third of its range by the 1940s -1950s, including the former Buena Vista Lake and Kern Lake in Kern County, and the historic Tulare Lake and other wetlands in Kings and Tulare Counties (Hansen and Brode 1980, Hansen 1980).

Surveys over the last two decades have found the snake as far north as the Butte Basin in the Sacramento Valley. As recently as the 1970s, the range of the snake extended from near Burrell, Fresno County (Hansen and Brode 1980), northward to the vicinity of Chico, Butte County (Rossman and Stewart 1987). California Department of Fish and Game (CDFG) studies (Hansen 1988) indicate that snake populations currently are distributed in portions of the rice production zones of Sacramento, Sutter, Butte, Colusa, and Glenn Counties; along the western border of the Yolo Bypass in Yolo County; and along the eastern fringes of the Sacramento-San Joaquin River Delta from the Laguna Creek-Elk Grove region of central Sacramento County southward to the Stockton area of San Joaquin County.

Essential Habitat Components. Endemic to wetlands in the Sacramento and San Joaquin valleys, the snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals and rice fields, and the adjacent uplands. The snake feeds on small fishes, tadpoles, and frogs (Fitch 1941, Hansen 1980, Hansen 1988). Essential habitat components consist of: (1) wetlands with adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; (3) upland habitat with grassy banks and openings in waterside vegetation for basking; and (4) higher elevation uplands for escape cover (vegetation, burrows) and underground refugia (crevices and small mammal burrows) (Hansen 1980).

Reproductive Ecology. The breeding season extends through March and April, and females give birth to live young from late July through early September (Hansen and Hansen 1990). Brood size is variable, ranging from 10 to 46 young, with a mean of 23 individuals (Hansen and Hansen 1990). At birth young average about 20.6 cm snout-vent length and 3-5 grams. Young immediately scatter into dense cover and absorb their yolk sacs, after which they begin feeding on their own. Although growth rates are variable, young typically more than double in size by one year of age, and sexual maturity averages three years in males and five years for females (58 **FR** 54053).

Movements and Habitat Use. The giant garter snake typically inhabits small mammal burrows and other soil crevices throughout its winter dormancy period (November to mid-March). Although these areas are generally thought to be above prevailing flood elevations, snakes may not always utilize high ground during their winter dormancy period. The Biological Resources Division (BRD) has documented giant garter snakes at the Colusa National Wildlife Refuge overwintering in areas with few high ground retreat sites (Wylie *et al.* 1997). Snakes in another study population at Gilsizer Slough overwintered in a low elevation wetland area, even though higher ground was present nearby. Both of these populations survived flooding and were not displaced from the area. The snake also uses burrows as refuge from extreme heat during their active period. While the snakes usually remain in close proximity to wetland habitats, the BRD has documented snakes using burrows as much as 165 feet away from the marsh edge to escape extreme heat (Wylie *et al.* 1997). Overwintering snakes have been documented to use burrows as far as 820 feet from the edge of marsh habitat. Snakes typically select south- and west-facing burrows as hibernacula (58 **FR** 54053).

In studies of marked snakes in the Natomas Basin, snakes moved about 0.25 to 0.5 mile per day (Brode and Hansen 1992). However, total activity varies widely between individuals, and individual snakes have been documented moving up to 5 miles over the period of a few days in response to dewatering of habitat (Wylie *et al.* 1997). In agricultural areas, snakes were documented using rice fields in 19-20 percent of the observations, marsh habitat in 20-23 percent of observations, and canal and agricultural waterway habitats in 50-56 percent of the observations (Wylie 1999). Telemetry studies have also shown that active snakes use uplands extensively–more than 31 percent of observations were in uplands (Wylie 1999). Almost all snakes observed in uplands during the active season were near vegetative cover, where cover exceeded 50 percent in the area within 1.6 feet of the snake; less than 1 percent of observations were of snakes in uplands with less than 50 percent cover nearby (Wylie 1999).

Reasons for Decline and Threats to Survival. The current distribution and abundance of the snake is much reduced from former times. Loss of habitat due to agricultural activities and flood control have extirpated the snake from the southern one third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lakebeds. These lakebeds once supported vast expanses of ideal snake habitat, consisting of cattail and bulrush dominated marshes. Vast expanses of bulrush and cattail floodplain habitat also typified much of the Sacramento Valley historically (Hinds 1952). Prior to reclamation activities beginning in the mid to late 1800s, about 60 percent of the Sacramento Valley was subject to seasonal overflow flooding in broad, shallow flood basins that provided expansive areas of snake habitat (Hinds 1952). Valley floor wetlands are subject to the cumulative effects of upstream watershed modifications, water storage and diversion projects, as well as urban and agricultural development; all natural habitats have been lost and an unquantifiable but small percentage of semi-natural wetlands remain extant. Only a small percentage of extant wetlands currently provide habitat suitable for the snake.

Ongoing maintenance of aquatic habitats for flood control and agricultural purposes eliminate or prevent the establishment of habitat characteristics required by snakes and can fragment and isolate available habitat, prevent dispersal of snakes among habitat units, and adversely affect the availability of the garter snake's food items (Hansen 1988, Brode and Hansen 1992). In many areas, the restriction of suitable habitat to water canals bordered by roadways and levee tops renders snakes vulnerable to vehicular mortality. Fluctuation in rice and agricultural production affects stability and availability of habitat. Recreational activities, such as fishing, may disturb snakes and disrupt basking and foraging activities. Nonnative predators, including introduced predatory gamefish, bullfrogs (*Rana catesbiana*), and domestic cats also threaten snake populations. While large areas of seemingly suitable snake habitat exist in the form of duck clubs and waterfowl management areas, water management of these areas typically does not provide the summer water needed by snakes. Although snakes on national wildlife refuges are relatively protected from many of the threats to the species, degraded water quality continues to be a threat to the species both on and off refuges. A number of land use practices and other human activities currently threaten the survival of the snake throughout the remainder of its range. Although some snake populations have persisted at low levels in artificial wetlands associated with agricultural and flood control activities, many of these altered wetlands are now threatened with urban development. Rapidly expanding cities within the current range of the snake include Chico, Yuba City, Sacramento, Galt, Stockton, Gustine, and Los Banos.

Status with Respect to Recovery. Currently, the Service recognizes 13 separate populations of the snake, with each population representing a cluster of discrete locality records (USFWS 1993). The 13 extant population clusters largely coincide with historical riverine flood basins and tributary streams throughout the Central Valley (Hansen 1980; Brode and Hansen 1992): (1) Butte Basin, (2) Colusa Basin, (3) Sutter Basin, (4) American Basin, (5) Yolo Basin-Willow Slough, (6) Yolo Basin-Liberty Farms, (7) Sacramento Basin, (8) Badger Creek-Willow Creek, (9) Caldoni Marsh, (10) East Stockton-Diverting Canal and Duck Creek, (11) North and South Grasslands, (12) Mendota, and (13) Burrell-Lanare. These populations span the Central Valley from just southwest of Fresno (Burrell-Lanare) north to Chico (Hamilton Slough).

The draft recovery plan for the snake subdivided its historic range into four recovery units (Service 1999). These are: (1) the Sacramento Valley unit, extending from the vicinity of Red Bluff south to the confluence of the Sacramento and Feather Rivers; (2) the Mid-Valley unit, extending from the American and Yolo Basins south to Duck Creek near the City of Stockton; (3) the San Joaquin Valley unit, extending south from Duck Creek to the Kings River; and (4) the South Valley unit, extending south of the Kings River to the Kern River Basin. Portions of the Mid-Valley recovery unit are within the action area.

The Sacramento Valley Recovery Unit at the northern end of the species' range is known to support relatively large, stable populations of the snake. This unit contains three populations (Butte Basin, Colusa Basin, and Sutter Basin) and a large amount of suitable habitat, in protected areas on state refuges and refuges of the Sacramento NWR Complex in the Colusa and Sutter Basins, and along waterways associated with rice farming (Service 1999). While populations within this unit have some protection on refuge and other public lands within National Wildlife Refuges, snakes are subjec to flooding and mortality from predatory fish and birds, vehicular traffic agricultural practices, aand maitenance of water channels. The populations within this unit are widely distributed and mostly restricted to unnatural agricultural water delivery and drainage facilities associated with rice fields, and habitat corridors connecting populations and subpopulations are not present and/or protected.

The Mid-Valley Recovery Unit, directly to the south of the Sacramento Valley Recovery Unit, includes seven populations: American Basin, Yolo Basin–Willow Slough, Yolo Basin–Liberty Farms, Sacramento Area, Badger Creek/Willow Creek, Caldoni Marsh, and East Stockton. The status of the seven snake populations in the Mid-Valley Recovery Unit is very uncertain. The East Stockton population may be extirpated, and is not considered recoverable as a result of urban encroachment into habitat (Service 1999). Five of the remaining six populations within the recovery unit are very small, highly fragmented and isolated, and, except for the Badger Creek/Willow Slough population, are also threatened by urbanization. This latter population is within a small isolated area. Within the Mid-Valley unit, only the American Basin population supports a sizeable snake population which is dependent largely upon rice lands. The American Basin population, although threatened by urban development, will receive protection from the approved Metro Air Park Habitat Conservation Plan (HCP) and Natomas Basin HCP (NBHCP), which share a regional strategy to maintain a viable snake population in the basin.

The remaining two recovery units are located to the south in the San Joaquin Valley, where the best available data indicate that the snake's status is precarious. The San Joaquin Valley Recovery Unit contains three historic snake populations: North and South Grasslands; Mendota Area; and Burrell/Lanare Area (Service 1999). This recovery unit formerly supported large snake populations, but numbers have declined severely in recent decades, and recent survey efforts indicate numbers are very low compared to Sacramento Valley populations.

No surviving snake populations are known from the fourth recovery unit, the South Valley Recovery Unit, at the southern end of the snake's historic range; this unit includes only extirpated populations, including the historic but lost Tulare and Buena Visa lakes.

Current Research Related to Recovery Efforts. Since April of 1995, the BRD has further documented occurrences of snakes within some of the known populations. The BRD has studied snake subpopulations at the Sacramento and Colusa NWRs within the Colusa Basin, at Gilsizer Slough within the Sutter Basin, the Badger Creek area of the Cosumnes River Preserve within the Badger Creek-Willow Creek area, and the Natomas area within the American Basin (Wylie *et al.* 1997, Wylie 1999). These subpopulations represent the largest known extant subpopulations. With the exception of the American Basin, these subpopulations are largely protected from many of the threats to the species. Outside of these protected areas, snakes in these populations are still subject to all the threats identified in the final listing rule. The remaining nine populations identified in the final rule are distributed discontinuously in small isolated patches and are vulnerable to extirpation by stochastic environmental, demographic, and genetic processes. The 13 extant populations are largely isolated from each other, with any dispersal corridors between them limited and not protected. When small populations are extirpated, the recolonization is unlikely in most cases, given the isolation from larger populations and the lack of dispersal corridors between them.

ENVIRONMENTAL BASELINE

The action area for the proposed project is included in the American Basin snake population. The American Basin population is within the Mid-Valley Recovery Unit (Service 1999). A description of the recovery unit along with the status of the population is outlined below.

The Mid-Valley Recovery Unit includes seven giant garter snake populations: American Basin, Yolo Basin–Willow Slough, Yolo Basin–Liberty Farms, Sacramento Area, Badger Creek/Willow Creek, Caldoni Marsh, and East Stockton. The status of the seven snake populations in the Mid-Valley Recovery Unit is very uncertain. The East Stockton population may be extirpated, and is not considered recoverable as a result of urban encroachment into habitat (Service 1999). Five of the remaining six populations within the recovery unit are very small, highly fragmented and isolated, and, except for the Badger Creek/Willow Slough population, are also threatened by urbanization. This latter population is within a small isolated area. Within the Mid-Valley unit, only the American Basin population supports a sizeable snake population which is dependent largely upon rice lands. The American Basin population, although threatened by urban development, receives some protection on lands managed by the Natomas Basin Conservancy, which has a goal of maintaining a viable snake population in the basin.

The American Basin has one of the largest and better protected snake poulations, but the unit is subject to the effects of a number of projects. Many development projects have been constructed in or near snake habitat in this rapidly urbanizing area, and snakes are subject to secondary effects of urbanization such as predation by house cats and increased vehicular mortality. Most documented localities have also been adversely impacted by freeway construction, flood control projects, and commercial development. Several former localities are known to have been lost or depleted to the extent that continued viability is in question (Brode and Hansen 1992). The scarcity of remaining suitable habitat, flooding, stochastic processes, and continued threats of habitat loss pose a severe threat to this population.

<u>Factors Affecting the Snake within the Action Area</u>. A number of State, local, private, and unrelated Federal actions have occurred within the action area and adjacent region affecting the environmental baseline of the species. Some of these projects have been subject to prior section 7 consultation. These actions have resulted in both direct and indirect impacts to snake habitat within the region. In addition to projects already discussed, projects affecting the environment in the action area include communication projects (e.g., installation of cable systems) and transportation projects with Federal, county or local involvement. The Corps has consulted the Service on the issuance of wetland fill permits for several bridge replacement projects within the Sacramento Basin that affected snake habitats. The direct effect of these projects is often small and localized, but transportation projects which improve access can indirectly affect snakes by facilitating development of habitat, and by increasing traffic mortality, and these effects are not quantifiable.

Ongoing agricultural activities also affect the environmental baseline for the snake, and are largely not subject to section 7 consultation. Some agriculture, such as rice farming, can provide valuable seasonal foraging and upland habitat for the snake. Although rice fields and agricultural waterways can provide habitat for the snake, agricultural activities such as waterway maintenance, weed abatement, rodent control, and discharge of contaminants into wetlands and waterways can degrade snake habitat and increase the risk of snake mortality (Service 1999). Ongoing maintenance of agricultural waterways can also eliminate or prevent establishment of snake habitat, eliminate food resources for the snake, and can fragment existing habitat and prevent dispersal of snakes (Service 1999). Flood control and maintenance activities which can result in snake mortality and degradation of habitat include levee construction, stream channelization, and the riprapping of streams and canals (Service 1999).

Several flood control programs administered by the Corps are completed or ongoing within the action area. Large completed projects include the Sacramento River Flood Control Project, which constructed and/or improved levees and other flood control features which make up the Federal Sacramento River Flood Control System; this system includes the levee which would receive bank protection under the Corps' proposed action. Subsequent to the 1986 flood events, the Corps initiated the ongoing Sacramento River Flood Control System Evaluation (SRFCSE) to examine the existing flood control system and to develop remedial repair plans to restore the designed level of protection. The Natomas Area Flood Control Project allowed urban development in the Natomas Basin to move forward. The American River Watershed Investigation administered by the Corps will affect snakes in the Natomas and American Basins. A separate recent flood control action in the immediate vicinity of the proposed project area in this consultation is the Lower Dry Creek and Robla Creek Levee Improvement Project (Public Notice 200000541; Service File Number 1-1-01-F-01340), conducted by SAFCA under permit from the Corps. That work involved reconfiguring a section of Robla Creek, and included grading and planting to enhance habitat for the giant garter snake. Other on-going or planned activities include levee raising along the Natomas Cross Canal, modification of the NEMDC Levee, and relocation of canals and stability berms along the various levees. Although the Corps has consulted on previous projects and is expected to continue to do so on future projects, the ongoing nature of these activities and the administration under various programs makes it difficult to determine the continuing and accumulative impacts of these activities.

The Snake in the Proposed Project Area. Numerous California Natural Diversity Database (CNDDB) (CDFG 2001) locality records are known from the Natomas Basin portion of the American Basin and are distributed throughout most of the basin. Robla Creek, Dry Creek, and Magpie Creek all converge with the Natomas East Main Drain Canal east of the Natomas Basin. Recent research efforts by BRD to collect demographic and habitat use data during 1998 and 1999, have further documented occurrences of giant garter snakes within the Natomas Basin (Wylie and Casazza 2000, Wylie *et al.* 2000). BRD surveys have provided significant recent information on the distribution of giant garter snakes within the Basin, and supplements previous research on the snake within Natomas Basin (e.g. Brode and Hansen 1992, Hansen and Brode 1993). BRD capture data and CNDDB records indicate giant garter snakes are distributed throughout the Basin, but relative abundance varies widely across the Basin. Wylie and Cassaza (2000) concluded that habitat within the Natomas Basin has apparently degraded over time, as compared to previous accounts of habitat in the Basin. They also concluded that the quality of habitat within the Natomas Basin is less than that at other geographic locations where giant garter snakes are found. The other localities studied by BRD included more extensive areas of native or restored and/or protected habitat as compared with the Natomas Basin.

EFFECTS OF THE ACTION

The proposed work would affect giant garter snake upland habitat, adjacent to the MCDC. No snake aquatic habitat would be affected. The disturbance would be temporary and occur within the footprint of existing flood control structures, with the exception of a new maintenance road spanning between Raley Boulevard and Dry Creek Road on the outboard side of the levee or adjacent to the existing channel. The Service acknowledges that the levee raise approach obviates the need to disturb giant garter snake habitat in the MCDC, as would have been required by the channel widening approach considered in our previous biological opinion of September 20, 1995 (File Number 1-1-95-F-30). However, construction activities on upland near aquatic habitat may remove vegetative cover and basking sites used for thermoregulation and fill, or crush burrows/crevices needed for hibernation. Construction or maintenance vehicles may harm or crush snakes, or cause snakes to move to other areas at risk. The risk of take of the snake is reduced by restricted road access (i.e, gates) and limitation on road use for the purpose of channel maintenance. The area of uplands in which the maintenance road would be constructed is currently subject to infrequent disturbance by discing or mowing, and infrequent channel maintenance activity with heavy equipment. Due to the presence of uplands on the levee or uplands on the side of the MCDC opposite the maintenance road, uplands would not be entirely eliminated by the proposed action, and snakes would not be required to cross this maintenance road to access essential habitat elements due to the presence of uplands on the opposite side. Although the Service agrees that the protection measures proposed by the Corps would reduce construction-related effects, these measures do not compensate for the loss of upland in association with aquatic habitat.

Although not specifically identified as a compensation measure, the Service evaluated the potential for the preservation area - which functions as an area to detain peak flood flows - to provide for improved habitat and offset impacts to the giant garter snake not identified in the DEA. The habitat which would be acquired and preserved as part of the proposed project is in the vicinity of portions of Magpie and Don Julio Creeks both of which appear to have more consistent, perennial flow than does the MCDC, and possess essential habitat elements for giant garter snake. The preservation area is also adjacent to and serves as an upland buffer to other undeveloped habitat areas in McClellan Business Park with known vernal pool crustacean populations as well as potential suitability for giant garter snake. Due to its proximity to Raley Boulevard and Interstate 80, and current land use designation for light industry, the preservation area would otherwise be considered at a modest risk of development loss over the long- term. However, due to its lower topography and position between two creeks, portions would require either extensive pad construction or additional, upstream flood control measures to avoid flood damage. The acquisition and preservation as provided in the project description allow for future opportunity for habitat enhancement actions as discussed in the Service's December 2003, FWCA report, even though specific enhancements are not proposed as part of the flood control project.

The Service also considered whether the proposed flood control project could have an indirect effect in terms of affecting the rate of development and consequential loss of habitat within the floodplain along portions of historic Magpie Creek that may support giant garter snake or other listed species. In evaluating this influence, we note the floodplain is currently designated FEMA Zone X, a classification which does not require flood insurance for loans, but which may still experience damage during some flood conditions. If the proposed project were not built, earth pads could still be feasibly constructed for individual development actions within the floodplain to reduce flood damage risk to the desired level. Thus, development within the floodplain could occur with or without the project, but at a potentially faster rate (and lower cost) with the project. Loss of habitat due to development near the historic Magpie Creek channel may be limited due to provisions of the *North Sacramento Community Plan Amendment: Magpie Creek Goals and Policies* (approved by City Council July 27, 1993) to establish and enhance a creek right of way, but this policy could be modified over the long-term and would not apply to wetlands outside the right-of-way provision. The largest component of seasonal wetlands is outside the right of way near Sunset Lawn Cemetary, and is currently zoned as agriculture. As reviewed in our May 2003 FWCA report, several recent development actions have already occurred in the floodplain in the absence of the flood control project and, to our knowledge, nearly all have been properly considered and compensated under the Service's Programmatic Consultations. Taken together, the flood zoning, protective local policies, and history of permit actions indicate that the effect of the project in terms of accelerated development is modest if at all, and that any related loss of habitat would likely be detected and compensated under the Corps' 404 permit administration.

We note, however, that this same risk of harm to habitat from development is substantially eliminated from the 76.5 acres of habitat in the preservation area. This preservation area includes a mosaic of two creeks, seasonal and permanent wetland types, and associated upland, and includes numerous vernal pools of which four occurrences of the listed vernal pool fairy shrimp have been documented. It is also adjacent to similar habitat within McClellan Business Park. In the Service's opinion, the preservation element of the proposed project offsets the particular net effect of inducing development growth in the floodplain, and the modest loss of upland near the MCDC. The Service expressly limits this finding to any growth-inducing effect of the flood control project only - not the actual loss of habitat or indirect effect near habitat due to future development action(s). Accordingly, consultation is required for any subsequent action, separate from the proposed project, involving take of a listed species in the historic Magpie Creek floodplain.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed project are not considered in this section because they require separate consultation pursuant to section 7 of the Act, and, therefore, are not considered cumulative to the proposed project.

An undetermined number of future land use conversions and routine agricultural practices that are not subject to Federal authorization or funding may alter the habitat or increase incidental take of giant garter snake, vernal pool fairy shrimp, and vernal pool tadpole shrimp and are, therefore, cumulative to the proposed project.

Cumulative effects that apply to giant garter snake include: (1) unpredictable fluctuations in aquatic habitat due to water management; (2) dredging and clearing vegetation from irrigation canals; (3) discing, mowing, ornamental cultivation, and routine grounds maintenance of upland habitat; (4) increased vehicular traffic on access roads adjacent to aquatic habitat; (5) use of burrow fumigants on levees and other potential upland refugia; (6) contaminated runoff from agriculture and urbanization; (7) predation by feral animals and pets; (8) human intrusion into habitat; (9) diversion of water; and (10) rip-rapping or lining of canals and stream banks.

CONCLUSION

After reviewing the current status of the giant garter snake, the environmental baseline, the effects of the proposed action, and any cumulative effects, it is the Service's biological opinion that the proposed project as described, with the proposed protection measures and habitat preservation/acquisition components, is not likely to jeopardize the continued existence of the giant garter snake. No critical habitat has been designated for this species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary for listed species in this opinion and must be implemented by the Corps so they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Federal agency (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

AMOUNT OR EXTENT OF INCIDENTAL TAKE

The Service anticipates incidental take of the snake will be difficult to detect or quantify for the following reasons: snakes are cryptically colored, secretive, and known to be sensitive to human activities. Snakes may avoid detection by retreating to burrows, soil crevices, vegetation, and other cover. Individual snakes are difficult to detect unless they are observed, undisturbed at a distance. Most close-range observations represent chance encounters that are difficult to predict. It is not possible to make an accurate estimate of the number of snakes that would be harassed, harmed, or killed during construction activities, including in staging areas, canal banks, soil burrow areas and roads carrying vehicular traffic to borrow areas. In instances where take is difficult to detect, the Service may estimate take in the form of numbers of a species per acre of habitat affected as a result of the action. The Service expects that all snakes in the 6.1 acres of upland habitat on the proposed project site may be harassed, harmed, or killed by loss and disturbance of habitat as a result of the proposed project. The proposed project may result in the death of one snake.

The Service authorizes the following forms of incidental take:

1. The number of giant garter snakes found in 4.7 acres of upland habitat will be disturbed, harassed, harmed, or killed by project activities resulting from temporary impacts due to use of heavy equipment and earthmoving activity near aquatic habitat. No more than one snake will be killed.

2. 1.4 acres of giant garter snake habitat would be permanently lost due to construction of new maintenance road on upland near aquatic habitat.

Upon implementation of the following reasonable and prudent measures, incidental take associated with the proposed project on the snake, in the form of harm, harassment, or death from habitat loss or direct mortality will become exempt from the prohibitions described under section 9 of the Endangered Species Act for direct and indirect effects.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service has determined that the anticipated take is not likely to jeopardize the giant garter snake or destroy or adversely modify its critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of giant garter snakes.

1. The potential effects of the proposed project on the giant garter snake shall be minimized.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. The terms and conditions are non-discretionary.

The following terms and conditions implement the reasonable and prudent measure:

1. Best Management Practices (BMPs) shall be implemented to prevent sediment from entering areas containing giant garter snake habitat including, but not limited to, silt fencing, temporary berms, no cleaning equipment in or near snake habitat, installation of vegetative strips, and temporary sediment disposal.

2. Project-related vehicles shall observe a 20-mph speed limit within construction areas, except on County rods, and State and Federal highways; this is particularly important during periods when the giant garter snake may be sunning or moving on roadways.

3. To eliminate attraction of predators of the snake, all food-related trash items such as wrappers, cans, bottles, and food scraps must be disposed of in closed containers and removed at least every other day from the entire project site.

4. Plastic monofilament netting (erosion control matting) or similar material shall not be used at the project because giant garter snakes may become entangled and trapped in it. Acceptable substitutes include conconut coir matting or takified hydroseeding.

5. After completion of construction activities, any temporary fill and construction debris shall be removed and the 4.7 acres of disturbed areas shall be restored to pre-project conditions. Project proponents will monitor the project site for one year following completion of construction and restoration of habitat. Monitoring

reports documenting the restoration effort shall be submitted to the Service upon completion of the restoration activity, and after one year. The monitoring reports shall include photo-documention when restoration was completed, what materials were used, specified plantings, and justification of any substitution to the Service-recommended guidelines (refer to Appendix A, Snake Programmatic Consultation, Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat, attached).

6. The Corps shall ensure compliance with the Reporting Requirements below.

REPORTING REQUIREMENTS

The Service-approved biologist shall notify the Service immediately if giant garter snakes are found on site, and will submit a report including date(s), location(s), habitat description, and any corrective measures taken to protect the snake(s) found. The Service-approved biologist shall submit locality information to the California Department of Fish & Game (CDFG), using completed California Native Species Field Survey Forms or their equivalent, no more than 90 calendar days after completing the last field visit of the project site. Each form shall have an accompanying scale map of the site such as a photocopy of a portion of the appropriate 7.5 minute U.S. Geological Survey map and shall provide at least the following information: township, range, and quarter section; name of the 7.5' or 15' quadrangle; dates (day, month, year) of field work; number of individuals and life stage (where appropriate) encountered; and a description of the habitat by community-vegetation type.

A post-construction compliance report prepared by the Service-approved monitoring biologist shall be forwarded to the Chief, Endangered Species Division, at the Sacramento Fish and Wildlife Office within 60 calendar days of the completion of the project. This report shall detail: (i) dates that construction occurred; (ii) pertinent information concerning the applicant's success in meeting project mitigation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on federally listed species, if any; (v) occurrences of incidental take of federally listed species, if any; and (vi) other pertinent information.

The Corps shall also monitor specific execution of the proposed measures for protection in perpetuity of the preservation area provided in the project description, and obtain and submit documentation of property purchase, placement of flood easement, request of zoning change, and the decision pertaining to that request, to the Chief, Endangered Species Division, at the Sacramento Fish and Wildlife Office within 60 calendar days of the completion of the project.

The Sacramento Fish and Wildlife Office is to be notified within three working days of the finding of any dead listed species or any unanticipated harm to the species addressed in this biological opinion. The Service contact person for this is the Chief, Endangered Species Division at (916) 414-6600.

CONSERVATION RECOMMENDATIONS

Section 7 (a) (1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibilities for these species.

1. As a Recovery Plan for the giant garter snake is developed, the Corps should assist the Service in its implementation.

2. The Corps should incorporate into bidding documents the "Standard Avoidance and Minimization Measures for Construction Activities in Giant Garter Snake Habitat" provided in the Snake Programmatic Opinion, Appendix C, when appropriate.

3. The Corps, in partnership with the Service, should develop maintenance guidelines for the project that will reduce adverse effects of routine maintenance on giant garter snakes and their habitat. Such actions may contribute to the delisting and recovery of the giant garter snake by preventing degradation of existing habitat and increasing the amount and stability of suitable habitat.

4. The Corps should support and assist SAFCA with development of a habitat management plan for the preservation area element of this project with the goal of maximally protecting and enhancing habitat values for listed species, and overall habitat value of the two creeks, associated riparian, seasonal wetland, and upland habitats. Example actions of this type outlined in our May 2003 FWCA report include: a) modest replanting of native trees and shrubs at the top of creek banks, such as oak and elderberry, willow, cottonwood, or box elder; b) management of star thistle in conjunction with reseeding with native grasses and forbs; c) monitoring and management of beaver activity and damage to riparian trees; and d) potential realignment of Don Julio Creek west of Raley Boulevard to a more westerly alignment away from Raley (and with a reconstructed confluence with the MCDC), and revegetation of this reconstructed creek segment. Density and distribution of tree plantings should be such that they would establish with minimal or no irrigation, require no long term irrigation, and would not adversely affect listed vernal pool crustacean habitat.

5. The Corps should support and assist SAFCA with restoration of the historic section of Magpie Creek west of Raley Boulevard including: a) re-establishing flows through the reconstructed low-flow outlet from the MCDC to the historic creek (an element proposed as part of the flood control project action); and b) reconstructing the channel for sections that are now leveled or filled. These actions should be consistent with the North

Sacramento Community Plan Amendment: Magpie Creek Goals and Policies, reference number M92-071, but are recommended to be implemented in advance of that which would be required by the amendment. We especially encourage re-establishing oaks and elderberry, which are largely absent from this drainage, together with more common natives like cottonwood, willow or box elder, and reseeding with native grasses and forbs.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

This concludes formal consultation on the proposed Magpie Creek Flood Control Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. If you have any questions regarding this biological opinion for the Magpie Creek Flood Control Project, please contact Steven Schoenberg of my staff, at (916) 414-6564.

Sincerely,

Cliff Wagar

fn Kenneth D. Sanchez
Acting Field Supervisor

cc:
AES, Portland, OR
American River Flood Control District, Sacramento, CA (Attn: Paul Devereux)
CDFG, Rancho Cordova, CA
COE, Sacramento, CA (Attn: Ed Stewart)
EDAW, Sacramento, CA (Attn: Debra Bishop)
SAFCA, Sacramento, CA (Attn: Grant Kreinberg)

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APPENDIX A

Guidelines for Restoration and/or Replacement of Giant Garter Snake Habitat

Replacement and Restoration Guidelines are provided together, as the two conservation measures may not be mutually exclusive. Replacement of habitat may also require restoration of some areas. Preserved habitat may additionally be improved for giant garter snake by using some of the restoration guidelines.

Reference sites

A nearby reference site should be chosen both for restoration of giant garter snake habitat and for creation of replacement habitat. The reference site will be used to determine the success of conservation efforts. For restoration of habitat, the pre-project condition may be used as a reference site if adequate documentation exists. For creation of replacement habitat or for restoration where pre-project conditions are not documented, the reference site should be nearby or adjacent and should represent high quality giant garter snake habitat.

Restoration of giant garter snake habitat

Restoration may include incorporating some of the Replacement guidelines to enhance habitat value for giant garter snake. Restoration should follow the guidelines outlined below:

1. Restoring giant garter snake habitat includes minimizing impacts of project activities to the existing habitat, including using silt fencing, designating environmentally sensitive areas, using protective mats, preventing runoff, and providing worker awareness training. Measures to minimize impacts include:

a. Avoid construction activities within 200 feet from the banks of giant garter snake aquatic habitat. Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.

b. Construction activity within habitat should be conducted between May 1 and October 1. This is the active period for giant garter snakes and direct mortality is lessened, because snakes are expected to actively move and avoid danger. Between October 2 and April 30 contact the Service's Sacramento Fish and Wildlife Office to determine if additional measures are necessary to minimize and avoid take.

c. Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided giant garter snake habitat within or adjacent to the project area as Environmentally Sensitive Areas. This area should be avoided by all construction personnel.

d. Construction personnel should receive Service-approved worker environmental awareness training. This training instructs workers to recognize giant garter snakes and its habitat(s).

e. 24-hours prior to construction activities, the project area should be surveyed for giant garter snakes. Survey of the project area should be repeated if a lapse in construction activity of two weeks or greater has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the snake will not be harmed. Report any sightings and any incidental take to the Service immediately by telephone at (916) 414-6600.

f. Any dewatered habitat should remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

2. Remove all construction debris and stockpiled materials.

3. Regrade area to preexisting contour, or a contour that would improve restoration potential of the site.

4. Replant and hydroseed the restoration area. Recommended plantings consist of a) wetland emergents, b) low-growing cover on or adjacent to banks, and c) upland plantings/hydroseeding mix to encourage use by other wildlife. Riparian plantings are not appropriate because shading may result in lack of basking sites. Native plantings are encouraged except where non-natives will provide additional values to wildlife habitat and will not become invasive in native communities. The applicant should obtain cuttings, plantings, plugs, or seeds, from local sources wherever possible. The applicant should attempt to restore conditions similar to that of adjacent or nearby habitats.

a. Emergent wetland plants recommended for giant garter snake habitat are California bulrush (*Scirpus californicus*), cattail (*Typha* spp.), and water primrose (*Ludwigia peploides*). Additional wetland plantings may include common tule (*Scirpus acutus*), Baltic rush (*Juncus balticus*), or duckweed (*Lemna* spp.).

b. Cover species on or adjacent to the bank may include California blackberry (*Rubus vitifolius*) or wild grape (*Vitis californica*), along with the hydroseeding mix recommended below.

c. Upland plantings/hydroseeding mix: Disturbed soil surfaces such as levee slopes should be hydroseeded to prevent erosion. The Service recommends a mix of at least 20-40 percent native grass seeds [such as annual fescue (*Vulpia* spp.), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.)], 2-10 percent native forb seeds, five percent rose clover (*Trifolium hirtum*), and five percent alfalfa (*Medicago sativa*). Approximately 40-68 percent of the mixture may be non-aggressive European annual grasses [such as wild oats (*Avena sativa*), wheat (*Triticum* ssp.), and barley (*Hordeum vulgare*)]. The Corps will not include aggressive non-native grasses, such as perennial ryegrass (*Lolium perenne*), cheatgrass (*Bromus tectorum*), fescue (*Festuca* spp.), giant reed (*Arundo donax*), medusa-head (*Taeniatherum caput-medusae*), or Pampas grass (*Cortaderia selloana*) in the hydroseed mix. The Corps will not include endophyte-infected grasses in the mix. Mixes of one-hundred percent native grasses and forbs may also be used, and are encouraged.

Replacement of giant garter snake habitat

Location

Replacement location should be within the same population cluster boundaries (population clusters are defined in 58 **FR** 54053) as the habitat lost. For example: The boundaries of the Sacramento Basin population cluster are approximately, Highway 16 to the north, Sacramento River to the west, Twin Cities Road to the south, and the Folsom Aqueduct to the east. Habitat lost within this area must also be replaced within this area.

Habitat components

Giant Garter Snake Habitat. The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, other waterways and agricultural wetlands such as irrigation and drainage canals and rice fields, and the adjacent uplands. Essential habitat components consist of (1) adequate water during the snake's active period, (early spring through mid-fall) to provide a prey base and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat; (3) upland habitat for basking, cover, and retreat sites; and (4) higher elevation uplands for cover and refuge from flood waters. For the purposes of this programmatic opinion, a basic giant garter snake habitat unit will incorporate 2.00 acres (0.81 hectares) of surrounding upland for every 1.00 acre (0.40 hectare) of aquatic habitat. The 2.00 acres (0.81 hectares) of upland also may be defined as 218 linear feet (66 meters) of bankside habitat which incorporates adjacent uplands to a width of 200 feet (61 meters) from the edge of the bank.

Replacement habitat must provide the above mentioned essential habitat components and include the following:

1. All replacement habitat must include both upland and aquatic habitat components. Upland and aquatic habitat components must be included in the replacement habitat at a ratio of 2:1 upland acres to aquatic acres

2. A semi-permanent or permanent aquatic habitat which provides water during the active period for giant garter snakes (April through October) with suitable vegetative cover present. Linear or meandering channels with slow flowing water over mud or silt substrate are preferred.

3. Upland basking and retreat sites with low growing vegetation cover adjacent to aquatic habitat, and upland retreats and flood refugia with partially buried broken concrete or animal burrows.

4. Small fish and amphibian larvae for foraging, but predatory "gamefish" (bass, *Micropterus* spp.; sunfish, *Lepomis* spp.; catfish, *Ictalurus* spp. and *Ameiurus* spp.) absent or controlled.

5. An adequate buffer (at least 200 feet) from roadways to reduce vehicular mortality.

6. Follow planting recommendation provided above under restoration guidelines.

Monitoring

Habitat restoration

Restoration of habitat should be monitored for one year following implementation. Monitoring reports documenting the restoration effort should be submitted to the Service: (1) upon completion of the restoration implementation; and (2) one year from restoration implementation. Monitoring reports should include photo documentation, when restoration was completed, what materials were used, plantings (if specified) and justification of any substitutions to the Service recommended guidelines. Monitoring reports should also include recommendations for remedial actions and approval from the Service, if necessary, and justification from release of any further monitoring, if requested.

Creation of replacement habitat

Replacement habitat should be monitored for 5 years following implementation. Hydrology should be monitored for the first two years after creation of wetlands. The monitoring effort should continue for three additional years to ensure success criteria are met. Monitoring reports documenting implementation of conservation measures should be submitted to the Service: (1) upon completion of wetland creation; (2) yearly for the first two years of monitoring; and (3) 5 years from implementation. Monitoring reports should include photo documentation, when restoration was completed, what materials were used, plantings (if specified) and justification of any substitutions to the Service recommended guidelines. Monitoring reports should also include recommendations for remedial actions and approval from the Service, if necessary, and justification from release of any further monitoring, if requested.

APPENDIX A

Success criteria for replacement habitat:

1. At completion of monitoring, the cover measured on the habitat area should be 90 percent of cover measured on the reference site.

2. At completion of monitoring, the species composition measured on the habitat area should be 90 percent of that measured on the reference site.

3. At completion of monitoring, wetlands created on the site should meet Corps jurisdictional criteria.

Maintenance and management of replacement giant garter snake habitat

1. A final management plan of replacement habitat must be approved by the Service.

2. All maintenance activities should follow Standard Avoidance and Minimization Measures During Construction Activities in Giant Garter Snake Habitat.

3. Additional guidance includes:

   a. Canal Maintenance - Hand clearing of canals is preferred for removal of excessive vegetation or debris. Any equipment should be operated from the bank top. Excavate from only one side of the canal during a given year. Avoid excavating the banks above the high water level. Preferably, one side of the canal should be left undisturbed indefinitely (the preferred side would be the west or north side) so that emergent vegetation and bank side cover is left in place.

   b. Place the spoils from canal clearing in a designated location, rather than along bank tops. This will prevent burying or crushing snakes basking on the banks, or trapping snakes taking cover in burrows or bank-top soil crevices.

   c. Vegetation control - Uplands should not be disced. Leave vegetation on levees and canal sides wherever possible. Mowing to control vegetation should take place July through September and mower blades should be raised at least six inches to avoid injuring snakes and to leave some grassy cover.

   d. Traffic - Control vehicle access to avoid vehicular mortality of giant garter snakes.

4. Use a water maintenance regime that will maintain some open water to provide vegetated edge for giant garter snake to forage along.

5. Eradicate/control non-natives and invasive exotics.

APPENDIX A

Compatible uses of giant garter snake replacement habitat:

Rice farming is a compatible land use for adjacent properties.

Uses of giant garter snake replacement habitat that are incompatible with the habitat of giant garter snake, or represent threats to giant garter snakes include row cropping on uplands, orchards on uplands, OHV (off-highway vehicle) use, and combining with riparian habitat creation which requires dense cover or SRA (shaded riverine aquatic) habitat.

APPENDIX C

Standard Avoidance and Minimization Measures During Construction Activities in Giant Garter Snake (*Thamnophis gigas*) Habitat

HABITAT TYPE:

Marshes, sloughs, ponds, small lakes, low gradient streams, irrigation and drainage canals, and rice fields. Permanent aquatic habitat, or seasonally flooded during the snake's active season (early-spring through mid-fall), with herbaceous wetland vegetation, such as cattails and bulrushes, grassy banks (often salt grass), and uplands for cover and retreat sites during the snake's active season and for refuge from flood waters during the dormant season (winter). Giant garter snakes are typically absent from larger rivers because of lack of suitable habitat, and from wetlands with sand, gravel, or rock substrates. Some riparian woodlands may not provide suitable habitat because of excessive shade, lack of basking sites, and absence of giant garter snake prey.

AVOIDANCE AND MINIMIZATION MEASURES:

1. Avoid construction activities within 200 feet from the banks of giant garter snake aquatic habitat. Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.

2. Construction activity within habitat should be conducted between May 1 and October 1. This is the active period for giant garter snakes and direct mortality is lessened, because snakes are expected to actively move and avoid danger. Between October 2 and April 30 contact the Service's Sacramento Fish and Wildlife Office to determine if additional measures are necessary to minimize and avoid take.

3. Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided giant garter snake habitat within or adjacent to the project area as Environmentally Sensitive Areas. This area should be avoided by all construction personnel.

4. Construction personnel should receive Service-approved worker environmental awareness training. This training instructs workers to recognize giant garter snakes and their habitat(s).

5. 24-hours prior to construction activities, the project area should be surveyed for giant garter snakes. Survey of the project area should be repeated if a lapse in construction activity of two weeks or greater has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been

completed or it has been determined that the snake will not be harmed. Report any sightings and any incidental take to the Service immediately by telephone at (916) 414-6600.

6. Any dewatered habitat should remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

7. After completion of construction activities, remove any temporary fill and construction debris and, wherever feasible, restore disturbed areas to pre-project conditions. Restoration work may include such activities as replanting species removed from banks or replanting emergent vegetation in the active channel.

8. Follow the conservation measures in Table 1 to minimize the effects of loss and disturbance of habitat on giant garter snakes. Replacement ratios are based on the acreage and on the duration of disturbance.

TABLE 1 - SUMMARY OF GIANT GARTER SNAKE CONSERVATION MEASURES

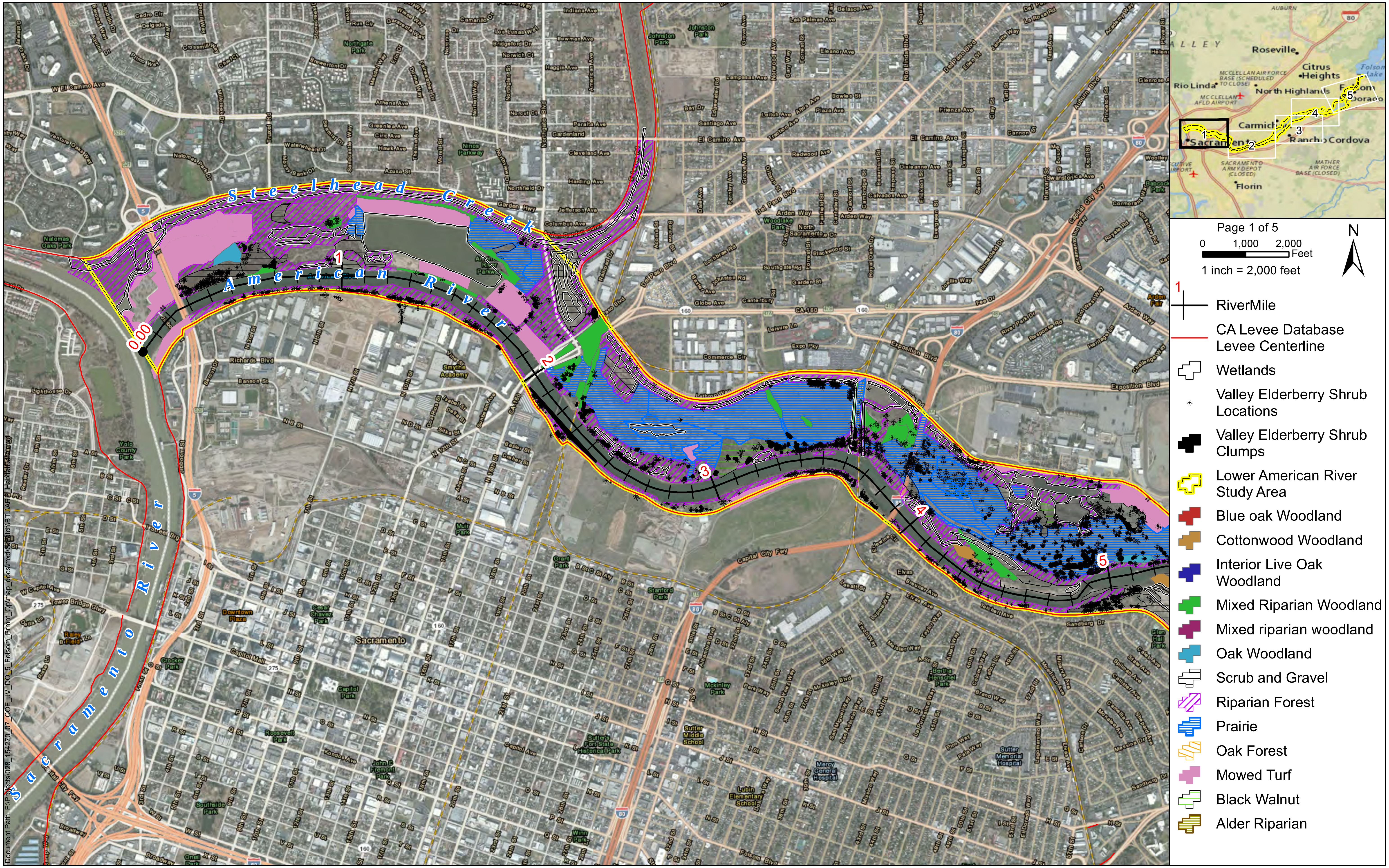
	IMPACTS: DURATION	**IMPACTS:** ACRES	**CONSERVATION MEASURE:** COMPENSATION
LEVEL 1	1 season	Less than 20 and temporary	Restoration
LEVEL 2	2 seasons	Less than 20 and temporary	Restoration plus 1:1 replacement
LEVEL 3	More than 2 seasons and temporary	Less than 20 and temporary	3:1 Replacement (or restoration plus 2:1 replacement)
	Permanent loss	Less than 3 acres total giant garter snake habitat AND Less than 1 acre aquatic habitat; OR Less than 218 linear feet bank habitat	3:1 Replacement

Giant garter snake habitat includes 2.0 acres of surrounding upland habitat for every 1.0 acre of aquatic habitat. The 2.0 acres of upland habitat also may be defined as 218 linear feet of bankside habitat which incorporates adjacent uplands to a width of 200 feet from the edge of each bank. Each acre of created aquatic habitat should be supported by two acres of surrounding upland habitat. Compensation may include creating upland refuges and hibernacula for the giant garter snake that are above the 100-year flood plain.

A season is defined as the calendar year period between May 1 and October 1, the active period for giant garter snake when mortality is less likely to occur.

Appendix F

American River Parkway Habitat Maps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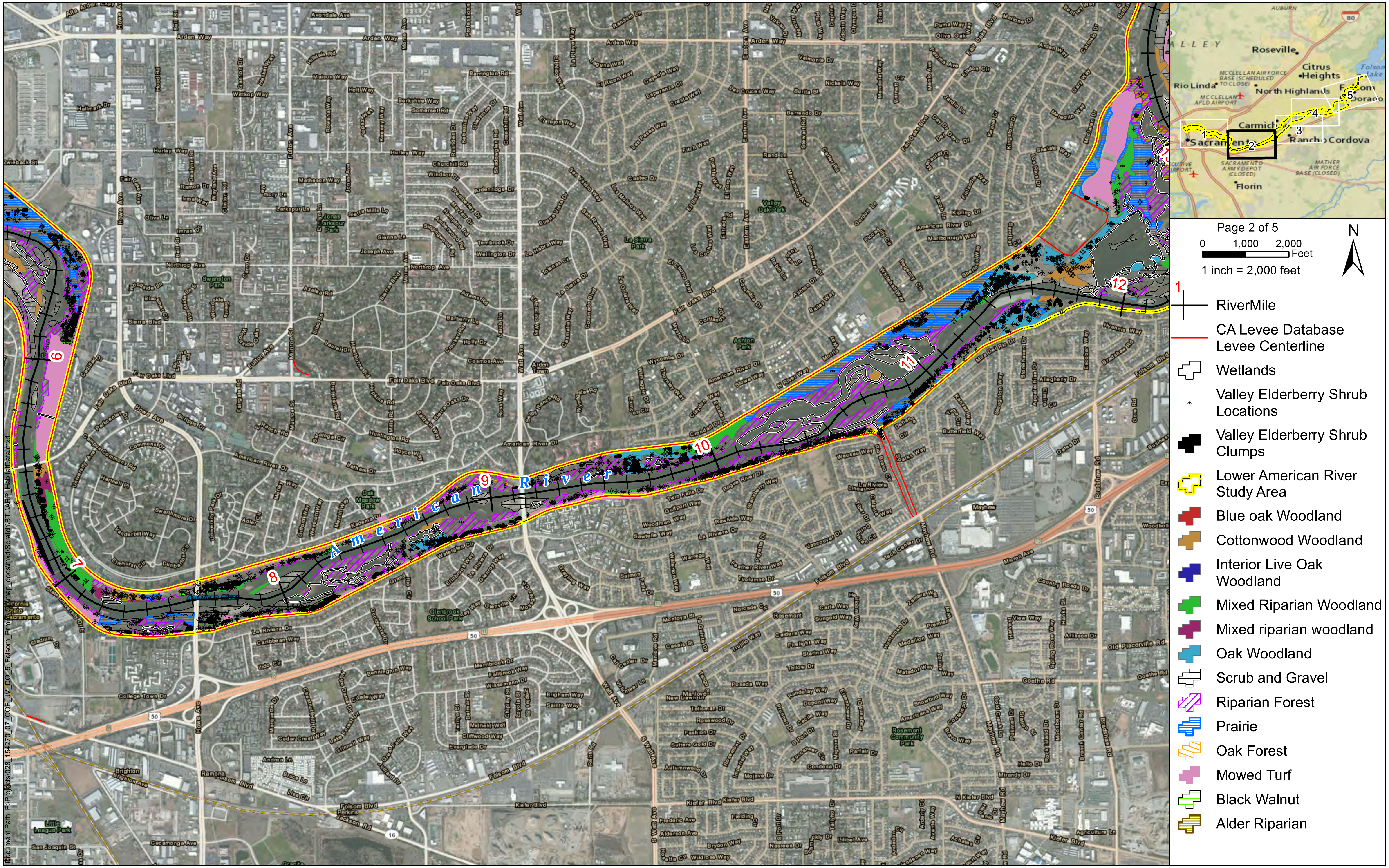
Valley Elderberry Shrub Clumps
Lower American River Study Area
Blue oak Woodland
Cottonwood Woodland
Interior Live Oak Woodland
Mixed Riparian Woodland
Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
Prairie
Oak Forest
Mowed Turf
Black Walnut
Alder Riparian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Interior Live Oak Woodland
Mixed Riparian Woodland
Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
Prairie
Oak Forest
Mowed Turf
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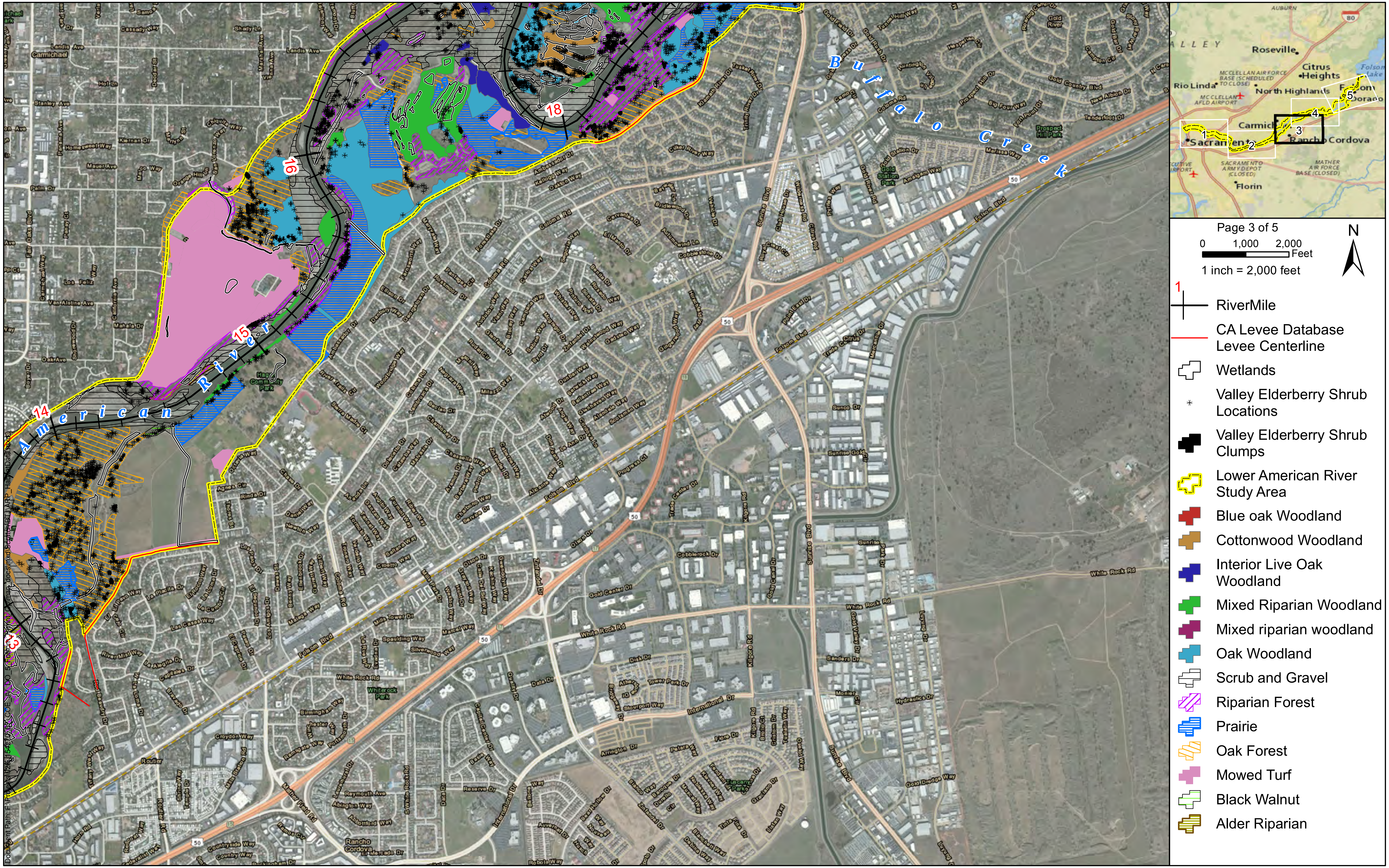
Rio Linda
North Highlands
Rancho Cordova
Florin
Auburn



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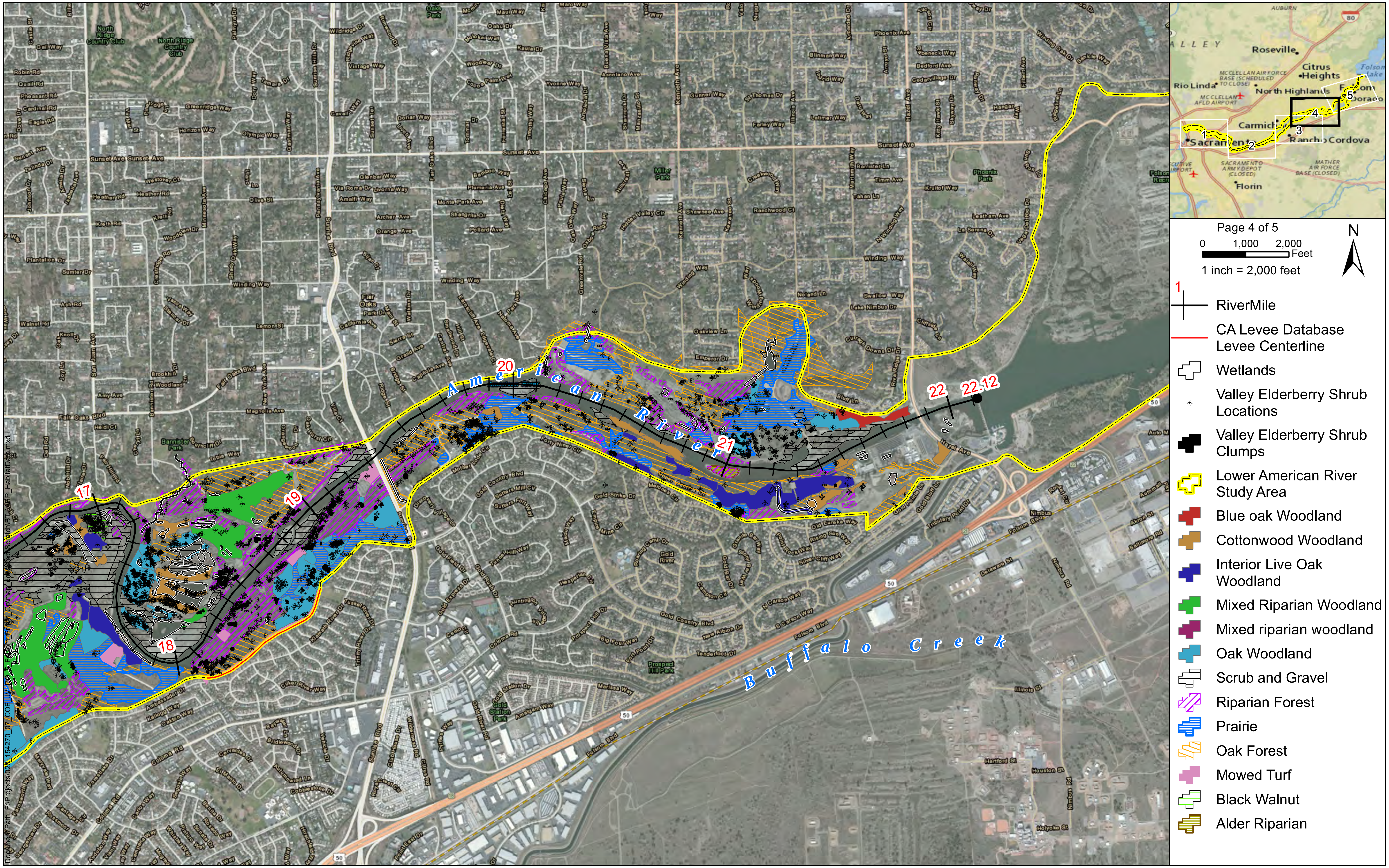

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Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
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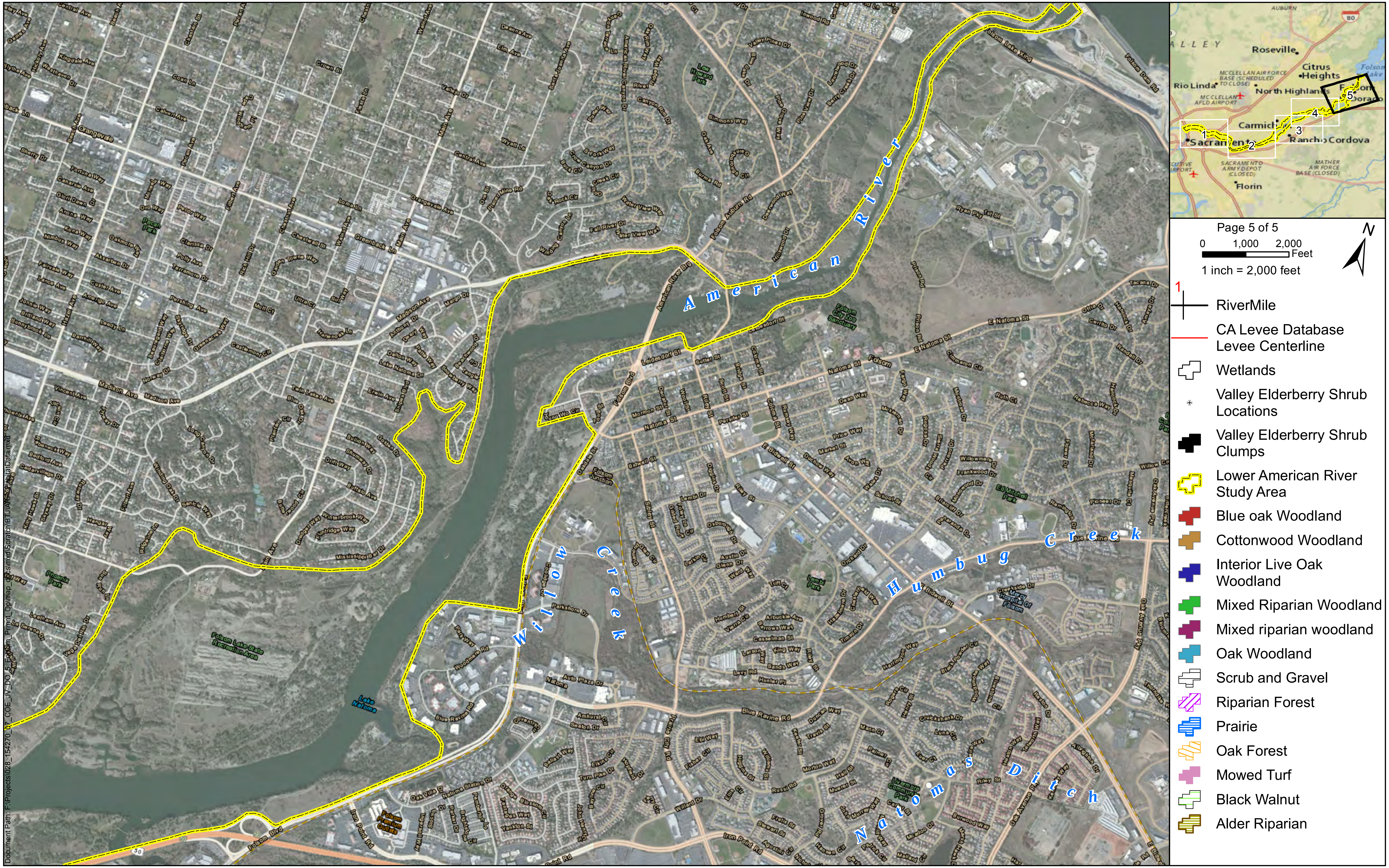
Florin



American River
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Humbug Creek
Natomas Ditch
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North Highlands
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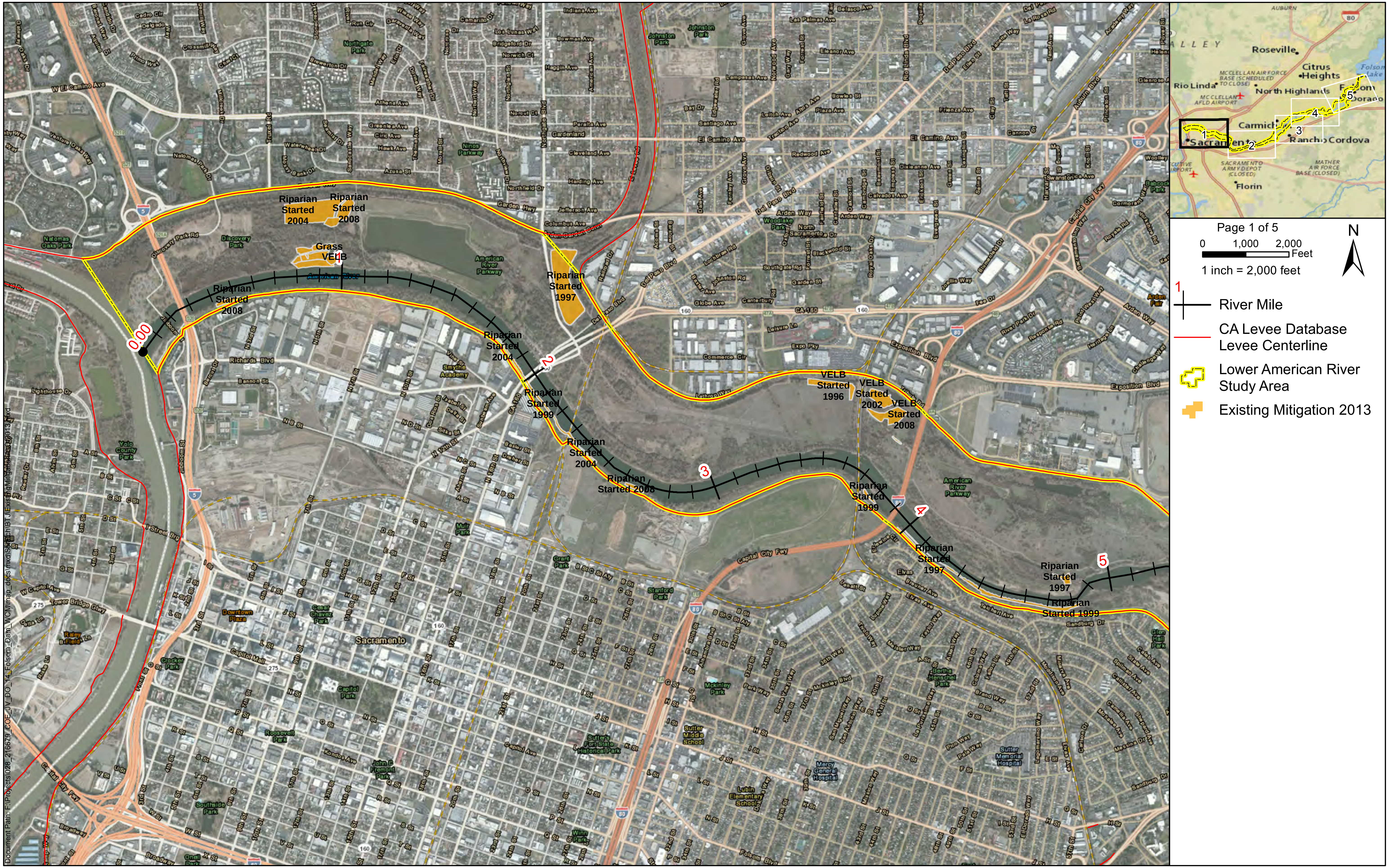
Mixed riparian woodland
Oak Woodland
Scrub and Gravel
Riparian Forest
Prairie
Oak Forest
Mowed Turf
Black Walnut
Alder Riparian

Appendix G

Existing VELB Mitigation Sites in the American River Parkway



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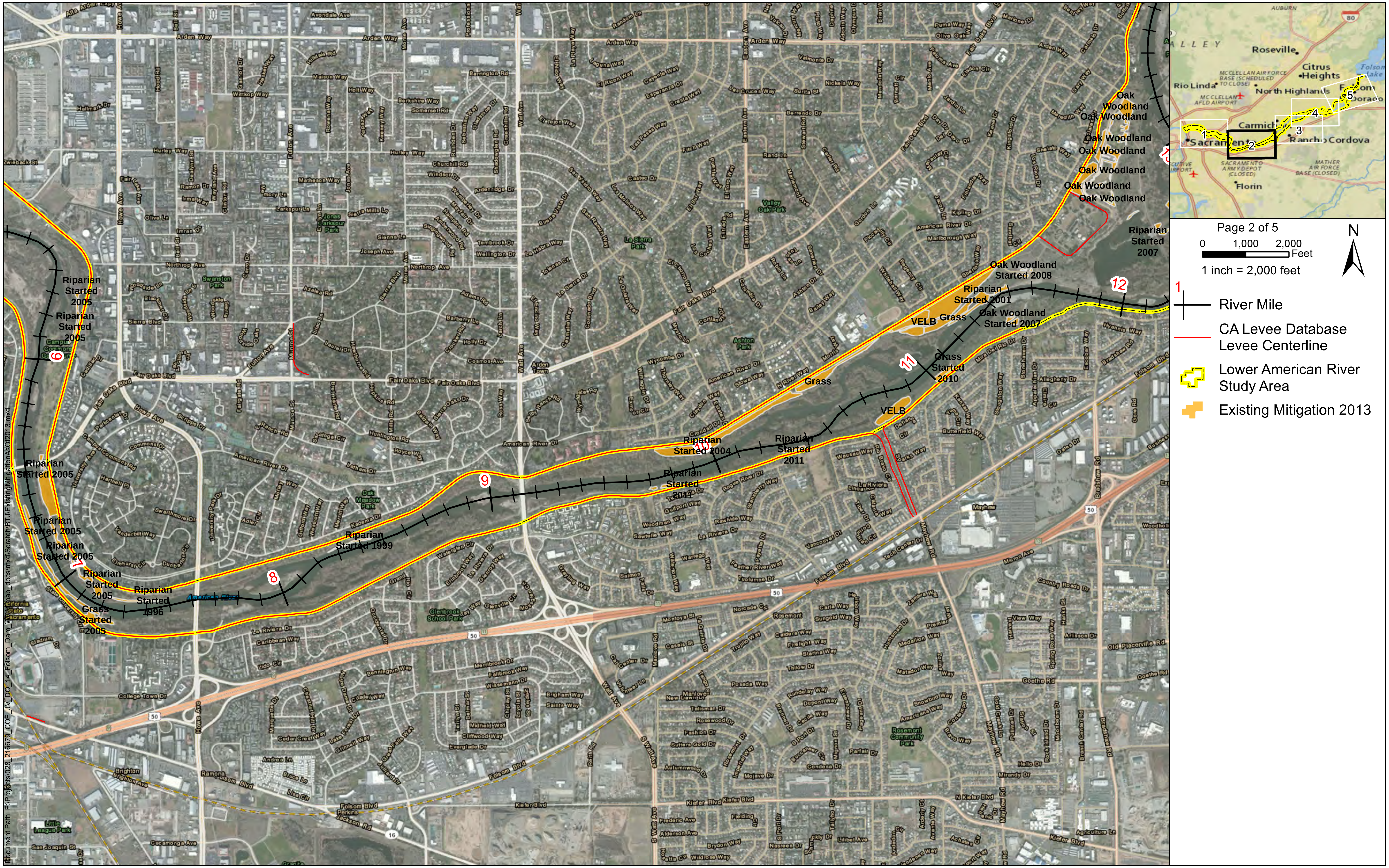

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Carmichael
Sacramento
Rancho Cordova
Florin
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SACRAMENTO ARMY DEPOT (CLOSED)
MATHER AIR FORCE BASE (CLOSED)
Oak Woodland
Oak Woodland Started 2008
Riparian Started 2001
VELB
Grass
Oak Woodland Started 2007
Grass Started 2010
Riparian Started 2007
Riparian Started 2004
Riparian Started 2011
Riparian Started 1999
Riparian Started 1996
Riparian Started 2005
Grass Started 2005
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Page 3 of 5
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Riparian Started 2007
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Oak Woodland Started 1988
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Page 5 of 5
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Lower American River Study Area
Existing Mitigation 2013
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Citrus Heights
Rio Linda
North Highlands
Carmichael
Rancho Cordova
Florin
Sacramento
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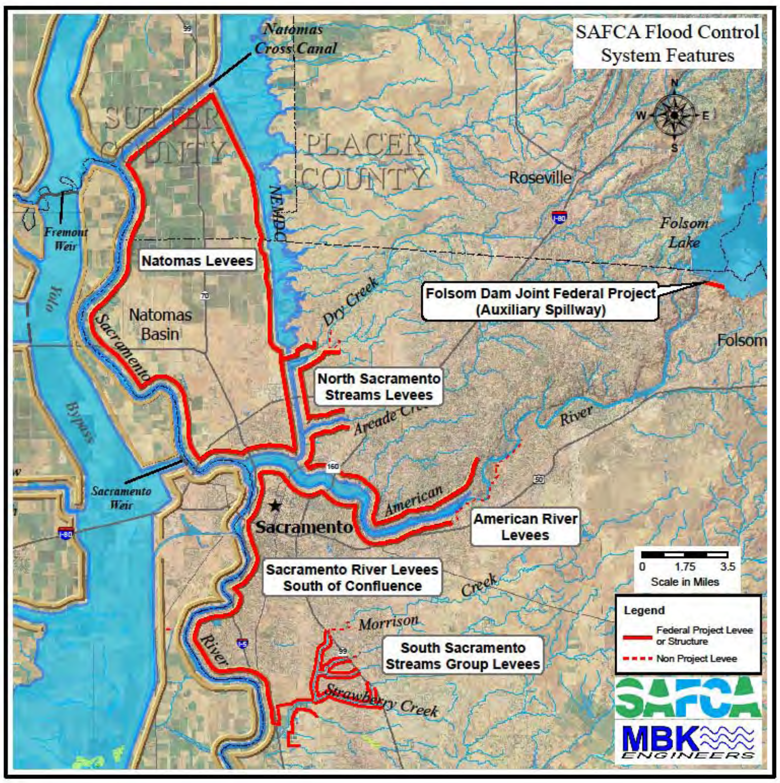
PHASE I ENVIRONMENTAL SITE ASSESSMENT

AMERICAN RIVER COMMON FEATURES GENERAL REEVALUATION REPORT (GRR)

Sacramento, CA



Prepared by:
Environmental Engineering Branch
Sacramento District

US Army Corps of Engineers

August 2012

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS

ARFCD	American River Flood Control District
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CESPK	US Army Corps of Engineers, Sacramento District
COCs	Contaminates of Concern
DCA	Di-chloro Ethane
DCE	Di-chloro Ethylene
DoD	Department of Defense
DTSC	Department of Toxic Substance Control
DWR	California Department of Water Resources
DWSC	Deep Water Ship Channel
EDR	Environmental Data Resources Inc.
ER	Engineering Regulation (US Army Corps of Engineers)
ESA	Environmental Site Assessment
FUDS	Formerly Used Defense Sites
GRR	General Reevaluation Report
HTRW	Hazardous, Toxic or Radioactive Waste
IAW	In accordance with
KMEP	Kinder Morgan Energy Partners
LUFT	Leaking Underground Fuel Tank
LUST	Leaking Underground Storage Tank
MTBE	Methyl tert-butyl ether
NEPA	National Environmental Policy Act
NFA	No further Action
NGVD29	National Geodetic Vertical Datum of 1929
NPL	National Priority List (Superfund Site)
PCB	Polychlorinated Biphenyl
PCE	Tetra-chloro ethylene
RCRA	Resource Conservation and Recovery Act
RD900	State of California Reclamation District 900 (West Sacramento)
RD1000	State of California Reclamation District 1000 (Natomas)
SAFCA	Sacramento Area Flood Control Agency
SLIC	Spills, Leaks, Investigations and Cleanups
SVE/AS	Soil Vapor Extraction/Air Sparging
SWRCB	State Water Resources Control Board
TARP	Tesoro ARCO Remediation Project
TBA	Tert-butyl Alcohol
TCA	Tri-chloroethane
TCE	Tri-chloroethylene
TPH-d	Total Petroleum Hydrocarbons as Diesel
TPH-g	Total Petroleum Hydrocarbons as Gasoline
TSCA	Toxic Substance Control Act
USACE	United States Army Corps of Engineers

USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WSAFCA	West Sacramento Area Flood Control Agency

EXECUTIVE SUMMARY

The American River Common Features General Reevaluation Report (GRR) project is currently performing a study along approximately 40 miles of the levee system that surround the American River, Natomas Basin and the Sacramento Bypass.

The GRR is in the Feasibility Study phase of the Civil Works process, which requires a Phase 1 Environmental Site Assessment (ESA) to be performed to identify environmental contamination at or near the project construction site. Contaminated sites have the potential to significantly impact future construction activities and need to be identified as early as possible.

Records review identified 491 environmental sites including 7 sites that have the Hazardous, Toxic, Radiologic Waster (HTRW) concerns with the potential to affect future construction activities and 45 sites with HTRW concerns that should not affect future construction activities. Regional contaminants from historic agriculture and mining sources are likely present and should be considered on a site-specific basis if future construction activity generates soil for reuse or disposal.

This Phase 1 ESA identifies and generally describes locations where environmental conditions exist in proximity to the project levee. The purpose of the GRR is to identify deficiencies in the levee system and perform feasibility analysis on potential remedies for these deficiencies. Separate reports and construction plans will be developed for the chosen remedial alternatives. As the American River Common Features GRR project schedule approaches actual construction, an additional Phase 1 ESA may be necessary to provide up-to-date information necessary to comply with the USACE Civil Works process.

The presence of the Old Bryte Landfill adjacent to the Sacramento Bypass may influence alternative selection, as may the presence of the old Southern Pacific rail yard in downtown Sacramento. The bulk fuel facility at Broadway and Front Street near downtown Sacramento is a petroleum release site on both sides of the levee with fuel pipelines going through the levee and may be unavoidable; but non-hazardous waste under CERCLA.

Further investigation of these sites as they may affect the cost of levee relocation or rehabilitation for seepage, stability and erosion is recommended.

1.0 Introduction

1.1 Purpose

The purpose of this Phase 1 ESA is to identify recognized HTRW environmental conditions, including the presence or likely presence of any hazardous substances or petroleum products under conditions that indicate an existing release, a past release, or the material threat of a release into structures, the ground, and groundwater or surface waters of the project site.
A Phase 1 ESA is required by the United States Army Corps of Engineers (USACE) *Engineering Regulation (ER) 1165-2-132; HAZARDOUS, TOXIC AND RADIOACTIVE (HTRW) GUIDANCE FOR CIVIL WORKS PROJECTS. , Policy Guidance Letter 34 Non-CERCLA Regulated Contaminated Materials at Civil Works Projects* and *ASTM 1527-05 – Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* is widely used in the environmental industry and will be followed as applicable in this report.

The American River Common Features GRR will analyze the levee system surrounding the American River, Sacramento Bypass, and east bank of the Sacramento River downstream of the American River. These areas will be addressed in the future by using three alternatives developed from past levee construction and repair. The range of possible future construction activities may use techniques and methods that require soil and/or groundwater disturbance, thereby creating possible contaminant exposure concerns.

1.2 Detailed Scope of Services

The scope of this ESA is limited to assessing the environmental condition of the property associated with the levees under study in the American River Common Features General Reevaluation. It also is concerned with identifying HTRW sites within the project boundaries and the surrounding area using commonly known and reasonably ascertainable information.

1.3 Limitations and Exceptions

The Phase I ESA does not include any sampling or testing of soil, air, water or building materials.

1.4 Special Terms and Conditions

The current American River Common Features GRR project does not involve purchase of property for commercial purposes, and as such, the conditions for the ASTM specifications are not completely applicable. The ASTM standard is used as a guide and sections that are not applicable are deleted or modified to meet the requirements of the project. Where applicable, the format and guidance recommended by ASTM is followed as stated in standard E 1527-05. The ASTM post-dates the Regulation, and there is no requirement to follow it, but the ASTM is the industry standard and a convenient guide to follow in performing the environmental site assessment.

1.5 Site Definition

The approach of this report is to search environmental databases and produce a list of sites that have recognized environmental concerns in proximity to the project levee. Sites identified from the environmental database search are classified using the following criteria. The criteria are based on site characteristics that affect the potential of the site to impact future levee construction and repair activities.

Table 1 - Site Characterization Definitions

Type	Definition
1	Site with significant HTRW concerns that may impact future construction activities
2	Site with HTRW concerns that are not likely to have an impact on future construction activities, but warrant mention due to close proximity
3	Site with no apparent HTRW concerns or concerns that have been remediated and closed in the past, or sufficiently removed from the levees so as to have no possible impact.

Type 1 sites have current, significant HTRW concerns that may impact future construction activities. A significant HTRW concern for the American River GRR study and future levee construction projects include soil contamination within the footprint of levee construction activities, or groundwater contamination present on the site that extends to areas of levee construction. Sites with currently undefined or ill-defined contaminant plumes that have the possibility to affect future activities are also included in this category. Most of these sites are currently undergoing assessment, active remediation, or monitoring activities that are under the regulation of the California State Water Resources Control Board (SWCRB), or the California Department of Toxic Substances Control (DTSC).

Type 2 sites have identified HTRW concerns that present a low potential to impact future construction activities. These sites are removed from the levee centerline and will not be included in future areas of construction activity. Current remediation measures on these sites have stabilized a groundwater contaminant plume, remediated or removed a significant amount of the soil contamination present on the site. The combination of remediation measures and distance from the project centerline lead to the lower risk categorization of the site. Also included are contaminated properties that warrant mention simply due to close proximity (generally immediately adjacent to the levee) but pose no apparent problem for work on the levee unless the property must be used, such as a levee setback or staging area.

Type 3 sites have either been closed by a regulatory agency or have no historical evidence of potential HTRW problems. Sites located outside of the “Approximate Minimum Search Distance” defined in ASTM section 8.2.1 but included in the EDR records report are included in this site category as well. Sites with HTRW problems that are sufficiently removed from the levees, such as a site with a 300 foot petroleum groundwater plume located a half mile away, are included.

The best reasonably ascertainable data available to evaluate potential impacts of surface water on the project sites or other regional contaminant considerations comes from California Regional Water Quality Control Boards. Review of the most recent water quality information showed that COCs in the American River / Sacramento River included PCBs, mercury, and other agricultural related chemicals. Environmental impacts from PCBs was observed in fish tissue and seems to be a river wide problem that is regional (agriculture and mining) and best represented as area sources. Mercury contamination originates from the historic uses of the river basin for mining purposes. The levees themselves may be a source of these contaminants as historical records indicate that they were dredged from the riverbed and constructed after hydraulic mining was banned in the Sierra foothills and long after commencement of agricultural use.

1.6 Guidance

This report was prepared in accordance with ASTM E 1527-05, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process; ER 1165-2-132, HTRW Guidance for Civil Works Projects and Policy Guidance Letter 34: Non-CERCLA Regulated Contaminated Materials at Civil Works Projects. Deviations from the approved guidance procedures are noted where appropriate in the report. Reasons for the deviations generally include the unavailability of required information and feasibility concerns associated with the study. All reasonably ascertainable information has been reviewed in the preparation of this report.

An electronic database search and field observations were conducted in order to compile information for this Phase 1 ESA. This assessment did not include sampling or analysis of environmental media.

ER 11165-2-132 requires that the project avoid hazardous waste as defined by CERCLA. If it cannot be avoided, it must be cleanup at the 100% non-federal sponsor expense. Policy Guidance Letter 34 states that non-hazardous waste (such as State Special or Designated Waste) may be cleaned up as part of the Project; however it is the District’s policy that the non-federal sponsor performs the cleanup. Paragraph 8 of the regulation requires that a site investigation and HTRW feasibility study or “ESA Phase 2” should be performed during the flood risk management feasibility study where waste is unavoidable.

HTRW assessments during the feasibility phase will determine the type and extent of HTRW contamination, if any, and how HTRW considerations will impact on the alternative project plans. A preliminary cost estimate of required HTRW response actions will be needed for each project alternative in order to be able to make a reasoned choice among alternative project plans. Alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative plan should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. These assessments, conducted during the feasibility stage, are shared with the local sponsor for cost-shared studies.

2.0 Site Description

The Project incorporates all or part of the following areas:

- Sacramento Area Flood Control Agency
- American River Flood Control District
- Reclamation District 1000 (Natomas Basin)
- Reclamation District 900 (West Sacramento)
- West Sacramento Area Flood Control Agency

2.1 Location and Legal Description

The American River Levee system is a levee system that divides Sacramento County and joins the Sacramento River on the western boundary of the County. The entire flood-prone area was once called Natomas Basin but has since been sub-divided into Reclamation District 1000 (Natomas Basin) north of the River and American River Flood Control District mostly south of the River, and north of the River east of the Natomas main drainage canal. One alternative considers diverting more of the Sacramento River flow into the Yolo Bypass at the Sacramento Bypass and therefore some of the levee system in Yolo County across the Sacramento River is considered. A separate project to raise the height of the levees on the American River is ongoing.

Levees "reaches" have been assigned to segments of the levee to assist with identification of specific locations (see Figure 1). The Project has divided levee reaches into American River North (ARN) including Dry Creek, Magpie Creek and Arcade Creek, American River South (ARS) including the Sacramento River south of the American River confluence, and Natomas (NAT).

2.2 Site Vicinity General Characteristics

The City of Sacramento is in Sacramento Valley located immediately east of the City of West Sacramento at the confluence of the American River and Sacramento River. The two cities are separated by the Sacramento River, which flows from north to south. The City and County contains a mix of residential, commercial, agricultural and industrial properties. Approximately 500,000 people reside in the City and 1,500,000 reside in the County. The City is the Capital of the State of California. It is considered to be at the highest risk of flooding of any major city in the nation. Most of Reclamation District 1000 is included in a separate flood risk management project. The study area includes

• **Natomas Main Drainage Canal South and East Levee** from the confluence of Dry Creek, Magpie Creek and Arcade Creek to the Sacramento River is included.

• **American River North and South Leve**es from Carmichael through the City of Sacramento to the Sacramento River are included.

• **Sacramento River East Levee** from the American River south to Clarksburg, Freeport and Elk Grove/Laguna Creek is included

• **Sacramento Bypass Levee** extends for approximately 1.1 miles along the Sacramento Bypass left bank from the Sacramento Weir west to the Yolo Bypass Levee.

2.3 Current Use of Property

The American River Common Features Levee system property is a currently used a flood protection levee for the City of Sacramento and Sacramento County.

2.4 Descriptions of Structures, Roads, and Other Improvements on the Site

Roads along the levee system are a mix of gravel and paved roads, railroads and bike trails that can be found along the levee crest and at the base of the levee. The levee system is crossed by numerous bridges. There are numerous residences, businesses and landfills built on the project site (levee) within the developed areas of the City.

2.5 Current Uses of Adjoining Properties

Landside adjacent properties are a mix of light industrial, commercial properties, and residential subdivisions and agricultural lands. Waterside adjacent property is the American River Parkway, the undeveloped Sacramento River; the Yolo Bypass, which is a diversionary floodwater channel used during periods of high water. There are several parks and recreational areas located between portions of the levee and the Sacramento River.

2.6 Completed Study Work

Several earlier feasibility studies to include environmental impact statements and environmental site assessments for the American River (USACE, 1991, 1996, 2004) and Magpie Creek (USACE, 1995) were completed by the Sacramento District. This environmental site assessment is an update to previous assessments.

2.7 Possible Project Alternatives

All alternatives include adding erosion control to the American River levees.

One alternative adds measures for levee stability and seepage control to the levees on the east bank of the Sacramento River south of the American River.

Another alternative avoids improvement of Sacramento River levees by widening the Sacramento Bypass north of West Sacramento to divert more water from the Sacramento River into the Yolo Bypass.

The Project has not fully defined all alternatives but they have defined the project area.

3.0 User Provided Information

3.1 Title Records

Title records are not provided because the project site, including the levees and waterways, is essentially public land, easement or right-of-way.

3.2 Environmental Liens or Activity and Use Limitations

There are no NPL or proposed NPL sites located within the study area. There is one delisted NPL site, Jibboom Junkyard. Three CERCLIS sites are located within the study area including: La Quinta Inn and Jibboom Junkyard Super Fund Site. There are no DoD sites within the study area. One FUDS sites, the Sacramento District Engineer Yard is included in the study area. There are no tribal lands included in the search area. No sites with state environmental liens are located within the study area.

3.3 Reason for Performing Phase 1

A Phase 1 ESA for HTRW is required by USACE ER 1165-2-132 for all civil works projects during the reconnaissance or feasibility study phase. A Phase 1 ESA is also required by National Environmental Protection Act (NEPA) for all construction activities.

3.4 Other

This ESA will follow the environmental industry practice of using the guidelines set forth in the USEPA rule concerning “All Appropriate Inquiries,” the *ASTM E 1527-05* standard, USACE *Engineering Regulation (ER) 1162-2-132* and *Policy Guidance Letter 34, Non-CERCLA Regulated Contaminated Materials at Civil Works Projects. ASTM E 1527-05* was designed to protect persons purchasing property from liability arising from adverse environmental conditions, but also may be used for other situations per section 4.2.1 of the standard.

4.0 Records Review

4.1 Standard Environmental Record Sources

Environmental Data Resources (EDR) conducted a records research of the study area consisting of 71 federal, state, public, and proprietary available data bases.

Figure 2 shows the EDR map used with the one mile buffer around the project levee. A complete copy of the EDR Report is included as Appendix A. Standard "point" searches apply different levels of scrutiny at the ¼ mile, ½ mile and 1 mile search radius per the ASTM. This "corridor" search applies the same level of scrutiny to the entire one mile search radius.

The report generated by EDR searched the following Federal environmental record sources:

- National Priority List (NPL), including current, proposed, de-listed, liens
- Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), including archived sites (CERC-NFRAP) and CERCLA Lien Information (LIENS 2)
- Resource Conservation and Recovery Act (RCRA), including transporters, storage and disposal (TSDF), large quantity generators (LQG), small quantity generators (SQG), conditionally exempt small quantity generators (CESQG), non-generators (NonGen) and the RCRA Administration Action Tracking System (RAATS)
- The Emergency Response Notification System (ERNS)
- The Hazardous Materials Incident Report System (HMIRS)
- The EPA's listing of Brownfield properties (US BROWNFIELDS)
- Department of Defense sites (DOD) and Formerly Used Defense Sites (FUDS)
- The Toxic Chemical Release Inventory (TRIS)
- Integrated Compliance Information System (ICIS)
- PCB Activity Database (PADS)

The following State and Local environmental record sources were searched:

- California Department of Health Services (CA BOND EXP. PLAN)
- Solid Waste Facilities/Landfill Sites (SWF/LF)
- California Water Resources Control Board Waste Discharge System (CA WDS)
- Water Management Database System (WMUDS/SWAT)
- Leaking Underground Storage Tank Incident Reports (LUST), Facility Inventory Database (CA FID UST), Underground Storage Tank Database (UST), Historical Underground Storage Tank Database (HIST UST) and the Aboveground Storage Tank Database (AST)
- California Regional Water Quality Control Board (SLIC)
- DTSC Liens (LIENS)

- California Hazardous Material Incident Report System (CHMIRS)
- Confirmed release sites involving DTSC (RESPONSE)
- Pollutant emissions data (AIRS)
- The DTSC database that identifies sites that have known contamination or sites that require further investigation (ENVIROSTOR)

There were no tribal records found that applied to the area in question

4.2 Additional Environmental Record Sources

Federal Sources:

- Corrective Action Report (CORRACTS)
- A listing of sites with engineering controls in place (USENG CONTROLS)
- A listing of sites with institutional controls in place (US INST CONTROL)
- Department of Transportation Office of Pipeline Safety incident and accident data (DOT OPS)
- A listing of clandestine drug lab locations (US CDL)
- Land Use Control Information System (LUCIS)
- A listing of sites that cleanup responsibility and standards have been established by U.S. District Courts (CONSENT)
- Uranium Mill Tailings sites (UMTRA)
- Open Dump Inventory (ODI)
- Torres Martinez Reservation Illegal Dump Site Locations (DEBRIS REGON 9)
- Mines Master Index File (MINES)
- Administrative cases and pesticide enforcement actions (FTTS) and (HIST FTTS)
- FIFRA-related reporting (SSTS)
- Material Licensing Tracking System (MLTS) and Radiation Information Database (RADINFO)
- Facility Index System (FINDS)

State and Local Sources:

- Known and potential hazardous substance sites (HIST Cal-Sites, formerly ASPIS and replaced by ENVIROSTOR)
- School Property Evaluation Program (SCH)
- Toxic Pits CEANUP Act Sites (Toxic Pits)
- Sites designated by LUST, SWF/LS and Cal-Sites (Cortese)
- Recycling facilities (SWRCY)
- Statewide Environmental Evaluation and Planning System (SWEEPS UST)
- Proposition 65 Database (Notify 65)
- Recorder Land Use Restrictions (DEED)
- DTSC low threat level properties (VCP)
- Dry cleaning-related facilities with EPA ID numbers (DRYCLEANERS)
- Clandestine Drug Labs (CDL)

- Well Investigation Program Case List (WIP)
- Extracts from hazardous waste manifests (HAZNET)
- List of waste tire haulers (HAULERS)

4.3 Historical Record Review

Historic aerial, topographic, and fire maps were not obtained for this search due to the cost for a search of this magnitude. Instead the assessment reviewed these historical records obtained for a previous assessment (USACE, 2008) which covered most of the same area, with the assumption that the historic records haven't changed significantly since 2008.

4.4 Regional Contaminant Considerations During Future Construction

Environmental records searches are efficient ways to identify and track sites where past releases have occurred. Other types of contaminants unlikely to be picked up in an environmental records database search are considered in this report because they are associated with significant industries that were historically active in the region. Gold mining and large-scale agricultural activities are two historic activities that have produced regional contaminants in the project area and should be considered when future levee construction occurs.

The levee system around the American River and Natomas Basin lies in a region that has a history of gold mining. The regional history of gold mining coupled with the regional agriculture land use and the historic use of dredge material from the rivers as levee construction material, suggests there are some chemicals for which data collection would be useful to confirm if contaminants from these historic process are present. These include arsenic, mercury, pesticides and herbicides.

Additionally, based on the vehicular use of the existing levee crown, lead and petroleum hydrocarbons may have been released to the upper 3 feet of the roadway shoulder on the existing levee, especially at bridge locations where old corrosion-resistant lead paint would be present. Herbicides are sometimes used for weed abatement on the levees.

Railroad tracks are located on the levee on the Sacramento River west of the downtown area. Old railroad ties were preserved with creosote. Newer wooden ties are probably preserved with copper arsenate. If the railroad road bed must be disturbed for the project, further investigation for these contaminants will be warranted.

Sacramento Regional County Sanitation District has regionalized its wastewater treatment system (SRCSD, 20007). Most or all wastewater is collected and pumped to the regional wastewater treatment plant in Elk Grove. Treated wastewater is discharged just south of the Freeport Bridge in the project area. Wastewater from Natomas is moved south to the west of the Sacramento River and now crosses to Elk Grove at the Freeport bridge. There were wastewater treatments plants located between Exposition Park and Howe Avenue (the "Arden Station") and on River Walk Road (the "Northeast Facility") along the north bank of the American River. These old wastewater treatment plants have been converted to pumping and flow equalization stations that today move wastewater through force mains across the American River. The

Sacramento City Interceptor parallels the Sacramento River south of the Sacramento Marina for several miles. The Dry Creek Interceptor crosses Dry Creek and Magpie Creek between Rio Linda Blvd and Dry Creek Road near the Sacramento Northern Bike Trail, and crosses Arcade Creek at Rio Linda Boulevard. There is no record of overflows but the wastewater pipelines are to be avoided and special personal protective equipment for biological hazards may be required when working in close proximity to present and former treated wastewater discharge locations.

5.0 Site Reconnaissance

5.1 Methodology and Limiting Conditions

The study area site visit was conducted for the Phase 1 ESA by staff from the Environmental Engineering and Geology Sections of the United States Army Corps of Engineers, Sacramento District.

The objective of the site visit was to identify recognizable environmental concerns in connection with the property. Common environmental concerns that were looked for include the following: asbestos; construction and demolition debris; drums; landfill or solid waste disposal sites; pits, ponds or lagoons; wastewater; fill dirt, depressions, mounds, or any artificial structures; PCB containing transformers; monitoring wells, and the presence or likely presence of any hazardous substance or petroleum products on the property under conditions that indicate an existing release, a past release, or a material threat of a release on the property or into the ground, groundwater, or surface water of the property.

The mere presence of a contaminated property on the dry side of the levee was generally considered to be avoidable. The presence of contaminated properties on the “wet” side of the levee or features on or inside the levee such as monitoring wells, drains and pipelines were generally assumed to be unavoidable.

5.2 Observations

Site visits to properties screened as likely affecting the Project were conducted on August 2, 2012. Photographs are included in Appendix D. Findings are incorporated in Chapter 8.

6.0 Historical Records

The 2008 assessment consulted Sanborn Fire Insurance records to glean any information about sites along the rivers that was not presented elsewhere. Basically, the maps confirmed the other sources that most of the industrial sites were located at or near the confluence of the American and Sacramento Rivers. Searching the Internet yielded a few aerial and historical photographs, and maps which confirmed earlier findings about the locations of various industrial sites.

6.1 Aerial Photo Review

EDR provided an Aerial Photo Decade Package (EDR, 2008) for the previous environmental site assessment (USACE, 2008). "Birdseye" view drawings, aerial and other historical photographs were obtained from the EDR report, and from the California State Library in Sacramento, California.

It is unlikely any additional historical air photos have been found in the last four years. Therefore this assessment used the 2008 historical record search from the previous study. It is included in Appendix E.

Several industrial sites were noted, especially along the confluence of the American and Sacramento Rivers. Water-borne shipping was more in evidence in the past than it is today, although the modem ships, while fewer in number carry much larger payloads.

6.2 Topographic Maps

The search also consisted of reviewing historical topographic maps (Appendix F):

- Sacramento East Maps
    - From the edition of 1949, six specific crossings of the Sacramento River were noted, Highway 99, H Street, a footbridge south of Arden Town and three railroads, Southern Pacific, Sacramento Northern and Western Pacific. In addition, there are power line crossings.
    - There are several pumps related to miscellaneous water uses associated with the levees.
    - The edition of 1954 showed the same features, except that the footbridge had become the Watts Avenue crossing.
    - The map of 1967 added a golf course east of the highway 80 and south of Cal Expo, a sewage disposal plant east of mile 5 and west of Howe Avenue, a filtration plant east of the Sacramento State University campus and a fire station, presumably associated with the Sacramento State campus.
    - The Sacramento East map of 1975 was a photo revision of the 1967 edition and added a crossing at Howe Road.

- The editions of 1980 and 1992 did not show any significant additions.

• Sacramento West Maps

- The map of 1949 noted an intake tower and filtration plant south of the confluence of the American River, a pumping plant at the end of the Natomas Canal, a boat launching ways near the confluence of the American River and a clay pit and stack near Clay Bank Bend. Crossings include the Tower Bridge, the I Street Bridge and the Jibboom Street Bridge.
- There are several pumps related to miscellaneous water uses associated with the levees.
- In the 1967 edition, the clay pit has become Lake Greenhaven and the stack is gone. The Sacramento Deep Water Ship Channel is added. There is a new filtration plant south of the end of 10th Avenue, a new sewage disposal plant at the confluence of the barge canal leading to the deep water ship channel, a new marina at Miller Park and borrow pits across the river from the old intake tower. Highway 80, 5 and a proposed crossing for highway 880 are added.
- The photo revision of the 1967 edition shows the actual location of the 880 bridge.

• Clarksburg Maps

- The 1952 edition of the Clarksburg map shows a sugar beet plant located north of Clarksburg on the west side of the Sacramento River and the Borges-Clarksburg Airport at benchmark 13. There are several pumps related to miscellaneous water uses associated with the levees. Crossings include several power lines and a drawbridge south of Freeport.
- The version of 1967 shows three industrial waste ponds in or on the location of the sugar beet plant, just north of Willow Point Road. There is a new water tank and sewage disposal plant at Freeport Bend on the east side of the Sacramento River
- The1975 photo revision of the 1967 edition adds a small waste pond at the old sugar beet plant.
- The 1980 photo revision of the 1967 edition shows a new waste pond at the sugar beet plant.

6.3 Commercial Environmental Database Report

The EDR “Environmental Records Database Search is in Appendix A. Due to the size of the document (over 2,000 pages), the Appendix contains only an extract. The entire document is included in PDF file format on CD.

7.0 Interviews

Six interviews were conducted in the 2008 assessment. One new interview was conducted for this assessment.

7.1 Interviews with Owners/Occupants

Individual Contacted	Date	Title/Organization	Contact Information	Page Number (USACE, 2008)
Mr. Joe Borges	10/23/2008	Owner Borges-Clarksburg Airport	N/A	5

7.2 Interviews with State and Local Government Officials

Tim Kerr, the President of the American River Flood Control Agency (ARFCA) was interviewed. His response is in Appendix C.

Previous interviews included

Individual Contacted	Date	Title/Organization	Contact Information	Page Number (USACE, 2008)
Ms. Mary Perlea	8/31/2007	US Army Corps of Engineers	(916) 557-7185	1
Mr. Terrie Figueroa	9/13/2007	Secretary/ RD1000	(916) 922-1449	2
Mr. Richard Payan	9/13/2007	Battalion Chief/City of Sacramento Fire Department	(916) 216-0311	3
Mr. Paul Devereaux	9/20/2007	General Manager/RD1000	(916) 922-1449	4
Lt(jg) Simone Moss	9/25/2008	Waterways Officer, USCG	(510) 437-2975	6

The interviewees had very limited knowledge of HTRW contaminated properties located along the levees. It is recommended that public officials at the California Department of Toxic Substances Control and Central Valley Regional Water Quality Control Board involved in cleanup of contaminated sites that may affect the Project be interviewed to help define how the Type 1 sites affect project alternatives.

8.0 Findings

The EDR search identified over 600 records of possible HTRW concerns within the study area. All of these sites were identified in the EDR search by a site identification-focus map number identifier. Many of the Site ID's had multiple records of possible HTRW associated with them so the total number of identified sites in the EDR report was 491. Of these, 7 sites were considered to be Type 1 and 45 were found to be Type 2.

Appendix B provides a summary of each site including its levee station and reach, whether or not the site may affect future construction, and links to regulatory information. This information was used to focus the Phase 1 ESA to the potential effects of the identified HTRW sites on future construction activities. Further investigation of potentially hazardous sites included review of available site information in the EnviroStor and GeoTracker databases maintained by the California Department of Toxic Substance Control (DTSC) and California State Water Resources Control Board (SWRCB) respectively. Reports from these databases were used to determine the possible impact identified sites may have on future construction activities. Characteristics used to classify the site included the suspected mass and volume of contaminants, their mobility within the soil-groundwater-air matrix, and the likelihood of traditional levee remediation measures impacting contaminated media.

As previously discussed, sites were classified in one of three types according to the potential for harmful impacts on future construction activities. Tables 2 & 3 below provide a listing of all the Type 1 and Type 2 sites, respectively. Figure 3 provides a map showing the location of all Type 1 and 2 HTRW sites. The remaining Type 3 sites are identified in Appendix A and B.

Whether a contaminated site adjacent to the levee is avoidable depends in part on what work is proposed to be done on the levee; erosion control, stability, seepage control, relocation or raise in elevation. Justification for classification as a Type 1 or Type 2 site is further discussed in Chapter 9, Findings.

Table 2 – Type 1 HTRW Sites

Type 1 Sites – HTRW concerns that may impact future activities					
Site Name	**EDR ID#**	**Assessor Parcel Number**	**Levee Reach**	**Address**	**Summary**
Full Stop Mini Mart	41-5	251-0292-016	ARN_D	3200 Rio Linda Blvd, Sacramento, CA 95815	Gasoline plume at gasoline station adjacent to the levee at a bridge crossing. Active remediation by soil vapor extraction and air sparging is occurring. The oxidizer is immediately adjacent to the levee. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606701131
Old Bryte Landfill	79-6	042-280-011	WS*	50035 County Rd 126, West Sacramento, CA 95691	Old unregulated landfill, uncapped, is immediately adjacent to the Sacramento Bypass levee. Waste from a car battery lead recycling company in West Sacramento was dumped here. http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001146 http://www.calrecycle.ca.gov/SWFacilities/Directory/57-CR-0002/Detail/
CA State Railroad Museum Unit SHO	120-7	No parcel number, public land	ARS_D	501 Jibboom ST, Sacramento, CA 95814	Union Pacific Railroad (old Southern Pacific) railyard. The museum appears to be a surrogate for the historic locomotive repair shops being preserved here for reevelopment. There are monitoring wells in the levee and in the waterfront park at this location. http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=80001665
TOSCO Corporation/ ConocoPhillips Sacramento Terminal	174-11	009-0030-054	ARS_D	76 Broadway, Sacramento, CA 95818	Bulk fuel terminal used by ConocoPhillips. Soil and groundwater beneath the site have been impacted by petroleum hydrocarbons, specifically from active gasolines and diesel fuels. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0606742138
TOSCO Corp. – Sacramento Terminal	174-11	009-0020-001	ARS_D	66 Broadway, Sacramento, CA 95818	Wet side of major petroleum release above still undergoing cleanup. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL372513618
Chevron Sacramento Terminal 1001620	178-11	009-0012-072 009-0012-071	ARS_D	2420 Front St, Sacramento, CA 95818	More dry-side petroleum bulk handling facility. Petroleum pipelines pass through the levee at all properties. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700657
Harbor Sand & Gravel/Bell Marine Co Inc.	128-8	001-0160-011	ARS_B	200 28th St, Sacramento, CA	Release was reported in 1994. The property is now occupied by an asphalt concrete recycling company. The new business has fenced off the levee road and its operation is encroaching on the levee.

					http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0606705586

Table 3 Type 2 HTRW Sites

Type 2 Sites – HTRW concerns that are not likely to impact future activities					
Site Name	**EDR ID#**	**Distance from Centerline (miles)**	**Levee Reach**	**Address**	**Summary**
PG&E – Sacramento Site	156-11	009-0012-003	ARS_D	2000 Front St, Sacramento, CA 95818	Former manufactured gas plant that produced gas from raw materials such as coal and petroleum from 1873 to 1930. Primary COCs in both soil and groundwater are BTEX, and PAHs including naphthalene. http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34490048
Shell #204-6678-9003	98-7	001-0011-003	ARS_D	225 Jibboom, Sacramento, CA 95814	Gasoline plume in groundwater. Two gasoline stations, one adjacent to the levee. This waterfront area was a Superfund site that has been redeveloped. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700500
Continental Chemical Company	69-8	275-0111-006	ARN_C	2175 Acoma St Sacramento, CA 95815	LUST, SLIC site http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL185472918
Micheletti Property	69-8	275-0112-005	ARN_C	2147 Barstow St Sacramento, CA 95815	SLIC site,CVOCs http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0606762702
Martin Sprocket & Gear Inc.	99-8	001-0070-036	ARS_C	1199 Vine St STE 204, Sacramento, CA 95814	Small quantity hazardous waste generator with a diesel tank on-site. No record of releases. A cluster of three monitoring wells was found in the levee near this property, probably associated with Lovotti Bros. at 1275Vine St. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606793627
Petro-Speed	123-8	001-0142-010 001-0142-011 001-0142-012	ARS_B	324 N 16th St Sacramento, CA	Old gasoline station that has been closed. Petroleum plume being monitoring. Sufficiently removed from the River. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700184
Sacramento City Landfill	128-8	001-0170-018	ARS_B	20 28th and A St, Sacramento, CA	Now known as “Sutter’s Landing Regional Park”. Closed Sacramento public solid waste landfill. The landfill is built right up against the levee so that the levee crown road is downhill from the landfill cap. Stormwater drains on the

					landfill cap go through the levee to the River. Landfill gas collection wells are close to the levee. A Kinder Morgan petroleum pipeline is buried under the water-side toe of the levee. http://www.calrecycle.ca.gov/SWFacilities/Directory/34-AA-0018/Detail/
Scollan (Old Sac City Landfill)	133-8	001-0160-013	ARS_B	24th and A St, Sacramento, CA	Old dump site along the AR between railyard and Sac City landfill http://www.calrecycle.ca.gov/SWFacilities/Directory/34-CR-5005/Detail/
Sacramento Housing & Redevelopment Agency	149-11	009-0012-002	ARS_D	1920 Front St, Sacramento, CA 95814	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700254 http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34240036
Sacramento Municipal Utility District (SMUD)	158-11		ARS_D	Front & T St, Sacramento, CA 95814	Across the street from the PG&E site. Historical uses include vehicle maintenance, fueling, and storage. The potential site contaminants of concern are polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons as gasoline (TPH-Gas), and volatile organics (VOCs). All remedial activities were completed in 2008, however, DTSC required the continued operation and maintenance of the GWETs and associated monitoring wells and prohibited certain uses of the site. http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34490057
Delta Shores	243-20		ARS_G	8145 Freeport Blvd Sacramento CA 95832	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000000566
Wastewater Treatment Plant Yolo APN		058-260-016 058-260-019		1991 South River Rd West Sacramento, Ca 95691	Worth noting for Health & Safety while working in this reach of the Sacramento River http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0611300170
Pell Drive	15-4	237-0400-019	ARN_F	4220 Pell Dr Sacramento, CA 95838	Chlorinated solvents in soil http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001003
Great American Stage	29-4	250-0122-011	ARN_F	3560 Western Ave #A Sacramento, CA 95838	NPDES/WDS Permit
Strawberry Manor/PCB Site	43-4	263-0313-003	ARN_E	188 Olmstead Dr Sacramento, CA 95838	PCB in soil http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34330034

Arco #6168	98-7	001-0012-016	ARS_D	222 Jibboom St, Sacramento, CA 95814	TPH release site by the levee, across the street from the Shell release site, monitored. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700277 http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700537
Jibboom Junkyard	119-7	001-0190-015	ARS_D	I-5 and Jibboom St, 240-260 Jibboom St, Sacramento, CA 95814	Redeveloped property, former NPL site http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34490023
Colfax Yard	63-8	275-0072-002		2225 Colfax St, Sacramento, CA 95815	LUST site, TPH-diesel release http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700685
Lawson Mechanical Yard	69-8	275-0113-022	ARN_C	58 Arden, Sacramento, CA 95815	LUST site http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700395
Rawson Drug & Sundry Corp	69-8	275-0111-001	ARN_C	2189 Acoma St Sacramento, CA 95815	Old North Sacramento, minor release, to groundwater but this property is adjacent to the levee. http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606793621
A-1 Plating Company	69-8	275-0112-017	ARN_C	2170 Acoma St Sacramento, CA 95815	Case closed in 2010 http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=34340002 http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL185792942
Petrocheck	69-8	275-0161-001	ARN_C	2076 Acoma St Sacramento, CA 95815	Old North Sacramento,Historical site, County response with no state involvement, organic liquid in soil
Green Property	69-8	275-0163-001	ARN_C	1000 Del Paso Blvd Sacramento, CA 95815	Old North Sacramento 4-LUSTS, County response
Central Maintenance	74-8	Public land	ARN_C	2080 Railroad Dr Sacramento, CA 95815	LUST, County response , Los Rios Community College
Subway Truck Parts	81-8	275-0200-010	ARN_C	903 Del Paso Blvd Sacramento, CA 95815	LUST, county response
Mells Cargo Supply	84-8	274-0200-005	ARN_C	1940 Railroad Dr Sacramento, CA 95815	LUST Site, RWQCB response http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700530
Special Service	84-8	274-0200-010	ARN_C	1930 Railroad Dr Sacramento, CA 95815	LUST, county response
Robertson Sand & Gravel	92-8	001-0160-011	ARN_B	(28th & A) Sacramento (County), CA	MINES database, no longer operating
Kinder Morgan Energy	95-8	275-0310-031	ARN_B	1111 Exposition Blvd	SLIC site – leaking petroleum pipeline

Partners KMEP Exposition Blvd		thru 275-0310-038		Sacramento, CA 95815	http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000001938
Sacramento Police Dept/Prop MNGT/Armory	96-8	001-0200-035	ARS_C	555 Sequoia Pacific Blvd Sacramento, CA 95814	Clandestine drug lab
Direct Current Inc.	101-8	275-0270-018	ARN_B	150 Commerce Cir Sacramento, CA 95815	RCRA Battery hazwaste, no releases
Sacramento Marina	174-11	009-0020-003	ARS_D	2701 Marina View Dr Sacramento, CA 95818 (2710 Ramp Way?)	LUST Site, County response
Setzer Forest Products Inc.	187-11	009-0030-019 009-0270-009 009-0270-033 009-0030-043 009-0030-045 009-0286-012	ARS_D	2570 3rd St and 2630 5th St, Sacramento, CA 95818	LUST site http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606786234
Sacramento City Unified School District Maint. Yard	191-11	009-0237-013	ARS_D	425 1st Ave (AKA 5th St @ 1st Ave), Sacramento, CA 95818	LUST site http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606728136
Utilities Sump 2A	210-11	017-0036-021 017-0036-020 017-0036-017 017-0036-019	ARS_D	3530 Riverside Blvd, Sacramento, CA 95814	AST with sump County response
Shell	216-11	017-0071-004	ARS_D	4000 S Land Park Dr Sacramento, CA 95822	LUST Site (TPHg) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700962
Hubacher Cadillac Inc	148-13	295-0020-004	ARN_A	1 Cadillac Dr Sacramento, CA 95825	UST permit
CA State University Sacramento	179-13	005-0010-007 005-0010-027 079-0221-002 079-0221-009	ARS_A	6000 J St Sacramento, CA 95819	hazmat storage http://www.envirostor.dtsc.ca.gov/public/hwmp_profile_report.asp?global_id=CAT080031115&starttab=
Chevron #9-1743	153-14	294-0107-006	ARN_A	3481 Fair Oaks Sacramento, CA 95825	LUST Site (TPHg) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700085

Arco #4968	153-14	292-0123-002	ARN_A	3501 Fair Oaks Blvd Sacramento, CA 95825	LUST Site (TPHg) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700223
Shell SS	153-14	292-0141-008	ARN_A	3510 Fair Oaks Blvd Sacramento, CA 95825	LUST Site (TPHg) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606701030
BP #11176 (Former)	153-14	293-0260-001	ARN_A	3480 Fair Oaks Blvd Sacramento, CA 95825	LUST Site (TPHg) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0606700100
Glenbrook Shopping Plaza	192-14	078-0011-017	ARS_A	8700-8760 La Riviera Dr, Sacramento, CA 95831	SLIC Site (PCE) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000003071
Riverside Plaza Shopping Center	225-16	030-0330-015	ARS_F	6401 Riverside Blvd, Sacramento, CA	SLIC Site (PCE) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0606734773
Cleaners Express	231-19	031-1030-017 031-0070-077 031-0070-078	ARS_F	7600 Greenhaven Dr, Unit 7, Sacramento, CA 95831	SLIC Site (PCE) http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000003089

9.0 Opinions

All information used to form the following opinions was gathered from the most recent reporting information available in the EnviroStor or GeoTracker databases, site reconnaissance and interviews. If no citation is given, general information on the website or the site details from the EDR report were used.

9.1 Type 1 Sites

76/66 Broadway & 2420 Front St EDR Site 174-11 is a bulk fuel terminal now used by ConocoPhillips. The site is located within an industrial area of Sacramento, north and east of the Sacramento Marina at the intersection of Front and Broadway Streets. Twelve aboveground storage tanks associated above- and below- ground piping, a loading rack, and several buildings are present at the site. Previous site investigations have revealed that the soil and groundwater beneath the site have been impacted by petroleum hydrocarbons, specifically from active gasoline and diesel fuels. Previous remedial activities include a soil vapor extraction system set up in 1991 that removed 26,000 pounds of petroleum hydrocarbons after two months; an expanded soil vapor extraction system. The site is located on both sides of the levee. Pipelines run through the levee from 2420 Front Street to 66 Broadway and from 76 Broadway to the Sacramento Marina. Pipelines also run parallel to the levee from 76 Broadway to 2420 Front Street. 66 Broadway St is on the water side of the levee while 76 Broadway is on the dry side of the levee making this site unavoidable. 2420 Front Street is on the dry side of the levee.

EDR Site 79-6, Yolo County Assessor Parcel Number (APN) 042-280-011 is the Old Bryte Landfill. The landfill was an old unregulated dump site. DTSC has found lead above risk level. The source of the lead is probably scrap from an old car battery lead recycling operation in West Sacramento which is now the site of Sacramento Stucco. The waste would probably classify as CERCLA hazardous waste based on toxicity and leachability. Very likely the north levee for the Sacramento Bypass cannot be moved without dumpsite removal by the non-federal sponsor at 100% non-federal expense.

EDR Site 41-5, Sacramento County APN 251-0292-016 Full Stop Mini Mart in ARN Reach N on Arcade Creek is a leaking underground storage tank adjacent to the Arcade Creek levee adjacent to a bridge. The site is being actively remediated with soil vapor extraction and air sparging and it is possible but not probable that some vapor-laden air from the air sparging escapes the soil vapor extraction system into the levee. The thermal/catalytic oxidizer is trailer-mounted and located at the dry side toe of the levee. The site is included here as it is an actively remediated groundwater contamination site on a parcel adjacent to the levee.

EDR Site Number 120-7 in ARS Reach D is the old Southern Pacific rail yard with engine houses. It has no assessor parcel number as it is now public land for historic preservation and redevelopment. This was a major cleanup site. Monitoring wells are found in and on the west (wet) side of the levee along the Sacramento River. Land use controls are in place. It is probably possible to avoid contamination at this site but the project will need to work around monitoring wells that will be in the way and will need to avoid digging or pile-driving.

EDR Site 128-8 APN 001-0160-011 "Harbor Sand & Gravel" in ARS Reach B is now the site of an asphalt concrete recycling company. The company has blocked the levee road with a gate and is encroaching on the levee including the wet side with piles of recyclable pavement materials and structures (see photo in Appendix D).

EDR Site 156-11 is a former manufactured gas plant, Pacific Gas & Electric Sacramento Site, which produced gas from raw materials such as coal and petroleum from 1873 to 1930 and was demolished in 1961 (there is a second such site located "south of the western end of Broadway"). The site is located between the Sacramento River levee and Front Street. Residuals of the manufactured gas process include lampblack, tar, total petroleum hydrocarbons (TPH), and spent oxides. Contaminants associated with these residues have been detected in soil and groundwater beneath the Site. The primary COCs in both soil and groundwater are benzene, toluene, ethylbenzene and total xylenes (BTEX), and polycyclic aromatic hydrocarbons (PAHs) including naphthalene. The major benzene plume is located in the north eastern area of the site, while a small separate plume exists at the foot of the levee in the central western part of the site based on monitoring results from May 2008 (DTSC 2011).

Numerous remedial investigations, soil removal actions, and many years of groundwater extraction and treatment have been conducted at the Site. Remedial activities to date include: capping of the PG&E property with a geosynthetic clay liner, soil excavations, operation of a soil vapor extraction treatment system, and operation of a groundwater evapotranspiration system (GWETs). Currently, the site is paved to control soil migration and exposure. The Ranney Collector was decommissioned in 2009, thus necessitating a remedy modification. Soil stabilization/solidification, by the addition of Portland Cement and Activated carbon to the areas where the highest contamination is found in the vadose zone, has been selected as the remedial action. Any future construction work would be impacted by the presence of this plume and monitoring system.

9.2 Type 2 Sites

Several sites were visited during site reconnaissance and downgraded from a preliminary classification as "Type 1" to a final classification of Type 2 or 3 based on avoidability. They are discussed here. ***Sites determined from map reconnaissance and records review to be Type 2 and Type 3 sites without site reconnaissance are not discussed***. Most of the sites discussed here are contaminated properties adjacent to or near to the levee that are unlikely to affect levee improvements so long as the properties are avoided.

EDR Site 158-11 is a vacant parcel owned by the Sacramento Municipal Utility District that is located at the intersection of Front and T Streets with the Sacramento River and levee to the west and the Interstate 5 Highway to the east. EDR 158-11 is located on the other side of Front Street, across from EDR 156-11. The site's historical uses include vehicle maintenance, fueling, and storage. This site was discovered during the groundwater investigation of EDR Site 156-11. The investigation revealed that the site consisted of a source of contaminants that were migrating to the groundwater. The potential site contaminants of concern are polynuclear aromatic hydrocarbons (PAHs) from diesel fuel, total petroleum hydrocarbons as gasoline (TPH-Gas), and volatile organics (VOCs). The source of contamination was removed in 1999 by excavating 4,290 tons of contaminated soil and disposing of it off-site. A seasonal soil vapor extraction system (SVETs) operated at the site from November 1999 to May 2007. The SVETs is estimated to have captured and treated 34 pounds of reactive organic compounds and 13 pounds of benzene from the vadose zone. Groundwater monitoring continues to occur on site. The site relies on the EDR Site 156-11 GWETs to remove residual amounts of site contaminants. The California Department of Toxic Substances Control (DTSC) certified that all appropriate remedial actions have been completed in April 2008. However, DTSC also recorded land use controls requiring that the operation and maintenance of the GWETs and associated monitoring wells continue and prohibiting certain uses of the site. Any future construction work should avoid this area (DTSC 2010a).

EDR Site 98-7 Sacramento APN 001-011-003 Shell station in ARS Reach C/D on the Sacramento River south of the American River is a monitored leaking UST across the street from another gasoline station that abuts the levee but does not reach it.

EDR Site 99-8 APN 001-0070-036 in ARS Reach C, Martin Sprocket & Gear. The site is adjacent to the levee along with a few other such properties. The presence of a cluster of three monitoring wells in the levee, probably due to a petroleum release at the Lovotti Brothers site at 1275Vine St, is noted here but unlikely to affect erosion control measures.

EDR Site 128-8 Sacramento APN 001-0170-018 in ARS Reach B is the Sacramento City Landfill, now known as the Sutter's Landing Regional Park (Appendix D). This will have a minor impact on erosion control measures for the Project. The landfill uses the levee as a cap so that the landfill crown is topographically above the road on the levee crown. Stormwater drains from the landfill cap penetrate the levee that will need to be avoided. Landfill gas extraction wells are in or next to the levee but if working properly present no problem. The Kinder Morgan petroleum pipeline parallels the Union Pacific Tracks through most of Placer and Sacramento Counties, but the presence of the landfill between the levee and the tracks at this location means they have buried the pipeline at the toe of the levee on the water side at this location. There is no documented petroleum release from the pipeline in this location, but there is such a site in old North Sacramento across the river. It should be feasible to place riprap on the levee at this location, but care must be taken to avoid landfill features such as the storm water drains and the buried pipeline.

EDR Site 133-8 APN 001-0160-013 the Scollan or "Old Sac Landfill" in ARS Reach B is mentioned here because it is an old, unregulated and un-engineered landfill abutting the levee. An on-line aerial photo in Google Map™ appears to show a cap being placed on the landfill. No leachate collection system or landfill gas collection system are visible.

EDR Site 69-8 Sacramento APN 275-0111-006 Continental Chemical and EDR Site APN 275-0112-005 Micheletti Property in ARN Reach B/N along the Natomas Main Drainage Canal are minor groundwater release sites with petroleum and chlorinated solvents. The issue is that there are several more such documented and monitored release sites in close proximity in this old industrial area in old North Sacramento. There is also a release site immediately adjacent to the levee at EDR Site 69-8, APN 275-0111-001. Due to the close proximity of many contaminated industrial sites and two such properties adjacent to the levee, the project would likely need to ensure that levee improvements would not adversely impact groundwater contaminant plume migration at this location.

1920 Front St - Sacramento Housing and Redevelopment Agency Site: The site was once a lumberyard. A leaking UST and waste from the adjacent manufactured gas plant were found on the property. The property was razed to create a parking lot that caps residual soil waste and has land use controls. A concrete wall 3 feet high separates the parking lot from the levee. A few empty waste drums remain on site. The State of California had a Ranney Well by the river used by the California Department of General Services to provide cooling water for downtown State office buildings. The well was destroyed in 2009.

2000 Front St – PG&E Former Manufactured Gas Plant Site: The site has been razed and paved over. It is located on the dry side of the levee. Land use restrictions are in place. The site is fenced and requires permission from PG&E to access. 40 hour OSHA Hazwoper training is required for access. The site is being remediated by Arcadis with deep soil mixing for soil stabilization/solidification. Remediation may be complete by November. The site is adjacent to the “Boat Section” of Interstate 5 which is lower than the River and actively de-watered. The property must be avoided.

Additional sites were categorized as Type 2 based on record screening without site visit. A summary can be found in Table 3. Type 3 sites are found in Appendix B.

10.0 Conclusions

A Phase 1 Environmental Site Assessment was performed in accordance with the scope and limitations of ASTM E 1527-05 and USACE ER 1165-2-132 for the American River Common Features GRR project. Any exceptions to, or deletions from, these practices have been outlined within the report. There are many contaminated properties adjacent to the levees on the dry side that are considered to be avoidable due to the nature of the contamination or the nature of the work proposed on the levees. This assessment has identified sites with recognized and probably unavoidable environmental conditions at the locations shown in Table 4 below.

Table 4 - Sites with Recognized Environmental Conditions

Site Name	Reach	EDR #	APN	Issue
Old Bryte Landfill	Sacramento Bypass	79-6	042-280-011	Lead in soil,
Southern Pacific Rail Yard	ARS Reach D Sacramento River	120-7	002-0010-049 002-0010-023 002-0010-054	CVOC, TPH Groundwater Plume, land use restrictions
Full Stop Mini Mart	ARN Reach N Arcade Creek	41-5	251-0292-016	TPHg plume at levee bridge crossing with air sparging
Robertson/Harbor Sand & Gravel	ARS Reach B American River	92-8 128-8	001-0160-011	Levee Encroachment, recycled pavement
Old North Sacramento	ARN Reach B/N Natomas Main Drainage Canal	69-8	275-0111-001	CVOC, TPH Groundwater Plumes adjacent to levee, multiple properties
TOSCO Corp./ Conoco-Phillips Sacramento Terminal	ARS_D	174-11	009-0030-054 009-0012-071 009-0012-072	Petroleum release site on dry side of the levee. Petroleum pipelines pass through the levee.
TOSCO Corp. Conoco-Phillips Sacramento Terminal	ARS_D	174-11	009-0020-001	Petroleum release site on wet side of the levee

The historical land uses of the region may also contribute to residual contamination of the entire project area with agricultural fertilizers, herbicides, and pesticides as well as arsenic and mercury from mining operations in the region. Additional sampling will be required during subsequent investigations to determine if project areas have been impacted by these historical contaminants.

On-line records are limited. For contaminated sites identified as unavoidable under the alternatives considered by the American River Common Features GRR, a public records review is recommended at the Central Valley Regional Water Quality Control Board office and the Sacramento Regional Office of the Department of Toxic Substances Control as the next step to determine if additional investigation is required to determine the impact of these sites on the project. Current groundwater plume maps and environmental liens / deed restrictions incorporating land use controls are particularly needed. Emphasis is needed on the Sacramento

Terminal bulk fuel handling facility, the old Southern Pacific rail yard, and the old Bryte landfill as these may affect alternative selection.

Due to the GRR process being a parent project that identifies the need for future actions, a Phase 1 ESA will need to be performed again, either at the appropriate GRR phase planning milestone, or at the beginning of actual construction activity. The subsequent Phase 1 ESA(s) will investigate if new sites have emerged and if existing sites still pose a threat to planned construction.

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12.0 Signature of Environmental Professional

8/6/2012

James C. Powers, PG, CEG, CHg #7062
Environmental Engineering Section

13.0 Qualifications of Environmental Professional

I declare that to the best of my knowledge and belief, I meet the definition of Environmental Professional as defined in 40 CFR , Section 321.10

8/6/2012

James C. Powers, PG, CEG, CHg
Environmental Engineering Section

FIGURES

Figure 1 American River Common Features GRR Levee Reaches and Project Area

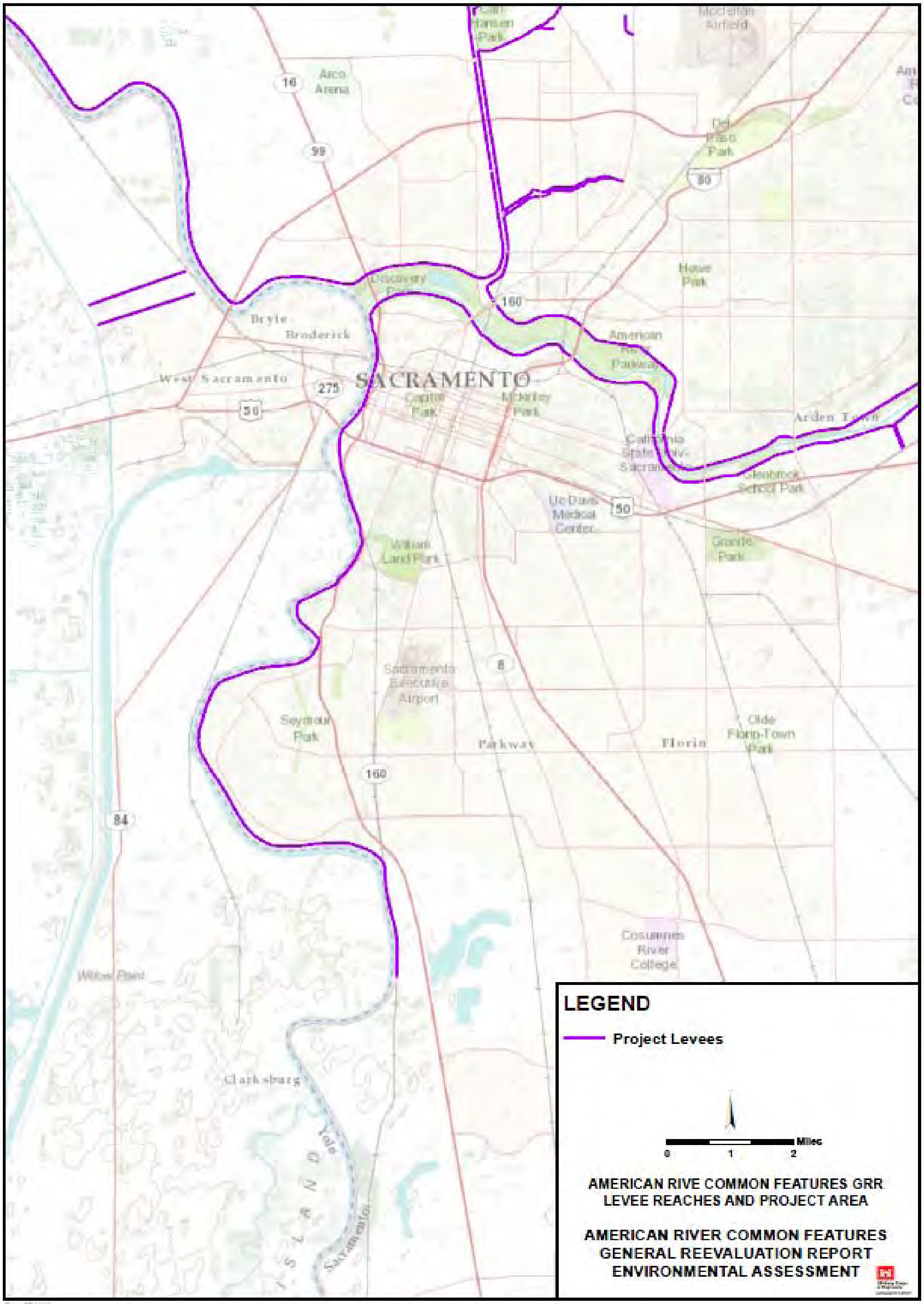


Figure 2 EDR Site Map with Search Radius

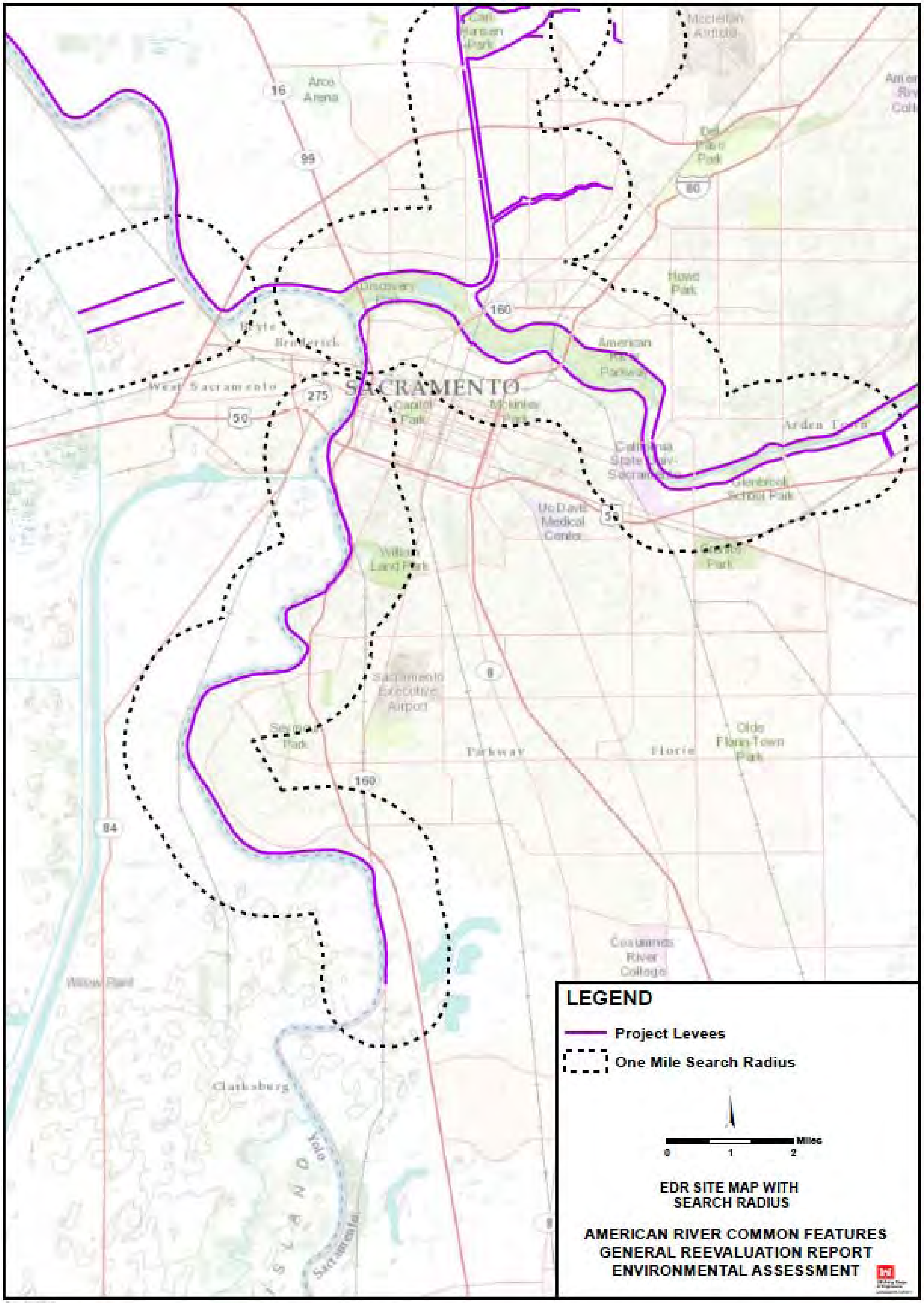
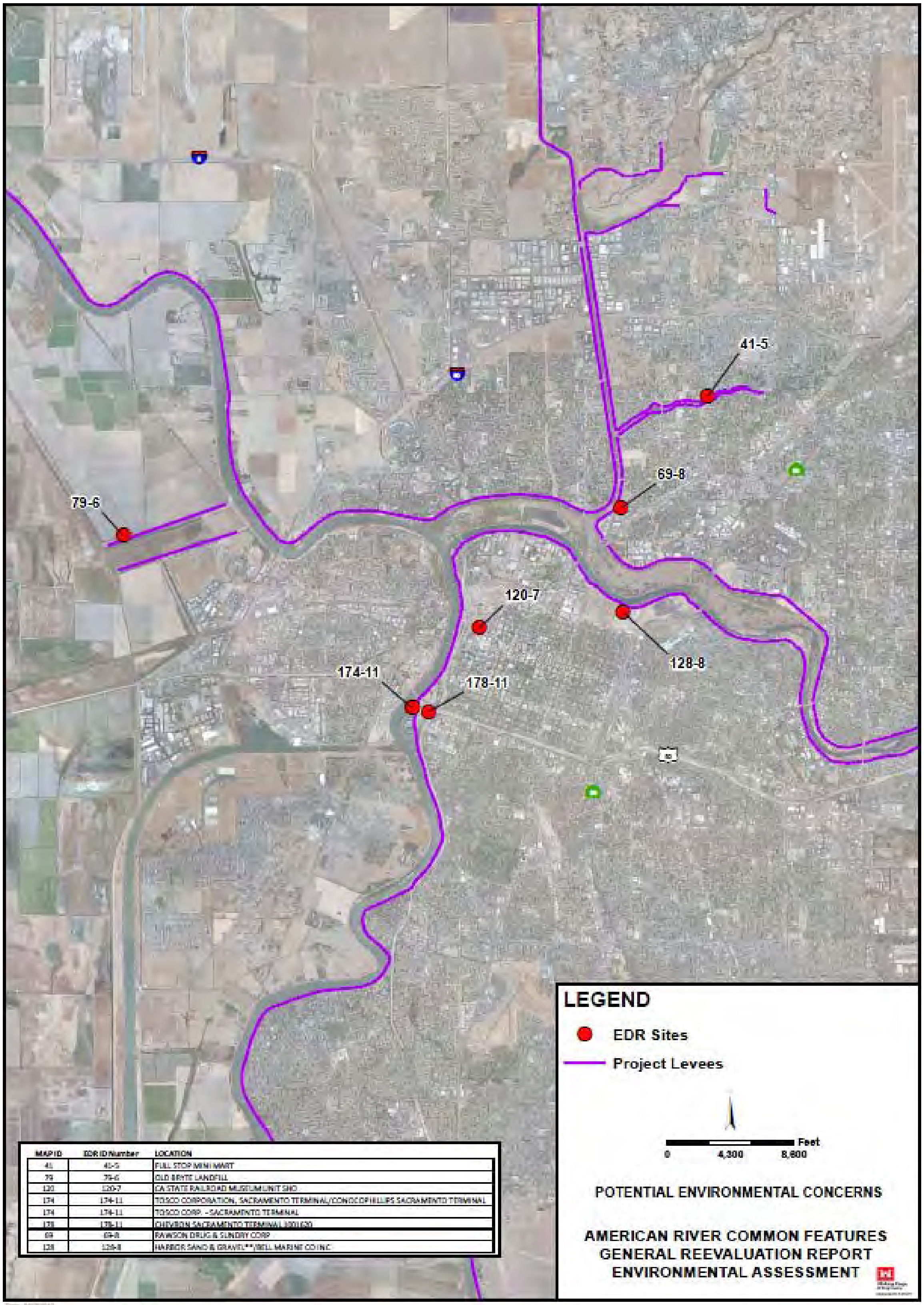


Figure 3 Potential Environmental HTRW Concerns



Habitat Mitigation, Monitoring, and Adaptive Management Plan

American River Common Features General Reevaluation Report

December 2015

US Army Corps of Engineers

CENTRAL VALLEY FLOOD PROTECTION BOARD
PUBLIC SAFETY
AND FLOOD MANAGEMENT
STATE OF CALIFORNIA

SAFCA
Sacramento Area Flood Control Agency

CONTENTS

Tables

Figures

Appendices

Acronyms and Abbreviations

AAHU	Average Annual Habitat Unit
ARCF	American River Common Features
BA	biological assessment
BO	biological opinion
BPWG	Bank Protection Working Group
Corps	U.S. Army Corps of Engineers
County Parks	Sacramento County Department of Parks and Recreation
EIS/EIR	environmental impact statement/environmental impact report
ERDC	Engineer Research and Development Center
ETL	Engineering Technical Letter
GRR	general reevaluation report
GGS	giant garter snake
HEC-EFM	Hydrologic Engineering Center Ecosystem Function Model
HMMAMP	Habitat Mitigation, Monitoring, and Adaptive Management Plan
HSI	Habitat Suitability Index
HU	Habitat Units
IEP	Interagency Ecological Program
IWG	Interagency Working Group
IWM	instream woody material
NMFS	National Marine Fisheries Service
NEMDC	Natomas East Main Drainage Canal
PCE	primary constituent elements
PED	preconstruction engineering and design
RM	river mile
sDPS	southern distinct population segment
SRA	shaded riverine aquatic habitat
SMART	specific, measurable, attainable, realistic, and timely
SMWSE	summer mean water surface elevation
SWIF	System Wide Improvement Framework
TSP	tentatively selected plan
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
VELB	valley elderberry longhorn beetle
WRDA	Water Resources Development Act
WMWSE	winter mean water surface elevation

1.0 INTRODUCTION

1.1 Purpose and Goals

Mitigation for habitat loss is a requirement to compensate for the loss of habitat due to a Federal action. Section 906(d) of the Water Resources Development Act of 1986 states that project alternatives must support recommendations with a specific plan to mitigate fish and wildlife losses. Additionally, the Endangered Species Act states that the purpose of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts.

The primary purpose of vegetation and habitat monitoring is to determine the level of ecological function at each mitigation site as a part of an overall plan to create sites that offset the loss of habitat affected by construction of the proposed project. This Habitat Mitigation Monitoring and Adaptive Management Plan (HMMAMP) describes the types of habitats that will be impacted, the potential impacts caused by the project, and describes the types and amounts of mitigation that would be established in order to compensate for habitat losses. This plan also establishes a framework for the creation of mitigation sites and methods to evaluate the success of these sites in order to ensure that the goals and requirements of the project's required mitigation are accomplished.

The goal of the HMMAMP is to ensure that the conservation values of the mitigation sites are maintained in good condition in perpetuity. The plan's biological goals are to: (1) preserve the abundance and diversity of native species (particularly special status species) in the established habitats; (2) protect the habitat features from the effects of indiscriminate land use that may adversely impact mitigation habitats; and (3) restore any adverse condition within the mitigation habitat areas that may affect or potentially affect these areas. Monitoring would be conducted in a manner compatible with the type of mitigation site. Mitigation requirements are provided by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) through biological opinions (BOs) received through the Endangered Species Act Section 7 consultation process.

The HMMAMP would be implemented by U.S. Army Corps of Engineers (Corps) staff through coordination with USFWS and NMFS. Monitoring would be conducted by qualified biologists from the Corps, USFWS, the Department of Water Resources (DWR), and the Sacramento Area Flood Control Agency (SAFCA) as necessary. Upon completion of the monitoring term as established by USFWS and NMFS, the land would be turned over to the non-Federal sponsor to be maintained in perpetuity.

1.2 Project Description

The Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared for the American River Common Features General Reevaluation Report (ARCF GRR) describes the environmental resources in the project area; evaluates the direct, indirect, and cumulative environmental effects of the three alternative plans; and identifies avoidance, minimization, and mitigation measures. Most potential adverse effects would be either short term or would be avoided or reduced using best management practices.

The proposed project is located in and around the city of Sacramento, California. Sacramento is the state capital of California, located at the confluence of the Sacramento and American Rivers in the northern portion of California's Central Valley. The Sacramento Metropolitan area is the fourth largest in California, and includes seven counties and seven incorporated cities.

The purpose of the ARCF GRR is to evaluate alternatives to reduce the flood risk in the greater Sacramento area. The Sacramento Metropolitan area is one of the most at risk areas for flooding in the United States. There is a high probability that flows in either the American or Sacramento Rivers would stress the network of levees protecting the study area to the point that levees could fail. The consequences of such a levee failure would be catastrophic since the inundated area is highly urbanized and the flooding could be up to 20 feet deep.

The ARFC GRR study area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Arcade Creek, and the Magpie Creek Diversion Canal (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento. A vegetation variance is being sought to allow for vegetation to remain on the lower portion of the waterside levee slope. A complete summary of the proposed measures is shown on Table 1.

Table 1. Proposed Measures for the ARCF Project.

Waterway/Location	Extent of Action	Proposed Measures
American River	North and south levees from the Sacramento River upstream for approximately 12 miles.	Construct bank protection or launchable rock trenches
Sacramento River	East levee from the American River to the North Beach Lake levee.	Install cutoff walls Construct bank protection Construct levee raise (Alternative 1 – 7 miles Alternative 2 – 1 mile) Construct geotextile reinforced soil embankment levee near the town of Freeport
NEMDC	East levee from Dry/Robla Creek to the American River.	Install cutoff walls Construct floodwalls
Arcade Creek	North and south levees from NEMDC to Marysville Boulevard.	Install cutoff walls Raise floodwalls Construct geotextile reinforced soil embankment levee in steep areas on the south levee
Magpie Creek Diversion Canal	Downstream of Raley Boulevard	Raise levees
Magpie Creek area	West side of Raley Boulevard	Construct new levee Install floodgates at two properties
Magpie Creek area	East of Raley Boulevard	Acquire property to create a flood detention basin Widen the Raley Boulevard/Magpie Creek bridge and raise the elevation of the roadway Remove the Don Julio Creek culvert
Magpie Creek area	Sacramento Northern Bike Trail	Install culvert beneath bike trail embankment Excavate new channel connecting culvert to Robla Creek Install stone erosion protection in new channel
Sacramento Weir and Bypass	North bypass levee to 1,500 feet north.	Widen the Sacramento Weir and Bypass by approximately 1,500 feet Construct a new section of weir and levee remove the existing Sacramento Bypass north levee

The Recommended Plan for the ARCF project is to Improve Levees and Widen the Sacramento Weir and Bypass. This alternative would include widening the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass and alleviate the need for most of the raises along the Sacramento River downstream of the bypass. This alternative would also include minimal levee raises along the Sacramento River. In order to reduce the extent of levee raises, the Sacramento Weir and Bypass would be widened to divert more flows into the Yolo Bypass. The levees along the American River, NEMDC, Arcade, and Magpie Creeks, would be improved to address identified seepage, stability, erosion, and height concerns. The levees along the Sacramento River would be improved to address identified seepage, stability, erosion, and a small amount of levee raising. Due to hydraulic, real estate, and environmental constraints within the study area, the majority of the levees would be fixed in place.

The Recommended Plan is the least environmentally damaging practicable alternative under the Clean Water Act and the environmentally preferable alternative under NEPA. This is mainly because it results in less riparian habitat removal along the Sacramento River.

1.3 Proposed Flood Risk Management Measures

1.3.1 Bank Protection

This measure consists of placing rock revetment on the river's bank, and in some locations on the levee slope, to prevent erosion (Figure 1). When necessary, the eroded portion of the bank would be filled and compacted prior to the rock placement. The sites would be prepared by clearing and stripping the site prior to construction. Small vegetation and loose materials would be removed. In most cases, large vegetation would be permitted to remain at these sites. Temporary access ramps would be constructed, if needed, using imported borrow material that would be trucked on site.

1.3.2 Launchable Rock Trench

This measure includes construction of a launchable rock filled trench, designed to deploy once erosion has removed the bank material beneath it (Figure 1). All launchable rock trenches would be constructed outside of the natural river channel. The vegetation would be removed from the footprint of the trench and the levee slope prior to excavation of the trench. The trench would be excavated at the toe of the existing levee. The bottom of the trench would be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and amount of rock required.

After excavation, the trench would be filled with revetment that would be imported from an offsite location. After rock placement the trench would be covered with a minimum of 3 feet of the stockpiled soil to allow for planting over the trench. Some vegetation could be permitted over the trench if planted outside the specified vegetation free zone required by the Engineering Technical Letter (ETL) 1110-2-583. This vegetation would likely be limited to native grasses, shrubs, and trees with shallow root systems to ensure that they do not limit the functionality of the trench during a flood event.

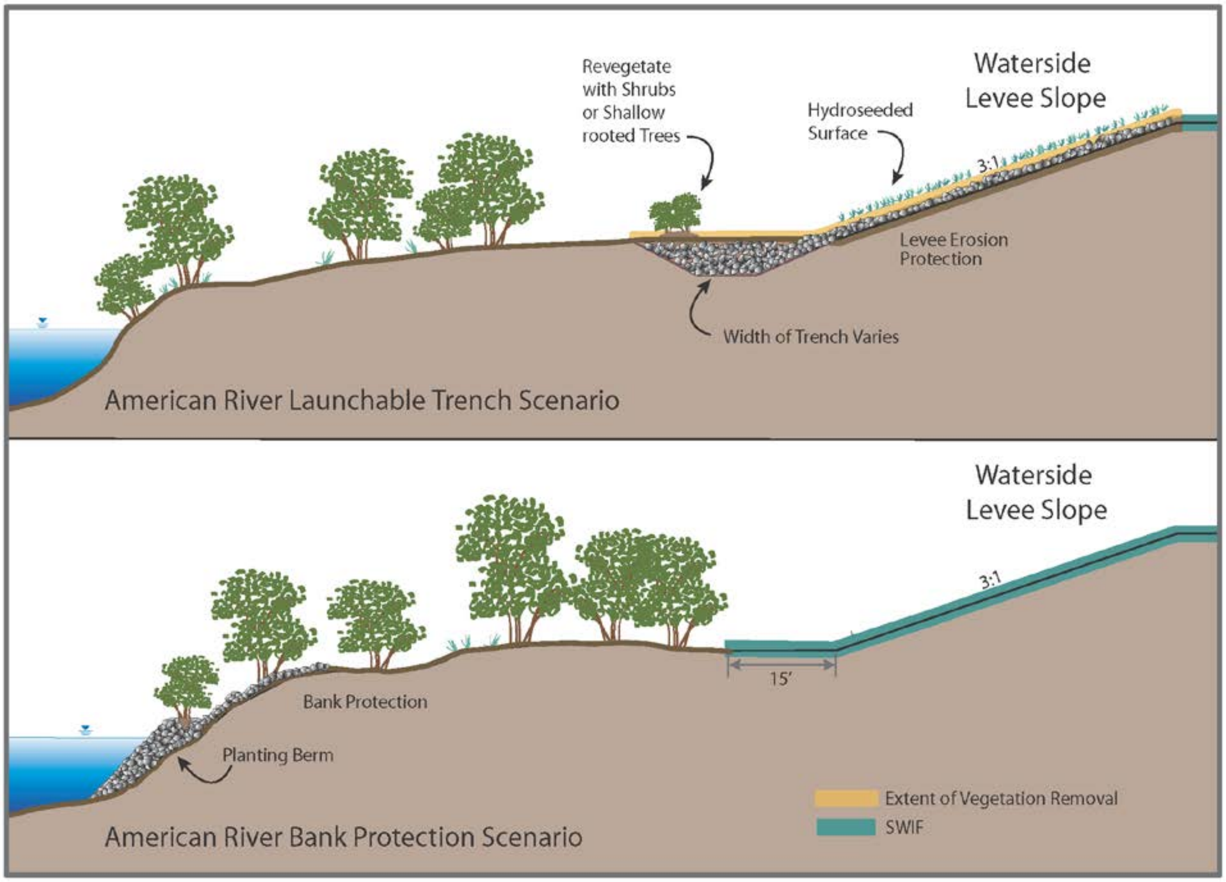


Figure 1. Bank Protection and Launchable Rock Trench Typical Design for American River.

1.3.3 Levee Geometry

Where the existing levee cross section does not meet the levee design requirements, slope flattening, crown widening, and/or a levee raise is required. This improvement measure addresses problems with slope stability, geometry, overtopping, and levee toe and crest access and maintenance. To begin levee embankment grading, the area would be cleared, grubbed, stripped, and, where necessary, portions of the existing embankment would be excavated to allow for bench cuts and keyways to tie in additional embankment fill. The existing levee centerline would be shifted landward where necessary in order to meet Corps standard levee footprint requirements. The levee crown patrol road would be re-established and a new toe access corridor would be added 10 feet landward of the levee toe in areas where levee raises are required.

1.3.4 Cutoff Walls

To address seepage concerns, a cutoff wall would be constructed through the levee crown (Figure 2). A cutoff wall is a water resistant barrier that is constructed vertically into the levee and is designed to prevent through and underseepage in the levee. The cutoff wall would be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of approximately 80 feet. For cutoff walls of greater depth, the DSM method would be utilized.

Prior to construction of either method of cutoff wall, the construction site and any staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded up to half the levee height to create a large enough working platform (approximately 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids.

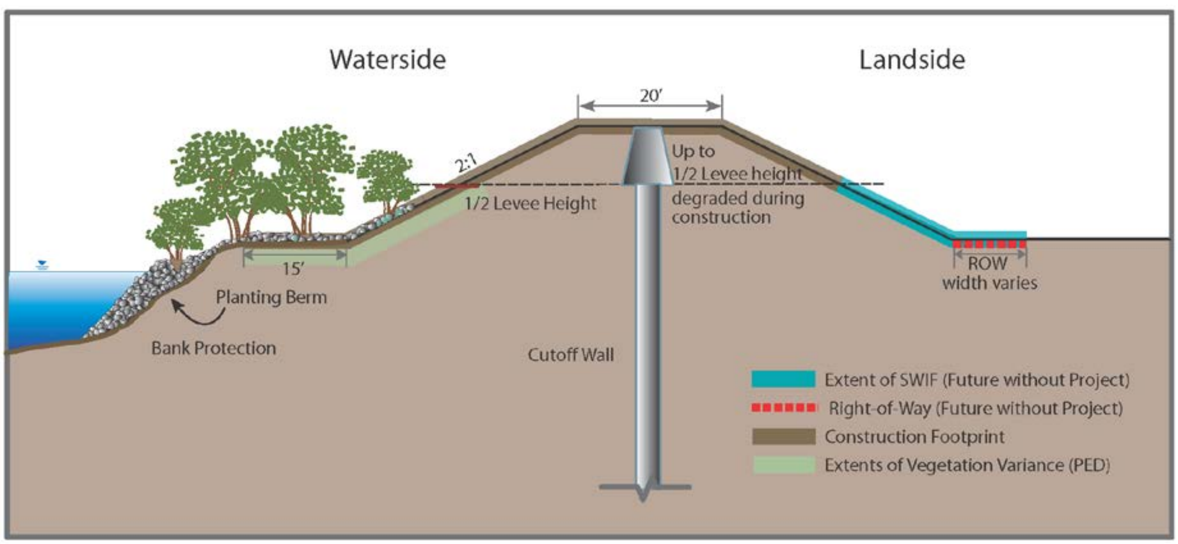


Figure 2. Fix-in-place with Cutoff Wall and No Levee Raise on the Sacramento River.

1.4 Types of Habitats Impacted

A variety of different habitat types occur within the study area including riparian habitat, shaded riverine aquatic habitat, oak woodland, ruderal herbaceous grasslands, and wetlands. These habitats are briefly described below.

1.4.1 Giant Garter Snake Upland Habitat

The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, other waterways and agricultural wetlands such as irrigation and drainage canals and rice fields, and the adjacent uplands. Essential habitat components consist of: (1) adequate water during the snake's active period, (early spring through mid-fall) to provide a prey base and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat; (3) upland habitat for basking, cover, and retreat sites; and (4) higher elevation uplands for cover and refuge from flood waters.

Disturbed soil surfaces such as levee slopes should be hydroseeded to prevent erosion and restore upland habitat for giant garter snake. USFWS recommends a mix of at least 20 to 40 percent native grasses such as annual fescue (*Vulpia* spp.), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.); 2 to 10 percent native forbs; 5 percent rose clover (*Trifolium hirtum*); and 5 percent alfalfa (*Medicago sativa*). Approximately 40 to 68 percent of the mixture may be non-aggressive European annual grasses such as wild oats (*Avena sativa*), wheat (*Triticum* ssp.), and barley (*Hordeum vulgare*). The Corps will not include aggressive non-native grasses, such as perennial ryegrass (*Lolium perenne*), cheatgrass (*Bromus tectorum*), fescue (*Festuca* spp.), giant reed (*Arundo donax*), medusa-head (*Taeniatherum caput-medusae*), or Pampas grass (*Cortaderia selloana*) in the hydroseed mix.

1.4.2 Shaded Riverine Aquatic Habitat

Shaded Riverine Aquatic (SRA) habitat is defined as the near shore aquatic area occurring at the interface between a river and adjacent woody riparian habitat. The principal attributes of this valuable cover type include: (1) the adjacent bank being composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water; and (2) the water containing variable amounts of woody debris, such as leaves, logs, branches and roots, as well as variable depths, velocities, and currents. SRA occurs throughout the study area along the riverbanks and levees and is contained within the other identified habitat types in these areas.

1.4.3 Valley Foothill Riparian Habitat

Most valley foothill riparian habitat in the study area (hereafter referred to as “riparian habitat”) occurs along the American and Sacramento Rivers, but smaller riparian areas are found at all of the levees in the study area. The overstory of the riparian habitat consists of mature, well-established trees: Fremont cottonwood (*Populus fremontii)*, valley oak (*Quercus lobata*), black willow (*Salix gooddingii*), and box elder (*Acer negundo var. californicum*). During the surveys, Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), and white alder (*Alnus rhombifolia*) were also observed. The shrub layer consists of smaller trees and shrubs; representative species observed were poison oak

(*Toxicodendron diversilobum*), sandbar willow (*Salix exigua*), and California blackberry (*Rubus ursinus*). Elderberry shrubs (*Sambucus mexicana*), the host plant of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), which is Federally listed as threatened, were observed in the riparian habitat along the American and Sacramento Rivers.

1.4.4 Valley Elderberry Longhorn Beetle Habitat

The valley elderberry longhorn beetle (beetle) is completely dependent on its host plant, elderberry (*Sambucus* spp.), which is a common component of the remaining riparian forests and adjacent upland habitats of California's Central Valley. These forests consist of several canopy layers with a dense undergrowth (Katibah, 1983). Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), willows (Salix spp.), and valley oak (*Quercus lobata*) are common upper canopy species. The shrub layer consists of smaller trees and shrubs; representative species observed were poison oak (*Toxicodendron diversilobum*), sandbar willow (*Salix exigua*), and California blackberry (*Rubus ursinus*). Studies have found that the beetle is more abundant in dense native plant communities with a mature overstory and a mixed understory.

1.4.5 Oak Woodland

Valley oak woodland is dominated with valley oak, interior live oak, box elder, white alder, Oregon ash, and black walnut. Shrubs in this habitat type include California grape (*Vitis californica*), California blackberry (*Rubus ursinus*), and blue elderberry (*Sambucus cerulea*). Oak woodlands are typically found on higher or upland portions of the study area than the riparian habitat discussed above.

1.4.6 Green Sturgeon Benthic Habitat

Little is known about juvenile green sturgeon freshwater rearing. Green sturgeon are presumed to be generalist, opportunistic benthic feeders. Benthic substrate needs to include abundant prey items within estuarine habitats and soft bottom substrates for juvenile, subadult, and adult life stages. Prey species for juvenile, subadult, and adult green sturgeon within bays and estuaries primarily consist of benthic invertebrates and fishes, including crangonid shrimp, burrowing thalassinidean shrimp (particularly the burrowing ghost shrimp), amphipods, isopods, clams, annelid worms, crabs, sand lances, and anchovies. These prey species are critical for the rearing, foraging, growth, and development of juvenile, subadult, and adult green sturgeon within the bays and estuaries. The benthic substrate should include sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of elevated levels of contaminants (e.g., selenium, PAHs, and pesticides) that can cause adverse effects on all life stages of green sturgeon.

1.5 Environmental Baseline

The ARCF action area includes the mainstem Sacramento River from Freeport (river mile [RM] 46) in the Delta upstream to the American River confluence (RM 60). The region also includes the lower American River from the confluence with the Sacramento River upstream to RM 11, NEMDC, Arcade Creek, Dry/Robla Creeks and Magpie Creek.

Downstream from the American River confluence, the Sacramento River is moderately sinuous (average sinuosity of 1.3), with the channel confined on both sides by man-made levees enhanced by decades of man-made additions. The channel in this reach is of uniform width, is not able to migrate, and is typically narrower and deeper relative to the upstream reach due to scour caused by the concentration of shear forces acting against the channel bed (Brice 1977). Channel migration is similarly limited along the lower American River because of man-made levees and regulated flows from Folsom Dam.

The natural banks and adjacent floodplains of both rivers are composed of silt- to gravel-sized particles with poor to high permeability. Historically, the flow regimes caused the deposition of a gradient of coarser to finer material, and longitudinal fining directed downstream (sand to bay muds). The deposition of these alluvial soils historically accumulated to form extensive natural levees and splays along the rivers, 5 to 20 feet above the floodplain for as far as 10 miles from the channel (Thompson 1961). The present day channels consist of fine-grained cohesive banks that erode due to natural processes as well as high flow events (Corps 2012).

Seasonal high flows enter the adjacent Yolo Bypass from this reach of the Sacramento River via the Sacramento Bypass (RM 63). Tidal influence emanating from Suisun Bay extends up the Sacramento River for 80 miles to Verona, with greater tidal variations occurring downstream during low river stages in summer and fall.

NEMDC is an approximately 13.3-mile, human-made, partially leveed drainage channel that provides drainage from Sankey Road and connects streams of the American Basin (Dry, Robla, and Arcade Creeks) to the American River. South of the confluence with Arcade Creek, the east and west levees of NEMDC are dominated by wild oats grasslands while the channel is characterized by Fremont cottonwood forest, with smaller amounts of valley oak woodland, smart-weed cocklebur patches, and perennial rye grass fields.

The approximately 16.2-mile-long channel of Arcade Creek extends east-to-west from Orangevale to the American River, via NEMDC. The north and south levees are dominated by wild oats grasslands. Valley oak woodland is the main riparian vegetation type along Arcade Creek, but Fremont cottonwood forest occurs in small patches along the easternmost reach of Arcade Creek near NEMDC. Hardstem bulrush marsh is found within Arcade Creek near Norwood Avenue while water primrose wetlands are predominant within the channel of Arcade Creek from approximately the confluence with NEMDC to Norwood Avenue. East of Norwood Avenue, the creek channel becomes narrower, and dominated by a shaded canopy of valley oak woodland.

The environmental baseline in the ARCF GRR action area includes the sites completed under the Water Resources Development Act (WRDA) 1996 and WRDA 1999 authorizations. The WRDA 1996 construction included installing slurry walls in the American River levees to address seepage and slope stability concerns. The WRDA 1999 construction included shape and slope improvements to specific reaches of the American River levee system and some segments of the Sacramento River levees.

1.6 Potential Project Impacts

A vegetation variance is being sought by the Sacramento District to comply with ETL 1110-2-583 on the waterside of the levee. The vegetation variance request requires the Corps to show that the safety, structural integrity, and functionality of the levee would be retained if the vegetation were to remain in place. This would allow most of the trees on the lower one half of the waterside slope to remain in place, reducing the impacts to vegetation and wildlife. In addition, a System Wide Improvement Framework (SWIF) agreement with the non-Federal sponsor would allow vegetation and encroachment compliance on the landside of the levee to be deferred and addressed by the local maintaining agency at a later time. This would be a beneficial effect to vegetation and wildlife, as standard long-term Operations and Maintenance (O&M) of the levee system in the study area would otherwise require the immediate removal of all vegetation. Vegetation impacts throughout the project area would occur in the proposed construction footprint.

Infestation of invasive weeds has an influence on hydraulic roughness during high-flow events, decreases the capacity of the floodway, and adversely affects bank erosion and sedimentation processes. The Corps would remove the noxious weeds from the various plant communities prior to construction. For each of the action alternatives, direct effects to stands of grassland habitat with invasive plants would result from clearing and grubbing and rock placement activities once levee improvements and construction begin. The total number of acres of grassland affected would be refined during the design phase.

The estimated impacts for the habitats discussed above and special-status species impacts as established in the BOs are shown below on Table 2.

Table 2. Impacts for ARCF GRR Recommended Plan.

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs **	Vernal Pools **	Delta Smelt Spawning **	Shallow Water **	Oak Woodland *	Wetlands
American River North										
Reach A (American River)			22 acres	19,000 LF	284 stems					
Reach B (American River)			0.5 acre		183 stems					0.05 acre
Reach C (American River & NEMDC)									1 acre	
Reach D (Arcade Creek)			6 acres							
Reach E (Arcade Creek)			4.5 acres							
Reach F (NEMDC)									1 acre	
Reach G (Dry/ Robla Creek)	*No Measures Proposed*									
Reach H (Dry/ Robla Creek)	*No Measures Proposed*									
Reach I (Magpie Creek)						0.25 acre				
American River South										
Reach A (American River)			37 acres	6,850 LF	1,437 stems					0.35 acre
Reach B (American River)			2 acres	875 LF	1,144 stems					

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs **	Vernal Pools **	Delta Smelt Spawning **	Shallow Water **	Oak Woodland *	Wetlands
Reach C (American River)				3,800 LF	81 stems					
Reach D (Sacramento River)			10.6 acres	9,200 LF	163 stems		10 acres	5 acre		
Reach E (Sacramento River)			6.2 acres	8,850 LF			6 acres	4 acre		
Reach F (Sacramento River)			41.6 acres	21,100 LF			12 acres	4 acre		
Reach G (Sacramento River)			12.2 acres	11,150 LF			4 acres	1 acre		
Sacramento Weir and Bypass	30 acres	15 acres	8 acres	1,500 LF						See GGS Aquatic
TOTAL (Alt 2)	**30 acres**	**15 acres**	**150.6 acres**	**82,325 LF**	**3,292 stems**	**0.25 acre**	**32 acres**	**14 acre**	**2 acre**	**0.40 acre**

*State Listed **Federal Listed ***State and Federal Listed

1.7 Habitat Evaluation

For the purposes of evaluating the impacts of the ARCF GRR on fish and wildlife resources in the project area, with a reliance on existing information in the spirit of SMART Planning, the Habitat Evaluation Procedures (HEP) for the *American River Watershed Investigation, Common Features Modifications, Mayhew Drain Site Project* were relied upon as a reference baseline. The HEP for the Mayhew Drain Site Project was conducted in 2005 to quantify anticipated impacts to fish and wildlife and their habitats, and to determine mitigation needs for the project. This HEP was selected for the ARCF GRR because the Mayhew Drain Site is located within the overall study area for the ARCF GRR, and the habitat type and value at the Mayhew site is consistent with the habitat that occurs throughout the ARCF GRR project area.

The HEP provided information for two general types of wildlife habitat comparisons: 1) the relative value of different areas at the same point in time; and 2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed project on wildlife habitat were quantified and compensation needs (in terms of acreage) for the project were determined. The assumption that habitat for selected wildlife species or communities can be numerically described by a model produces a Habitat Suitability Index (HSI). The HSI, a value from 0.0 to 1.0, provides a measure of habitat quality for a sample area in terms of suitability for the particular species or community being evaluated.

For the Mayhew Drain project, the Northern oriole Riparian woodland model was used because it best suited the habitat type in the project area. The quantity part of the formula is any measure of area which is appropriately sized for the study. The product of these two measures is comparable to "habitat value" which equals habitat quantity multiplied by habitat quality. This formula is expressed as a Habitat Unit (HU).

Habitat Type x Habitat Area = Habitat Value

The Average Annual Habitat Units (AAHUs) over the life of the project can then used to determine mitigation needs. The model, variables measured and data collection methods used for the Mayhew Drain Project are shown below in Table 3. For the ARCF GRR, data was estimated visually and using google earth.

Table 3. HSI model, Variables, and Data Collection Methods.

HSI Model and Cover-Type	HSI Model Variables	Data Collection Method
Northern oriole Riparian Woodland	V1 – Average height of deciduous tree canopy	Visual estimation
	V2- Percent deciduous tree crown cover	Densiometer along belt transects
	V3 – Stand width	Estimated using aerial photos

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific baseline variables and/or HSI values for each evaluation element for the Northern oriole based on best professional knowledge of performance at other mitigation sites, literature on plant growth, and conditions at reference sites. To predict changes in the HSI for each future scenario, it was necessary to make assumptions regarding baseline and future values within project impact and compensation areas. The assumptions made for the ARCF GRR with project can be seen in Table 4 and without project can be seen in Table 5 below.

Table 4. HSI Variables for the ARCF GRR Based on Habitat Values.

HEP - FUTURE WITH-PROJECT							
Time	**Variables**			**Suitability Index**			**Output**
	V1	**V2**	**V3**	**SI-V1**	**SI-V2**	**SI-V3**	**HSI**
TY1	20	25%	2	0.60	1.00	1.00	0.84
TY2	10	25%	2	0.30	1.00	1.00	0.67
TY25	20	75%	2	0.60	0.75	1.00	0.77
TY50	35	75%	2	1.00	0.75	1.00	0.91
HSI = (V1*V2*V3)^1/3						Average	0.80

Table 5. HSI Variables for the ARCF Without Project Based on Habitat Values.

HEP - FUTURE WITHOUT-PROJECT							
Time	**Variables**			**Suitability Index**			**Output**
	V1	**V2**	**V3**	**SI-V1**	**SI-V2**	**SI-V3**	**HSI**
TY1	35	75%	2	1.00	0.75	1.00	0.91
TY2	35	75%	2	1.00	0.75	1.00	0.91
TY25	35	75%	2	1.00	0.75	1.00	0.91
TY50	35	75%	2	1.00	0.75	1.00	0.91
HSI = (V1*V2*V3)^1/3						Average	0.91

The HSI value of 0.80 in Table 4 results from a temporal loss of habitat value and function from the removal of existing mature riparian habitat. This is due to the lower values given to mitigation plantings during the establishment period. The ARCF GRR proposes to implement riparian habitat mitigation at a 2:1 ratio. A 2:1 mitigation ratio is a reasonable requirement for implementation of mitigation for this habitat type, because the proposed project will decrease the connectivity of existing habitat along the Sacramento River system. Additionally, temporal loss of onsite habitat results in a reduction in value and function of the new vegetation within the mitigation areas as it grows to maturity. This also accounts for the loss of other services that riparian vegetation provides, including:

- An essential food source for fish and wildlife, including ESA species;

- Aquatic resting and refugia for resident and migratory fish species;
- Large woody debris recruitment;
- Nesting and rearing habitat for terrestrial wildlife species;
- Nutrients for the ecological system;
- Shade for the river which maintains water temperatures and dissolved oxygen concentrations; and,
- Increased habitat value for VELB.

The above-listed functions and services associated with a newly created acre of habitat are usually expected to be less than those associated with natural habitat. As a result the 2:1 mitigation ratio is appropriate to compensate for the loss of mature riparian habitats.

To determine whether the proposed mitigation amounts were cost effective, a Cost Effective /Incremental Cost Analysis (CE/ICA) was conducted. The CE/ICA report is included with this document as Appendix A. The Mayhew HEP and the Northern oriole HSI model variables were referenced to establish habitat values for the CE/ICA. The cost for mitigation was estimated for five scenarios for the purposes of the CE/ICA for both alternatives. These scenarios included: (1) maximized on- and off-site habitat creation; (2) maximizing the use of credits at a local mitigation bank; (3) a combination of on-site, off-site, and a mitigation bank at a 2:1 ratio; (4) a combination of on-site, off-site, and a mitigation bank at a 1:1 ratio; and (5) a combination of on-site, off-site, and a mitigation bank at a 3:1 ratio. Per the discussion above and the results shown in Table 4, the loss in ecological value associated with on-/off-site mitigation was reduced to an overall 0.8 habitat value. The Recommended Plan is the Alternative 2 Combination Plan with a 2:1 ratio, because it is the smallest mitigation proposal that accomplishes the terms and conditions of the Biological Opinions, and the CE/ICA determined that it was a cost effective plan.

1.8 Proposed Mitigation Measures

The preparation of mitigation plans, including objectives, plan design, determination of success criteria, and monitoring needs would be coordinated with Federal and State resource agencies to the greatest extent practicable. Mitigation objectives are specific actions to be taken to avoid and minimize adverse effects, such as Best Management Practices, compliance with Federal and State regulatory laws, and environmental commitments. Mitigation objectives include the identification of specific amounts of mitigation required to compensate for remaining unavoidable losses.

Items below present a summary of environmental commitments that the Corps would implement as part of the ARCF project to mitigate by avoiding and minimizing impacts and to meet the requirements, terms and conditions specified in the BOs.

- A vegetation variance is being sought by the Sacramento District to comply with ETL 1110-2-583 in order to exempting the Sacramento River and East Side Tributaries from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The ARCF GRR will be complying with the ETL on landside of the levee under a SWIF. This approval process is in alignment with the Corps' Levee Safety Program's goal of maintaining public safety as the primary objective and assuring application of consistent and well documented approaches. As a result, vegetation removed under the ARCF GRR would be limited to the footprint necessary in order to construct the proposed measures. Disturbance or removal of trees or larger woody vegetation would be replaced with native riparian species, outside of the vegetation free zone, as established in the ETL.
- The Corps would use a rock soil mixture to facilitate re-vegetation of the proposed project area. A (70:30) rock to soil ratio would be implemented. The soil-rock mixture would be placed on top of the of the rock revetment to allow native riparian vegetation to be planted to ensure that SRA habitat lost is replaced or enhanced. Alternatively, a rock lined soil trench approach could be taken.
- Vegetation removal, particularly tree removal, would be conducted between September 16 and January 31, to the extent feasible, to minimize potential loss of active bird nests and bat maternity roosts.
- Construction would be scheduled when listed terrestrial and aquatic species would be least likely to occur in the project area, approximately May or June through October, depending on the species present on a site-specific basis. If construction needs to extend into the timeframe that species are present, the Corps would coordinate with the resource agencies.

In addition to the mitigation measures described above, the Corps would implement compensatory mitigation, as described below.

The mitigation acreages for ARCF GRR were calculated using a combination of site surveys and aerial photography from Google Earth to determine where the project footprint impacted different habitat types. The habitat types included: riparian, SRA, giant garter snake (GGS), valley elderberry longhorn beetle (VELB), vernal pools, and Delta smelt shallow water. The acreages of each impacted habitat type were then broken up by reach.

Table 7 describes the types and amounts of habitat that would be potentially impacted by the project, the duration of the impacts, the amount of mitigation in total acreage per the USFWS and NMFS BOs and the recommendations of the USFWS Coordination Act Report, and projected costs as estimated according to existing mitigation prices.

Costs are displayed showing the difference between the estimate for on site mitigation or mitigation at a bank. Currently, permanent impacts to GGS uplands and aquatic habitat, vernal pools, Delta smelt spawning and shallow water habitat, and wetlands are proposed to occur at a mitigation bank. Riparian, SRA, elderberry, oak woodland, and green sturgeon are proposed to occur on site.

Table 7. Environmental Effects and Proposed Mitigation for the Recommended Plan.

Habitat Type	Potential Impacts	Duration of Impact	Mitigation (Acres/Linear Feet)	Cost at Mitigation Bank	Cost On- or Off-Site within Study Area
GGS Uplands	30 acres 75 acres	Permanent Temporary	90 acres 75 acres	$4,500,000	N/A*
GGS Aquatic	15 acres	Permanent	45 acres	$2,250,000	
Riparian	150.6 acres	Permanent	301.2 acres		$16,566,000
Shaded Riverine Aquatic Habitat	82,325 lf	Permanent	82,325 lf		$19,020,000**
Elderberry Shrubs	3,292 stems	Permanent	1,715.6 credits 70.89 acres		$6,026,000
Vernal Pools	0.25 acre	Permanent	0.5 acre	$138,000	---
Green Sturgeon	20 acres	Permanent	Restore acres, monitoring, and fish passage features		$16,259,000
Delta Smelt Spawning Habitat	34 acres	Permanent	34 acres	$4,160,000	
Shallow Water Habitat (Delta Smelt)	14 acres	Permanent	42 acres	$5,460,000	
Oak Woodland	2 acres	Permanent	4 acres		$200,000
Wetlands	0.4 acres	Permanent	0.8 acres	$130,000	---
Sub-Total				**$16,775,000**	**$58,341,000**

* 75 acres of temporary effects to GGS habitat from the relocation of the Sacramento Bypass toe drain would consist of standard site restoration erosion control features such as hydroseeding. This is contained within construction costs and is not considered a mitigation cost. It is presented in this plan due to monitoring requirements, as described in Section 2.1 below.
** SRA habitat mitigation is provided in the project's cost estimate as a separate construction cost rather than a mitigation cost, since it is a feature of the bank protection designs and would be included as a part of the construction contract. The cost is displayed under the Fish and Wildlife Facilities account as "Construction" costs and is estimated to be approximately $231 per linear foot.

1.9 Location of Mitigation and Compensation Sites

WRDA 2007 Section 2036(c) directs the Corps to, where appropriate, first consider the use of an approved mitigation bank to compensate for wetland impacts. Credits for additional habitat types, including riparian zones, is also permitted, if credits are available and the use of them is deemed appropriate. As discussed above, the Corps proposes to purchase credits at a mitigation bank for permanent impacts to GGS uplands and aquatic habitat, vernal pools, Delta smelt spawning and shallow water habitat, and wetlands. As a result, these habitat types are not discussed further in this document, because the mitigation bank would be responsible for all site establishment, monitoring, adaptive management measures, and for achieving mitigation success.

The onsite mitigation proposed for the ARCF GRR consists of riparian, SRA, oak woodland, elderberry habitats, all of which are components of the riparian habitat corridor along the Sacramento River. Section 4.a.3 of WRDA 2007 Section 2036(c) implementation guidance states that credits for riparian habitat may be purchased at a mitigation bank, but are not required to be as a first order preference. All of these habitats contribute to the riparian corridor of the Sacramento and American Rivers. As described in Section 1.7 above, the removal of 268 acres of riparian, SRA, oak woodland, and elderberry habitat under the ARCF GRR could adversely affect ESA species within the project area if the function and services provided by riparian habitat is relocated away from the Sacramento River and American River riparian corridors. Additionally, credits are not available for the quantity of riparian habitat being removed for the ARCF project and mitigation requirements would likely increase if the projects proposed all mitigation offsite. As a result, it is appropriate to select on- and off-site mitigation within the study area for these habitat types rather than purchasing credits at a mitigation bank.

Upon completion of construction, sites with preexisting habitat would be restored to pre-construction conditions, where feasible. Sites compatible with on-site mitigation such as the 75 acres of upland GGS habitat and 82,325 linear feet of SRA habitat would be restored in place. Riparian habitat, elderberry compensation, and oak woodland habitat would be mitigated on-and off-site within the project area to the greatest extent practicable. The specific locations for offsite mitigation along the American River would be coordinated with the Sacramento County Department of Parks and Recreation (County Parks) during the design phase of the project.

On-site mitigative features are proposed as part of the bank protection construction to mitigate for impacts to SRA habitat. These features would be designed on a site-specific basis during the design phase and would include a planting berm as shown on Figure 1 above. Riparian vegetation installed on the planting berm would include large woody species such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*), white alder (*Alnus rhombifolia*), and box elder (*Acer negundo var. californicum*); shrub-scrub species such as elderberry (*Sambucus* spp.), redbud (*Cercis canadensis*), and coyote brush (*Baccharis pilularis*); and understory species such as California rose (*Rosa californica*), California blackberry (*Rubus ursinus*), and wild grape (*Vitus californica*); and native grasses such as annual fescue (*Vulpia* spp.), California brome (*Bromus* *carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.).

The Corps is committed to implementing project conservation and mitigation as detailed in the BOs, however site selection and real estate coordination has not occurred at this time for onsite and offsite mitigation and would be determined during the design phase of the project. This HMMAMP will accompany the final EIS/EIR, and will be updated throughout the design phase as detailed design efforts allow for finalizing the mitigation plans. The HMMAMP will be coordinated with the Services during the design phase and updated as needed. The Corps would go through the following process in order to determine sites for implementing compensation for impacts to riparian habitat, including VELB compensation sites:

- The Corps would assess opportunities to purchase credits at a mitigation bank as a first option.
- The Corps would assess opportunities for on-site compensation to replace the habitat function and services that would be impacted within the study area. This assessment would include considering site-specific conditions, including whether the site is protected from future erosion by bank protection, or remains at risk of berm and vegetation loss due to the launchable rock trench.
- If on-site compensation is not possible, the Corps would evaluate opportunities to expand existing Corps mitigation sites within the American River Parkway, such as the River Bend Park mitigation site.
- If the Corps requires additional lands for compensation, other opportunities within the American River Parkway would be assessed in coordination with County Parks, USFWS, NMFS, and the American River Flood Control District.

Although much of the mitigation would occur on-site, for riparian, SRA, elderberries, oak woodland, and green sturgeon benthic habitat, some mitigation would be compensated for through the purchase of credits from approved mitigation or conservation banks. Mitigation bank credits are available within the project watershed for riparian habitat, elderberry shrubs, and oak woodland on the Sacramento River.

1.10 Compensation Timing

Compensation timing refers to the time between the initiation of construction at a particular site and the attainment of the habitat benefits to targeted species from designated compensation sites. For example, compensation time would be the time required for on-site plantings to provide significant amounts of shade or structural complexity from instream woody material recruitment to provide habitat for fish species. Significant long-term benefits have often been considered as appropriate to offset small short-term losses in habitat for listed species in the past, as long as the overall action contributes to recovery of the listed species. The authority to compensate prior to or concurrent with project construction is given under WRDA 1986 (33 United States Code [USC] § 2283). Additionally, ER 1105-2-100, Appendix C states that authorized ecological resource mitigation activities and features should occur before construction of the project, concurrent with the acquisition of lands, or concurrent with the physical construction of the project.

2.0 Mitigation and Management Strategy

The purpose of this HMMAMP is to present conceptual mitigation proposals, establish performance standards, and outline adaptive management tasks and costs. Conceptual mitigation proposals are based on the habitat impacts described above. Performance standards are established below for each habitat type, and monitoring would be conducted with the intent of meeting those standards. Over the 3 to 5 year site establishment period, improvements in field and analytic techniques may lead to changes in the monitoring methodology. While this vegetation and habitat monitoring methodology protocol builds on past years' experiences, it is likely that other opportunities for improvement will be identified in the future that should be incorporated into the protocol. In the future, there may be a determination that specific performance standards have been met and that associated monitoring tasks could cease. Similarly, it could be determined that a monitoring task was not returning useful information, and therefore not worth the expense of continuation.

Monitoring must be closely integrated with adaptive management. The application of adaptive management principles to mitigation projects by modifying mitigation objectives during the monitoring period is a reasonable and foreseeable alternative. Unrealistic expectations or inaccurate assumptions can lead to the establishment of inappropriate project objectives. It is possible that a decision to modify success criteria might be reached based on results after several years of monitoring. In addition to modifying project objectives, there is a potential for changes to or adaptation of management actions based on monitoring results. The purpose of adaptive management is to enable strategic changes to improve the mitigation sites to functioning habitat.

Vegetation and habitat variable monitoring and data collection would occur annually by a qualified biologist, botanist, or habitat restoration specialist using the protocol described below and shown in Table 8 to determine the success of riparian revegetation plantings and overall habitat development.

The project's compensation objective is to directly mitigate for the loss of habitat value that results from construction impacts. This plan focuses on establishing successful and diverse habitats that provide an ecological value consistent with mature existing habitat conditions in the study area. The specific habitats focused on within the sections below are the habitats that would be created by the Corps on-site or off-site, including GGS upland habitat, habitat for VELB, and habitat for green sturgeon. In addition, mitigation sites would be created which present a combination of riparian, oak woodland, and SRA habitats, which are highly related and provide value to a number of listed species, including VELB, Western yellow-billed cuckoo, and fish species.

Table 8. Summary of On-site Habitat Types and Monitoring Recommendations.

Habitat	Monitoring Variable	Method to be Used	Spacing/number of Samples	Data to be Collected	Success Criteria
GGS Upland	Total Herbaceous Species Cover	Visual estimates of cover within 1 square meter (m^2) sampling quadrats	One quadrat randomly located in each planting zone	Herbaceous species composition, total cover, and observation of GGS	Meeting 75% native species present and 95% overall cover onsite within 1 year
Riparian Habitat	Vegetation Species Cover (Ground and Canopy)	Line-intercept estimates of ground and overhead canopy cover with visual estimates of vigor	Monitoring transects; number of transects and spacing dependent on site length	Woody species composition, growth, and natural recruitment	75% vegetative cover after 5 years
SRA Habitat	Shaded Riverine Aquatic (SRA) Cover	Line-intercept estimates of canopy cover overhanging the river	Transect parallel to the shoreline along summer mean water surface elevation (SMWSE); length of transect dependent on site length	Woody species composition and percentage of canopy cover overhanging river (shade)	75% vegetative cover after 5 years
Elderberry	Elderberry and Native Vegetation Health and Vigor (VELB habitat)	Visual assessment of vegetation health and vigor; census of VELB and exit holes	Total census of elderberry shrubs and native vegetation, census of VELB and exit holes	Total survival of elderberry and native vegetation, census of VELB and exit holes	Survivability of 60% shrubs*; 75% vegetative cover after 5 years
Oak Woodland Habitat	Woody Species Overhead Canopy Cover	Line-intercept estimates of overhead canopy cover and visual estimates of vigor	Monitoring transects; number of transects and spacing dependent on site length	Woody species composition, growth, and natural recruitment	75% vegetative cover after 5 years
Green Sturgeon Benthic Habitat	In-water slope and substrate	Substrate sampling and visual assessment of slope/substrate conditions.	Monitoring the width and depth of the river at regular intervals throughout the project area.	Substrate content, percentage of fines, slope defining measurements.	Slope (H:V) of 2:1 with substrate at average of 0-10 inches.

*60% survivability is the established survival criteria for elderberry shrubs in the USFWS Conservation Guidelines for the Valley Elderberry Longhorn Beetle (1999).

2.1 GGS Uplands Mitigation

2.1.1 Objectives and Implementation Strategy

The primary objective of upland habitat mitigation is to restore upland refugia habitat for the giant garter snake (*Thamnophis gigas*) (GGS) in a manner consistent with adjacent equitable habitat. Upland refugia habitat is generally considered native grasslands with space appropriate for basking, cover, and retreat sites for GGS. Upland refugia is also considered higher elevation areas for cover and refuge from flood waters. Upland refugia restoration would take place on grasslands adjacent to GGS wetland habitat as well as levee slopes for higher elevation refuge. These conservation and restoration measures are taken from the Guidelines for Restoration and/or Replacement of Giant Garter Snake Habitat (USFWS, 1997).

Restoring GGS habitat includes minimizing the potential impacts of project activities to the existing habitat. Use of silt fencing and protective mats to prevent runoff and reduce the possibility of individual GGS from entering the project area is recommended. Designation of environmentally sensitive areas and providing worker awareness training is also recommended. Construction activities should be 200 feet from GGS aquatic habitat, and should occur between May 1 and October 1. Project areas should be surveyed for GGS 24 hours prior to ground disturbing activities, and surveys should be repeated if a lapse in construction activity of two weeks or greater has occurred. If aquatic habitat must be removed as part of the construction activities, any dewatering would occur after April 15 and dewatered habitat would be left dry for at least 15 consecutive days.

Upon the completion of construction, the area would be regraded to the preexisting contour. Upland refugia would be hydroseeded with native grasses. USFWS recommends a mix of native grass seeds such as annual fescue (*Vulpia* spp.), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.). Additional native plant seeds consistent with adjacent habitat may be used at the discretion of USFWS. Permanent irrigation would not need to be established for this habitat type, however the site would require periodic watering in drought conditions.

2.1.2 Success Criteria

Monitoring of GGS upland habitat would focus on: (1) the percentage cover of native species, and (2) the percentage of overall vegetative cover. The restored habitat would be considered successful if 75 percent of the vegetation on site consists of native species. Additionally, the overall vegetative cover on site must be 95 percent.

2.1.3 Mitigation Monitoring Strategy

Restored habitat should be monitored for one year following implementation. Surveys would involve a general overview of the condition of the site, an estimate of ground cover, and a passive (observation only) GGS survey to determine potential habitat use. A ground cover survey would occur to determine the ground cover percent of native and non-native species. Ground cover surveys, if determined by the Corps to be needed to evaluate the success of the mitigation area, would involve the use of a one square meter quadrat placed haphazardly in the restored areas. Once placed, all herbaceous vegetation within the quadrat would be recorded to species level. The percent of cover by native and non-native species would be determined in addition to the percent of total cover.

Monitoring reports documenting the restoration effort would be submitted to USFWS upon completion of the restoration implementation and one year from restoration implementation. Monitoring reports would include photos, the timing of the completion of the restoration, what materials were used in the restoration, plantings (if specified), and justification of any substitutions to USFWS recommended guidelines. Monitoring reports would also include recommendations for additional remedial actions, if necessary.

2.1.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

Adaptive Management Triggers

- Desired Outcome: Increase percent cover of GGS upland habitat.

  Trigger: 95% cover is not achieved within one year.

- Desired Outcome: Decrease percent of non-native invasive species that outcompete natives.

  Trigger: Non-native percent cover of more than 25% within one year.

Adaptive Management Measures

If the triggers established above occur, the following measures would be implemented for GGS upland habitat in order to adaptively manage the site for success.

- If the performance criteria are not met within one year, additional monitoring would be implemented in order to ensure that the site is successful.
- If non-native species are outcompeting the native species, measures would be implemented to manage presence of invasive species, including mowing and selective removal of non-native species at optimal times for native growth.
- If non-native species are outcompeting the native species and targets for overall cover are not being met, then revegetation of native species would occur.
- Supplemental watering if targets for overall cover are not being met.

2.2 Riparian, Oak Woodland, and Shaded Riverine Aquatic Habitat

2.2.1 Objectives and Implementation Strategy

The primary objective of riparian habitat mitigation is to compensate for impacted habitat types and community types, and reduce erosion rates within the alluvial floodplain. Native plant communities and streambank vegetation would be represented in species density appropriate to the surrounding area. As native vegetation matures, it helps to stabilize stream banks and shorelines; provides food, shelter, shade, and access to adjacent habitats; nursery habitat; pathways for movement by resident and nonresident aquatic, semi-aquatic, and terrestrial organisms; and improves and protects water quality by reducing the amount of sediment and other pollutants such as pesticides, organic materials, and nutrients in surface runoff. The long term goal of riparian mitigation is to provide habitat similar to the habitat that was impacted by project construction. These improvements would enhance nesting opportunities for native bird species, and provides opportunities to satisfy VELB compensation. Oak woodland and SRA habitat are considered components of riparian habitat with specific functions within the ecosystem.

Riparian vegetation would include large woody species such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), valley oak (*Quercus lobata*), white alder (*Alnus rhombifolia*), and box elder (*Acer negundo var. californicum*); shrub-scrub species such as elderberry (*Sambucus spp.*), redbud (*Cercis Canadensis*), and coyote brush (*Baccharis pilularis*); and understory species such as California rose (*Rosa californica*), California blackberry (*Rubus ursinus*), and wild grape (*Vitus californica*); and native grasses such as annual fescue (*Vulpia* spp.), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and needle grass (*Nassella* spp.). Native trees and shrubs provide a buffer to adjacent urban and industrial land uses, and provide habitat structure for wildlife. Leaf litter and large organic debris would create a variety of microhabitats, increasing species diversity and potentially creating a prey base for larger predators.

SRA habitat consists of riparian trees and shrubs growing on the bank and over-hanging the channel that provide instream shade for the water column adjacent to the bank and deposit insects, organic matter, and nutrients into the river. Shade from the vegetation helps to cool water temperatures in the river. SRA is especially important to juvenile salmonids as they migrate down the river to the sea. Terrestrial insects that live on riparian vegetation fall into the river and provide an important food source for fish. Proposed SRA mitigation would occur on the planting berms designed into the bank protection sites along the American and Sacramento Rivers, as shown in Figures 1 and 2 above. Riparian trees and shrubs would be installed in the planting berms, and existing large trees would be protected in place on the lower waterside slope of the levee. Implementation of this SRA habitat mitigation, including protecting large trees in place, is part of the recommended plan and is reliant on the approval of a vegetation variance, which will be sought during the design phase of the project.

The primary objective of oak woodland mitigation, which would occur in the upland zone of the riparian habitat, is the establishment of mature valley oaks and savannah. Planting would generally occur during the late fall when the plants are dormant and soils are moist. Establishment of woody vegetation would likely require multiple techniques including transplants, cuttings, acorn plantings, and seedlings.

Riparian and oak woodland mitigation sites would likely require fencing to protect establishing habitats from recreation, wildlife, and other potential damages. Sites would have irrigation during the establishment period, and would be watered as needed until the vegetation is established and self-sustaining. Mowing would occur periodically to ensure that weed species do not shade out new plantings.

SRA habitat would be established in planting berms along the river. These sites could require beaver fencing. Sites would have temporary irrigation during the summer, and would be watered as needed until the vegetation is established and self-sustaining. A weed eater would be used to ensure that weed species do not shade out new plantings.

2.2.2 Success Criteria

Monitoring of riparian, oak woodland, and SRA habitats would focus on: (1) the percent cover of native plant species; (2) presence of at least five native species contributing to structural diversity; (3) percentage of canopy cover over water; and (4) decrease percent cover of non-native invasive species that out-compete natives. Additionally, an inventory of wildlife species would be recorded during annual monitoring. Table 9 establishes the percentages required to meet these performance standards. If the habitat is meeting these performance standards, conditions should be consistent enough to estimate community composition and general success of planting efforts. Table XX establishes the percentages required to meet these performance standards.

Table 9. Riparian, Oak Woodland, and SRA Habitat Performance Standards.

Performance Standard	Quantitative Measure
Percent cover of native plant species	75%
Structural diversity	At least five native species contributing to 75% canopy and 50% shrub cover
Percent of canopy cover over water per LF	75%
Percent cover of non-native species	Less than 15%

2.2.3 Mitigation Monitoring Strategy

The following monitoring procedures will provide the information necessary to evaluate the success of riparian, oak woodland, and SRA habitat mitigation. Vegetation sampling will occur annually for the duration of the monitoring period. Sampling will occur during spring months, at the peak of growing season, and will consist of permanent field monitoring plots along one or more transects either perpendicular to the river or parallel to the floodplain slope. Plots will be located randomly within each site, and the distance between plots and along transects will be site specific. Woody species with overhead canopy cover that falls along the vegetation monitoring transect, including those that were planted, have recruited naturally to the site, or were existing at the site prior to planting efforts would be recorded. Monitoring will measure percent cover of native and non-native plant species, structural diversity, and percent cover over water. Photograph stations are also important for documenting vegetation conditions. All plots and photograph stations will be documented via Global Positioning System (GPS) coordinates to maintain consistency throughout the monitoring period.

Additionally, field personnel would visually estimate the height (+/- 2 feet) of each tree and shrub that provides overhead canopy cover. Exact heights are not necessary, since there is no tree height criterion included in this protocol. Rather, approximate tree heights would be visually assessed to monitor tree growth over time. Data collected would include species name, location (feet) along the vegetation monitoring transect (upper extent of canopy and lower extent of canopy), whether the tree or shrub is planted (P), recruited (R), or existing (E), height (feet), and vigor as determined using the metric outlined in Table 10, below.

Table 10. Estimation of General Health and Vigor for Plant Species.

Visual Estimate of Foliage	Vigor Category	Value
81 percent (or greater) of foliage appears to be healthy	Excellent	4
51 to 80 percent of foliage appears to be healthy	Good	3
25 to 50 percent of foliage appears to be healthy	Fair	2
Less than 25 percent of foliage appears to be healthy	Poor	1
Dead	Dead	0

General observations, such as fitness and health of plantings, native plant species recruitment, and signs of drought stress would be noted during the surveys. Additionally, potential soil erosion, flood damage, vandalism and intrusion, trampling, and pest problems would be qualitatively identified. A visual check of irrigation infrastructure and fencing would also be conducted. A general inventory of all wildlife species observed and detected using the mitigation site would be documented. Nesting sites and other signs of wildlife use of the newly created habitat would be recorded.

Monitoring reports documenting the restoration effort would be prepared following the first monitoring period and would continue annually until the site has met the success criteria. Monitoring reports would include photos, the timing of the completion of the restoration, what materials were used in the restoration, and plantings (if specified). Monitoring reports would also include recommendations for additional adaptive management measures, if necessary. Following this initial establishment period, any subsequent monitoring activities would be the responsibility of the local maintaining agency, and would focus primarily on general and biological inspections for the purposes of fire management and habitat evaluation.

2.2.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

Adaptive Management Triggers

- Desired Outcome: Increase percent cover of native riparian habitat.

  Triggers: If 50% cover of native riparian habitat is not achieved within 3 years, or 75% cover of native riparian habitat is not achieved within 5 years.

- Desired Outcome: Maintain appropriate structural diversity of native riparian habitats.

  Trigger: Suitable structural diversity is not achieved, if canopy cover and/or shrub cover does not achieve 50% within 5 years.

- Desired Outcome: Increase percent vegetative cover over water per linear foot to support native fish.

  Trigger: If percent cover over water is not 30% within 3 years, and 50% within 5 years.

- Desired Outcome: Decrease percent cover of non-native invasive species that outcompete natives.

  Trigger: If non-native percent cover is greater than 15% during the monitoring period.

Adaptive Management Measures

If the triggers established above occur, the following measures would be implemented for riparian, oak woodland, and SRA habitat in order to adaptively manage the site for success.

- Replanting may be needed if triggers for vegetative cover, vegetative cover over water, and/or structural diversity are being met. Monitoring results should be used to assess the underlying cause of inadequate cover, which may require that additional adaptive management actions be implemented to support successful replanting. Adaptive management actions could include targeted revegetation, such as replanting varieties of species that are exhibiting the greatest growth and survival, or planting at elevations that are exhibiting the greatest growth and survival.
- Nonnative species management may be needed if monitoring results show that the triggers for nonnative species present are met, or if nonnative species are impacting the survival of native species. Adaptive management measures may include adjustments to nonnative control methods, such as plant removal, grading of site to remove nonnative roots, or mowing and selective removal of non-native species at optimal times for native growth.
- Irrigation and/or supplemental water may be needed if vegetation is not meeting success criteria, or if species are exhibiting signs of water stress. Assessment of monitoring results may show that drought conditions are causing poor establishment or die off of planted vegetation. Adaptive management actions would include supplemental water to support achievement of percent cover criteria and structural diversity.
- Plant protection may be needed if triggers for vegetative cover and/or structural diversity are being met. If monitoring results show that plantings are failing due to predation or trampling from human use, then adaptive management actions would include plant cages or protective fencing that could be installed to protect plantings.

2.3 Elderberry Shrubs

2.3.1 Objectives and Implementation Strategy

The primary objective of elderberry shrub mitigation is to compensate for the adverse effects of the project on habitat important to the Federally listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB). Where possible, conservation areas would connect with adjacent habitat in order to prevent isolation of beetle populations. Removal, transplanting, and establishment of elderberry shrubs would be coordinated with USFWS and would follow the USFWS Conservation Guidelines for the valley elderberry longhorn beetle (USFWS, 1999).

Elderberry shrubs with one or more stems measuring one inch or greater in diameter at ground level must be transplanted if they cannot be avoided by the proposed project. Elderberry shrubs should be transplanted when they are dormant, typically from November to the first two weeks in February. Transplanting during the non-growing season would reduce shock to the plant and increase transplantation success. Most transplants require watering through the first summer.

Elderberry stems measuring greater than one inch in diameter are considered habitat for the VELB and trimming or removal of stems would require coordination and mitigation. Each elderberry stem that is adversely affected must be replaced in the conservation area with elderberry seedlings or cuttings as specified by USFWS. Seedlings and cuttings should be obtained from local sources. If the project site is in the vicinity of the conservation area, cuttings may be obtained from elderberry shrubs to be transplanted

Mitigation site planting areas must be at least 1,800 square feet for each elderberry transplant. As many as five additional elderberry plantings (cuttings or seedlings) and up to five associated native species plantings may also be planted within the 1,800 square foot area with the transplant. Studies have found that the VELB is more abundant in dense native plant communities with a mature overstory and a mixed understory. Therefore, a mix of native riparian species such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), valley oak (*Quercus lobata*), box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), and California button willow (*Cephalanthus occidentalis californica*) would be planted along with the elderberry shrubs. Stock of saplings, cuttings, and seedlings would be obtained from local sources. Planting or seeding the area with native herbaceous species is also encouraged. Weeds and other non-native plants would be removed by mechanical means at least once a year or at the discretion of USFWS.

No pesticides, herbicides, fertilizers, or other chemical agents would be used in or within 100 feet of the conservation area. Fencing would be placed around the conservation area during the establishment period of the elderberry shrubs. Signs would be posted on the fence stating the status of the VELB and the purpose of the habitat. The conservation area would be protected in perpetuity as habitat for the VELB. Conservation areas may be transferred to resource agencies or appropriate private organizations for long term management. Biologists and law enforcement personnel from the California Department of Fish and Wildlife and USFWS must be given complete access to the project site to monitor transplanting activities. Personnel from these agencies must also be given complete access to the conservation area to monitor the beetle and its habitat in perpetuity.

2.3.2 Success Criteria

After the first year, it is anticipated that the sites would be evaluated to determine the level of project success and apply adaptive management, if necessary. If the habitat meets the below performance standards for three consecutive years, depending on physical site characteristics, conditions should be consistent enough to estimate community composition and general success of planting efforts. Three consecutive years of success should indicate that the project sites are self-sustaining and should not require supplemental irrigation or intensive weed control. Following this initial establishment period, any subsequent monitoring activities would be the responsibility of the local maintaining agency, and would focus primarily on general and biological inspections for the purposes of fire management and habitat evaluation.

Monitoring of elderberry habitats would focus on a minimum survival rate of at least 60 percent of the elderberry shrubs. Within one year of discovery that survival has dropped below 60 percent, additional plantings would be installed to bring survival above this level. Monitoring of associated riparian habitat would focus on: (1) the percent cover of native plant species; (2) presence of at least five native species contributing to structural diversity; and (3) decrease percent cover of non-native invasive species that out-compete natives. Additionally, an inventory of wildlife species would be recorded during annual monitoring. Table 11 establishes the percentages required to meet these performance standards. If the habitat is meeting these performance standards, conditions should be consistent enough to estimate community composition and general success of planting efforts.

Table 11. Elderberry and Associated Riparian Habitat Performance Standards.

Performance Standard	Quantitative Measure
Percent survivability of elderberry shrubs	60%
Percent cover of native riparian species	75%
Structural diversity	At least 5 native species contributing to 75% canopy and 50% shrub cover
Percent cover of non-native species	Less than 15%

2.3.3 Mitigation and Monitoring Strategy

Monitoring would be conducted annually per the USFWS Conservation Guidelines for the valley elderberry longhorn beetle (USFWS, 1999). Two surveys would be conducted by qualified biologists between February 14 and June 30 of each year until the mitigation has met the success criteria. Surveys would include:

1. An evaluation of the elderberry plants and associated native plants on the site, including the number of plants, their size and condition.
2. Presence of the adult beetles, including the number of beetles observed, their condition, behavior, and their precise locations.
3. Presence of beetle exit holes in elderberry stems, noting their locations and estimated ages.
4. An evaluation of the adequacy of the fencing, signs, and weed control efforts in the avoidance and conservation areas.
5. A general assessment of the habitat, including any real or potential threats to the beetle and its host plants, such as erosion, fire, excessive grazing, off-road vehicle use, vandalism, excessive weed growth, etc.

A written report presenting and analyzing the data from the project monitoring would be prepared following the surveys, and would be submitted by December 31 of the same year to USFWS. The report would address the status and progress of the transplanted and planted elderberry shrubs, associated native plants and trees, and any failings of the conservation plan and the steps taken to correct them. Any observations of beetles or fresh exit holes must be noted. Copies of original field notes, raw data, and photographs of the conservation area would be included with the report. A vicinity map of the site and maps showing where the individual adult beetles and exit holes were observed would also be included. The survival rate, condition, and size of the elderberry and associated native plants would be analyzed in the report. Real and likely future threats would be addressed along with suggested remedies and preventative measures (such as limiting public access, more frequent removal of invasive non-native vegetation, etc.).

2.3.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

<u>Adaptive Management Triggers</u>

- Desired Outcome: Increase percent survivability of elderberry shrubs.

  Triggers: If 60% survivability is not achieved during the monitoring period.

- Desired Outcome: Increase percent cover of native riparian habitat.

  Triggers: If 50% cover of native riparian habitat is not achieved within 3 years, or 75% cover of native riparian habitat is not achieved within 5 years.

- Desired Outcome: Maintain appropriate structural diversity of native riparian habitats.

  Trigger: Suitable structural diversity is not achieved, if canopy cover and/or shrub cover does not achieve 50% within 5 years.

- Desired Outcome: Decrease percent cover of non-native invasive species that outcompete natives including elderberry shrubs.

  Trigger: If non-native percent cover is greater than 15% during the monitoring period.

Adaptive Management Measures

If the triggers established above occur, the following measures would be implemented for VELB habitat in order to adaptively manage the site for success.

- Replanting may be needed if triggers for vegetative cover and/or survivability are being met. Monitoring results should be used to assess the underlying cause of inadequate cover or survival, which may require that additional adaptive management actions be implemented to support successful replanting. Adaptive management actions could include targeted revegetation, such as replanting at elevations that are exhibiting the greatest growth and survival.
- Nonnative species management may be needed if monitoring results show that the triggers for nonnative species present are met, or if nonnative species are impacting the survival of native species including elderberry shrubs. Adaptive management measures may include adjustments to nonnative control methods, such as plant removal, grading of site to remove nonnative roots, or mowing and selective removal of non-native species at optimal times for native growth.
- Irrigation and/or supplemental water may be needed if vegetation is not meeting success criteria, or if species are exhibiting signs of water stress. Assessment of monitoring results may show that drought conditions are causing poor establishment or die off of planted vegetation. Adaptive management actions would include supplemental water to support achievement of percent cover criteria and structural diversity.
- Plant protection may be needed if triggers for vegetative cover and/or survivability are being met. If monitoring results show that plantings are failing due to predation or trampling from human use, then adaptive management actions would include plant cages or protective fencing that could be installed to protect plantings.

2.4 Green Sturgeon

2.4.1 Objectives and Implementation Strategy

The ARCF GRR project will restore existing or create new habitat to compensate for the quality and quantity of green sturgeon habitat (including soft bottom benthic substrate) permanently impacted by project construction. If possible, this would occur at a mitigation bank, however currently no mitigation banks in the Sacramento area provide credits for green sturgeon habitat.

If onsite mitigation is not possible, and there are no mitigation banks available, then compensation for green sturgeon habitat would occur within the north Delta in as close of a proximity to the study area as possible. The non-Federal sponsor supports green sturgeon mitigation, has the capability to implement the mitigation, and would participate in implementation of this mitigation in coordination with the Corps. Based on current best available science, there are limited opportunities for habitat creation within the study area. Created or restored habitat would be designed in coordination with NMFS and would be based on the primary constituent elements (PCEs) of critical habitat such as food availability, water flow, water quality, migration corridors, and sediment quality. Successful establishment of onsite mitigation or creation of offsite habitat will be determined through the success criteria in Section 2.6.3 below.

2.4.2 Success Criteria

The overall performance standard for green sturgeon habitat is based on the establishment of slope and substrate, with a focus on a suitable range of conditions for rearing juvenile green sturgeon developed from SAM. Slope and substrate are critical components of habitat for rearing juvenile green sturgeon. Slope is used as an indicator of shallow water refuge for juveniles as well as food and resting areas. Substrate size is used as an indicator of juvenile refuge from predators, suitable predator habitat, and food availability for juvenile and adult life stages of focus fish. Table 12 below establishes the suitable range of substrate and slope that must be met for each year of monitoring. Slope and substrate would be monitored yearly along with other potential variables discussed below. The monitoring will continue until all performance standards have been achieved for three consecutive years.

Table 12. Green Sturgeon Habitat Performance Standards.

	Acceptable Range
Slope (H:V)	>2:1
Substrate (average size, inches)	0 – 10

Note: Based on outputs from the SAM model. The Corps, in coordination with NMFS, determined that these outputs from the SAM model are the most likely outputs that would remain relevant to sturgeon with improved baseline condition data.

As stated previously, there is insufficient knowledge of the species' relationship to many habitat attributes; however, there may be opportunities to incorporate additional habitat attributes into the evaluation process. Experts at the Corps Engineering Research and Design Center would be engaged in order to develop a post-construction sampling and monitoring plan that would be refined during PED based on any improvements in the understanding of the species at that time. Potential habitat attributes that could be incorporated into success criteria following preconstruction monitoring and the development of the EFM model include:

- Food Resources – Benthic invertebrates and fishes (various species of shrimp, amphipods, isopods, clams, annelid worms, crabs, sand lances, and anchovies) can be measured in terms of biomass loss, gain, or recovery rate. The impact on the benthic environment can be quantified within the footprint and adjacent to the footprint. Grab samples would be collected at various points of the river. These samples would be analyzed in order to determine the bed material and any change in presence of benthic food sources (clams, invertebrates, etc.) that resulted from construction.
- Water Flow – Although levee improvement projects are unlikely to impact water flow, there may be some localized increase in flow over revetment that could affect the swimming or foraging habits of green sturgeon. These changes can be assessed through a physical or hydraulic model. This monitoring should be paired with a fish tracking study to assess the species presence/ association with habitat/project features in the project area.
- Water Depth – A diversity of water depth is necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages of green sturgeon and salmonids. Water depth impacted by levee construction or bank armoring can be measured impact through a direct physical quantification of changes to shallow and deep water habitat.
- Water Quality –Although levee improvement projects are unlikely to impact long term water quality, sediment quality, or migratory corridors, baseline conditions of these resources could be determined in order to develop a greater understanding of how these resources could impact normal behavior, growth, and viability of all life stages of green sturgeon and other fish species. Water Quality monitoring would involve testing water temperature, salinity, oxygen content, and other chemical characteristics within the project reach.

2.4.3 Mitigation Monitoring Strategy

The mitigation monitoring strategy will focus on the successful establishment of critical habitat elements, including slope and substrate. Post-construction monitoring would continue until the mitigation site has met the success criteria for three consecutive years. Slope would be monitored on an annual basis using range finding technologies. Slope will be sampled in varying distances perpendicular to the shoreline to assess slope ratio and depth. Substrate can vary seasonally and therefore will be monitored bi-annually before and after high flows. Substrate would be evaluated through direct physical samples. Substrate will be sampled in varying distances perpendicular to the shoreline to assess the content of benthic material.

A post-construction monitoring report would be produced annually following monitoring. The report would summarize and analyze all monitoring activities with overall evaluation of the performance of the success criteria. Additional results, analysis, proposed adaptive management measures, and associated costs would be incorporated into the monitoring report.

2.4.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

Adaptive Management Triggers

- Desired Outcome: Maintain slope gradient of greater than 2H:1V.

  Triggers: If slope is less than 2H:1V during the monitoring period.

- Desired Outcome: Maintain acceptable range of substrate conditions to provide benthic habitat.

  Triggers: If average substrate sizes are composed of cobbles larger than 10 inches during the monitoring period.

Adaptive Management Measures

If the triggers established above occur, the following measures would be implemented for green sturgeon benthic habitat in order to adaptively manage the site for success.

- Slope regrading may be needed if monitoring results show that the trigger for slope angle is met. Adaptive management measures may include grading to recontour slope angle to 2H:1V or greater.
- Sediment management measures may be needed if the trigger for substrate is met. If monitoring results show that average substrate composition is larger than 10 inches, then the following measures may be implemented. Measures may include gravel augmentation, sediment catching measures, and/or introduction of fines.

3.0 Adaptive Management Costs

This section outlines the feasibility level adaptive management costs for the American River Common Features (ARCF) General Reevaluation Report (GRR) study. The adaptive management plan for this project reflects a level of detail consistent with the project Feasibility Study. The primary intent is to develop adaptive management costs appropriate for and specific to the project's adaptive management measures and monitoring strategies, as described in Section 2.0 of this document. The specified management actions allow estimation of the adaptive management program costs for the project.

The cost for implementation of this plan are provided at October 2015 price levels and prior to contingency. The cost for implementing the monitoring plan proposed above is approximately $5.05 million and is shown on Table 13 below.

Table 13. Monitoring Costs for the ARCF GRR.

Monitoring	Assumed Tasks for Monitoring	Frequency	Cost Assumptions	Total Cost for 5 Years
Vegetation Monitoring	Assume monitoring of mitigation sites, including transects for percent cover of natives and non-natives, structural diversity, and canopy cover over water using transect/plot monitoring. Assume vegetation mapping, inventories of general wildlife, and observations of damage to habitat would be recorded. Assume monitoring of all parameters would be done concurrently during each monitoring event.	Annually for 5 Years	Monitoring: Cost estimate based on standard establishment contract, including monitoring cost and annual report from contractor. Assume $50,000 per year for 4 biologists to survey mitigation sites	$1,296,000
Green Sturgeon Habitat Monitoring	Assume monitoring of slope and in-channel habitat elements including substrates (i.e., composition and percentage of fines)	Annually for 5 Years	Monitoring: Assume monitoring of 8 reaches for 5 years	$3,750,000
			TOTAL MONITORING	**$5,050,000**

The cost for the adaptive management plan is approximately $5.15 million and is shown on Table 14 below.

Table 14. Adaptive Management Costs for the ARCF GRR.

Adaptive Management Measures	Assumed Tasks for Adaptive Management	Cost Assumptions	Total Cost for 5 Years
Irrigation/Supplemental Water	Apply supplemental irrigation to water stressed plants	Assuming $900 per acre per year for 5 years	$900,000
Re-planting	Assume that assume 25% of vegetation may require replanting over 5 years.	Cost of vegetation was estimated at $5,000 per planted acre	$2,220,000
Plant Protection & Fencing	Assume 10,000 plant cages and 10,000 feet of fencing may be needed.	Assume $10/plant cage; $3/linear foot for fencing; plus $50,000 installation. Costs referenced from existing restoration contracts.	$280,000
Slope Regrading and Sediment Management	Recontouring or existing slopes and gravel augmentation	Assume regarding and gravel augmentation at 25% of mitigation site at $35 per CY	$1,560,000
Annual Report	Produce annual report	Assume $37,500 per report, annually for 5 years	$190,000
		TOTAL ADAPTIVE MANAGEMENT	**$5,150,000**
		TOTAL MONITORING AND ADAPTIVE MANAGEMENT	**$10,200,000**

The combined monitoring and adaptive management costs at October 2015 price levels, as included in the certified total project cost summary under the 06 “fish and wildlife facilities” account, total $10.2 million for the Recommended Plan.

4.0 References

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Appendix A

Cost Effectiveness/Incremental Cost Analysis

Mitigation for ARCF GRR

Development of Compensatory Mitigation Acreages for Alternatives 1 and 2

Mitigation for habitat loss is a requirement to compensate for the loss of habitat due to a Federal action. Section 2036(a) of the Water Resources Development Act of 2007 states that project alternatives must support recommendations with a specific plan to mitigate fish and wildlife losses. Additionally, the Endangered Species Act states that the purpose of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts.

The ARFC GRR study area includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Arcade Creek, and the Magpie Creek Diversion Canal (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento.

The mitigation acreages for ARCF GRR were calculated using a combination of site surveys and aerial photography from Google Earth to determine where the project footprint impacted different habitat types. The habitat types included: riparian, shaded riverine aquatic (SRA), oak woodland, wetlands, GGS uplands and aquatic, elderberry shrubs, vernal pools, green sturgeon benthic habitat, and Delta smelt spawning and shallow water. The acreages of each impacted habitat type were then broken up by reach in order to show differences between the two Alternatives. Impacts caused by the construction of this project are shown in Tables 1 and 2.

Table 1: Impacts for ARCF GRR – Alternative 1

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs (VELB) **	Vernal Pools **	Delta Smelt Spawning	Shallow Water **	Green Sturgeon Benthic **	Oak Woodland *	Wetlands
American River North											
Reach A (American River)			22 acres	19,000 LF	284 stems						
Reach B (American River)			0.5 acre		183 stems						0.05 acre
Reach C (American River & NEMDC)										1 acre	
Reach D (Arcade Creek)			6 acres								
Reach E (Arcade Creek)			4.5 acres								
Reach F (NEMDC)										1 acre	
Reach G (Dry/Robla Creek)	*No Measures Proposed*										
Reach H (Dry/Robla Creek)	*No Measures Proposed*										
Reach I (Magpie Creek)						0.25 acre					
American River South											
Reach A (American River)			37 acres	6,850 LF	1,437 stems						0.35 acre
Reach B (American River)			2 acres	875 LF	1,144 stems						

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs (VELB) **	Vernal Pools **	Delta Smelt Spawning	Shallow Water **	Green Sturgeon Benthic **	Oak Woodland *	Wetlands
Reach C (American River)				3,800 LF	81 stems						
Reach D (Sacramento River)			18.6 acres	9,200 LF	163 stems		10 acres	5 acre			
Reach E (Sacramento River)			13.2 acres	8,850 LF			6 acres	4 acre			
Reach F (Sacramento River)			54.7 acres	21,100 LF			12 acres 1	4 acre			
Reach G (Sacramento River)			25.8 acres	11,150 LF			4 acres	1 acre			
TOTAL (Alt 1)	**0**	**0**	**184.3**	**80,825 LF**	**3,292 stems**	**1 acre**	**32 acres**	**14 acre**	**20 acres**	**2 acre**	**0.40 acre**

*State Listed **Federal Listed ***State and Federal Listed
GGS: Giant garter snake (*Thamnophis gigas*)
LF: linear feet
NEMDC: Natomas East Main Drain Canal
SRA: Shaded Riverine Habitat
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)

Table 2: Impacts for ARCF GRR – Alternative 2

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs (VELB) **	Vernal Pools **	Delta Smelt Spawning	Shallow Water **	Green Sturgeon Benthic **	Oak Woodland *	Wetlands
American River North											
Reach A (American River)			22 acres	19,000 LF	284 stems						
Reach B (American River)			0.5 acre		183 stems						0.05 acre
Reach C (American River & NEMDC)										1 acre	
Reach D (Arcade Creek)			6 acres								
Reach E (Arcade Creek)			4.5 acres								
Reach F (NEMDC)										1 acre	
Reach G (Dry/Robla Creek)	*No Measures Proposed*										
Reach H (Dry Robla Creek)	*No Measures Proposed*										
Reach I (Magpie Creek)						1 acre					
American River South											
Reach A (American River)			37 acres	6,850 LF	1,437 stems						0.35 acre 91000
Reach B (American River)			2 acres	875 LF	1,144 stems						

	GGS Upland ***	GGS Aquatic ***	Riparian/ Western Yellow-billed Cuckoo **	SRA Habitat ***	Elderberry Shrubs (VELB) **	Vernal Pools **	Delta Smelt Spawning	Shallow Water **	Green Sturgeon Benthic **	Oak Woodland *	Wetlands
Reach C (American River)				3,800 LF	81 stems						
Reach D (Sacramento River)			10.6 acres	9,200 LF	163 stems		10 acres	5 acre			
Reach E (Sacramento River)			6.2 acres	8,850 LF			6 acres	4 acre			
Reach F (Sacramento River)			41.6 acres	21,100 LF			12 acres	4 acre			
Reach G (Sacramento River)			12.2 acres	11,150 LF			4 acres	1 acre			
Sacramento Weir and Bypass	30	15	8 acres	1,500 LF							See GGS Aquatic
TOTAL (Alt 2)	**30**	**15**	**150.6**	**82,325 LF**	**3,292 stems**	**1 acre**	**32 acres**	**14 acre**	**20 acres**	**2 acre**	**0.40 acre**

*State Listed **Federal Listed ***State and Federal Listed NEMDC: Natomas East Main Drain Canal SRA: Shaded Riverine Habitat

GGS: Giant garter snake (*Thamnophis gigas*) LF: linear feet Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)

Table 3: Mitigation Costs

	GGS Upland ***	GGS Aquatic ***	Riparian	SRA Habitat***	Elderberry Shrubs (VELB)**	Vernal Pools **	Oak Woodland *	Delta Smelt Spawning	Shallow Water **	Green Sturgeon Benthic **	Wetlands
Mitigation Cost at a Bank per acre	$50,000	$50,000	$75,000	$75/LF	$4,500/ credit	$275,000	$75,000	$130,000	$130,000	----	$130,000
Mitigation Created per acre	----	----	$55,000	$231/LF	$85,000	----	$50,000	$55,000	$55,000	$150,000	----

The cost for mitigation was estimated for five scenarios for the purposes of the CE/ICA for both alternatives. These scenarios included: (1) maximized on- and off-site habitat creation; (2) maximizing the use of credits at a local mitigation bank; (3) a combination of on-site, off-site, and a mitigation bank at a 2:1 ratio; (4) a combination of on-site, off-site, and a mitigation bank at a 1:1 ratio; and (5) a combination of on-site, off-site, and a mitigation bank at a 3:1 ratio. The estimated acreage for the first scenario takes into account the feasibility of being able to do this mitigation on-site. For example, Delta smelt mitigation is not likely to be feasible on site due to the limitations of the waterways in the study area and the lack of real estate area to be able to create newly flooded habitat. As a result, Delta smelt mitigation is not assessed under this scenario since it is not implementable. However, it is a requirement of the project's biological opinion; therefore this alternative does not consider all required mitigation. Similarly, the mitigation bank only scenario also does not consider all required mitigation, because some habitat types must occur on-site due to limitations in available mitigation bank credits, and ESA requirements. Projected mitigation costs for both habitat creation and mitigation bank credits are shown in Table 3, above.

The cost for credits at a mitigation bank were obtained by contacting local mitigation banks to determine their prices per acre or credit for each of the habitat types needed for the GRR. These costs were then combined for each reach and Alternative to determine and overall mitigation cost per Alternative. These mitigation costs were included in the overall project cost for each alternative.

The combination alternative is likely the most implementable solution. It takes into account all required mitigation for the project per the NMFS and USFWS Biological Opinions, and assesses the implementation based on a reasonable estimate of on site mitigation, combined with using a mitigation bank. However, due to the temporal loss of habitat while new on site habitat is growing, the ecological value associated with onsite mitigation was reduced to an overall 80% habitat value for all scenarios based on the results of the associated HEP analysis, which was relied on for the purposes of this analysis.

For the purposes of evaluating the impacts of the ARCF GRR on fish and wildlife resources in the project area, with a reliance on existing information in the spirit of SMART Planning, the Habitat Evaluation Procedures (HEP) for the *American River Watershed Investigation, Common Features Modifications, Mayhew Drain Site Project* were relied upon as a reference baseline. The HEP for the Mayhew Drain Site Project was conducted in 2005 to quantify anticipated impacts to fish and wildlife and their habitats, and to determine mitigation needs for the project. This HEP was selected for the ARCF GRR because the Mayhew Drain Site is located within the overall study area for the ARCF GRR, and the habitat type and value at the Mayhew site is consistent with the habitat that occurs throughout the ARCF GRR project area.

The HEP provided information for two general types of wildlife habitat comparisons: 1) the relative value of different areas at the same point in time; and 2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed project on wildlife habitat were quantified and compensation needs (in terms of acreage) for the project were determined. The assumption that habitat for selected wildlife species or communities can be numerically described by a model produces a Habitat Suitability Index (HSI). The HSI, a value from 0.0 to 1.0, provides a measure of habitat quality for a sample area in terms of suitability for the particular species or community being evaluated.

For the Mayhew Drain project, the Northern oriole Riparian woodland model was used because it best suited the habitat type in the project area. The quantity part of the formula is any measure of area which is appropriately sized for the study. The product of these two measures is comparable to "habitat value" which equals habitat quantity multiplied by habitat quality. This formula is expressed as a Habitat Unit (HU).

Habitat Type x Habitat Area = Habitat Value

The Average Annual Habitat Units (AAHUs) over the life of the project can then used to determine mitigation needs. The model, variables measured and data collection methods used for the Mayhew Drain Project are shown below in Table 4. For the ARCF GRR, data was estimated visually and using google earth.

Table 4. HSI model, Variables, and Data Collection Methods.

HSI Model and Cover-Type	HSI Model Variables	Data Collection Method
Northern oriole Riparian Woodland	V1 – Average height of deciduous tree canopy	Visual estimation
	V2- Percent deciduous tree crown cover	Densiometer along belt transects
	V3 – Stand width	Estimated using aerial photos

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific baseline variables and/or HSI values for each evaluation element for the Northern oriole based on best professional knowledge of performance at other mitigation sites, literature on plant growth, and conditions at reference sites. To predict changes in the HSI for each future scenario, it was necessary to make assumptions regarding baseline and future values within project impact and compensation areas. The assumptions made for the ARCF GRR with project can be seen in Table 5.

Table 5. HSI Variables for the ARCF GRR Based on Habitat Values.

HEP - FUTURE WITH-PROJECT							
Time	**Variables**			**Suitability Index**			**Output**
	V1	**V2**	**V3**	**SI-V1**	**SI-V2**	**SI-V3**	**HSI**
TY1	20	25%	2	0.60	1.00	1.00	0.84
TY2	10	25%	2	0.30	1.00	1.00	0.67
TY25	20	75%	2	0.60	0.75	1.00	0.77
TY50	35	75%	2	1.00	0.75	1.00	0.91
HSI = (V1*V2*V3)^1/3						Average	0.80

The HSI value of 0.80 in Table 5 results from a temporal loss of habitat value and function from the removal of existing mature riparian habitat. This is due to the lower values given to mitigation plantings during the establishment period. The recommended plan for mitigation associated with the ARCF GRR is the Alternative 2 combination plan at a 2:1 ratio (the third scenario discussed above). A 2:1 mitigation ratio is a reasonable requirement for implementation of mitigation for this already scarce habitat type, because the proposed project will decrease the connectivity of existing habitat along the Sacramento River system. Additionally, temporal loss of onsite habitat results in a reduction in value and function of the new vegetation within the mitigation areas as it grows to maturity. This also accounts for the loss of other services that riparian vegetation provides, including:

- An essential food source for fish and wildlife, including ESA species;
- Aquatic resting and refugia for resident and migratory fish species;
- Large woody debris recruitment;
- Nesting and rearing habitat for terrestrial wildlife species;

- Nutrients for the ecological system;
- Shade for the river which maintains water temperatures and dissolved oxygen concentrations; and,
- Increased habitat value for VELB.

The above-listed functions and services associated with a newly created acre of habitat are usually expected to be less than those associated with natural habitat. As a result the 2:1 mitigation ratio is appropriate to compensate for the loss of mature riparian habitats.

Tables 6 and 7 below show the environmental effects and proposed mitigation for each of the two alternatives under the recommended plan. Note that some habitat types are adjusted to 1:1 and 3:1 to comply with the terms and conditions of the Biological Opinions.

Table 6. Environmental Effects of and Proposed Mitigation for Alternative 1.

Habitat Type	Potential Impacts	Duration of Impact	Mitigation (Acres/Linear Feet)	Cost at Mitigation Bank	Cost On- or Off-Site within Study Area
GGS Uplands	None	None	None	None	None
GGS Aquatic	None	None	None	None	None
Riparian	184.3 acres	Permanent	368.6 acres		20,273,000
Shaded Riverine Aquatic Habitat	82,325 lf	Permanent	82,325 lf		$19,020,000**
Elderberry Shrubs	3,292 stems	Permanent	1,715.6 credits 70.89 acres		$6,026,000
Vernal Pools	0.25 acre	Permanent	1 acre	$275,000	---
Green Sturgeon	20 acres	Permanent	Restore acres, monitoring, and fish passage features		$16,259,000
Delta Smelt Spawning Habitat	32 acres	Permanent	34 acres	$4,160,000	
Shallow Water Habitat (Delta Smelt)	14 acres	Permanent	42 acres	$5,460,000	
Oak Woodland	2 acres	Permanent	4 acres		$200,000
Wetlands	0.4 acres	Permanent	0.8 acres	$130,000	---
Sub-Total				**$10,025,000**	**$61,778,000**

** SRA habitat mitigation is provided in the project's cost estimate as a separate construction cost rather than a mitigation cost, since it is a feature of the bank protection designs and would be included as a part of the construction contract. The cost is displayed under the Fish and Wildlife Facilities account as "Construction" costs and is estimated to be approximately $231 per linear foot.

Table 7. Environmental Effects and Proposed Mitigation for Alternative 2, the Recommended Plan.

Habitat Type	Potential Impacts	Duration of Impact	Mitigation (Acres/Linear Feet)	Cost at Mitigation Bank	Cost On- or Off-Site within Study Area
GGS Uplands	30 acres 75 acres	Permanent Temporary	90 acres 75 acres	$4,500,000	N/A*
GGS Aquatic	15 acres	Permanent	45 acres	$2,250,000	
Riparian	150.6 acres	Permanent	301.2 acres		$16,566,000
Shaded Riverine Aquatic Habitat	82,325 lf	Permanent	82,325 lf		$19,020,000**
Elderberry Shrubs	3,292 stems	Permanent	1,715.6 credits 70.89 acres		$6,026,000
Vernal Pools	1 acre	Permanent	1 acre	$275,000	---
Green Sturgeon	20 acres	Permanent	Restore acres, monitoring, and fish passage features		$16,259,000
Delta Smelt Spawning Habitat	34 acres	Permanent	34 acres	$4,160,000	
Shallow Water Habitat (Delta Smelt)	14 acres	Permanent	42 acres	$5,460,000	
Oak Woodland	2 acres	Permanent	4 acres		$200,000
Wetlands	0.4 acres	Permanent	0.8 acres	$130,000	---
Sub-Total				**$16,775,000**	**$58,341,000**

* 75 acres of temporary effects to GGS habitat from the relocation of the Sacramento Bypass toe drain would consist of standard site restoration erosion control features such as hydroseeding. This is contained within construction costs and is not considered a mitigation cost. It is presented in this plan due to monitoring requirements, as described in Section 2.1 below.
** SRA habitat mitigation is provided in the project's cost estimate as a separate construction cost rather than a mitigation cost, since it is a feature of the bank protection designs and would be included as a part of the construction contract. The cost is displayed under the Fish and Wildlife Facilities account as "Construction" costs and is estimated to be approximately $231 per linear foot.

In order to establish a basis of comparison for this Cost Estimate, the "Without Project Condition" is assumed to be of such low habitat value that there would be 0 AAHU's without implementing compensatory mitigation. The "With Project Condition" is the completed mitigation as designed. On site costs were estimated using the average of costs for other onsite mitigation the District has constructed for projects in the region. Due to the temporal loss of habitat while new on site habitat is growing, the ecological value associated with onsite mitigation was reduced to an overall 80% habitat value.

The Mitigation Outputs and Cost tables below compare the Average Annual Habitat Units (AAHU's) and costs between the five scenarios.

Table 8. Mitigation Outputs On-/Off-Site for Alternative 1.

Maximized On/Off Site Habitat				
Increment	***Habitat Restored***			
	Acres	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	368.6	0	294.88	294.88
Oak Woodland	4	0	3.2	3.2
Wetlands	0	0	0	0
Delta Smelt	0	0	0	0
SRA	46	0	36.8	36.8
Vernal Pool	0	0	0	0
GGS	0	0	0	0
Green Sturgeon	20	0	20	20
VELB	70	0	56	56
Grand Total:	**508.6**		**410.9**	**410.9**

Table 9. Costs for On-/Off-Site for Alternative 1.

On-/Off-site Cost/Acre			***Cost On-/Off-Site***
$55,000			$20,273,000
$50,000			$200,000
$0			$0
$55,000			$0
$231	$231/lf-80,825lf	80,825	$19,020,000
$0			$0
$0			$0
$150,000			$3,000,000
$85,000			$5,950,000
			$48,443,000

Table 10. Mitigation Outputs at a Mitigation Bank for Alternative 1.

Mitigation Bank				
Increment	*Habitat Restored*			
	Acres	*AAHU's Without Project*	*AAHU's With Project*	*Net Change in AAHU's*
Riparian	368.6	0	368.6	368.6
Oak Woodland	4	0	4	4
Wetlands	1	0	1	1
Delta Smelt	74	0	74	74
SRA	0	0	0	0
Vernal Pool	1	0	1	1
GGS	0	0	0	0
Green Sturgeon	0	0	0	0
VELB	70	0	70	70
Grand Total:	**518.6**	**0**	**518.6**	**518.6**

Table 11. Costs for Mitigation Bank for Alternative 1.

Bank Cost/ Acre			*Cost at a Bank*
$75,000			$27,645,000
$75,000			$300,000
$130,000			$130,000
$130,000			$9,620,000
$0			$0
$275,000			$275,000
$50,000			$0
$0			$0
$4,500	Credit	1715	$7,717,500
			$45,687,500

Table 12. Combination Onsite and Mitigation Bank 2:1 Outputs for Alternative 1.

Combination On/Off-site and Bank					
	Habitat Restored				
Increment	***Acres on Site***	***Acres/Credits at Bank***	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	268.6	100	0	314.88	314.88
Oak Woodland	4	0	0	3.2	3.2
Wetlands	0	1	0	1	1
Delta Smelt	0	74	0	74	74
SRA	46	0	0	36.8	36.8
Vernal Pool	0	1	0	1	1
GGS	0	0	0	0	0
Green Sturgeon	20	0	0	20	20
VELB	70	0	0	56	56
Grand Total:	**408.6**	**176**	**0**	**506.88**	**506.88**

Table 13. Costs for 2:1 Combination Plan for Alternative 1.

Onsite Cost/ Acre	***Bank Cost/ Acre***	***Cost on Site***	***Cost at a Bank***	
$55,000	$75,000	$14,773,000	$7,500,000	
$50,000	$75,000	$200,000	$0	
	$130,000	$0	$130,000	
$55,000	$130,000	$0	$9,620,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$275,000	
$0	$50,000	$0	$0	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
		$42,943,000	**$17,525,000**	**$60,468,000**

Table 14. Combination Onsite and Mitigation Bank 1:1 Outputs for Alternative 1.

Combination On/Off-site and Bank at 1:1					
Increment	***Habitat Restored***				
	Acres on Site	***Acres at Bank***	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	184.3		0	147.44	147.44
Oak Woodland	2	0	0	1.6	1.6
Wetlands	0	0.45	0	0.45	0.45
Delta Smelt	0	46	0	46	46
SRA	46	0	0	36.8	36.8
Vernal Pool	0	0.25	0	0.25	0.25
GGS	0	0	0	0	0
Green Sturgeon	20	0	0	20	20
VELB	70	0	0	56	56
Grand Total:	**322.3**	**46.7**	**0**	**308.54**	**308.54**

Table 15. Costs for 1:1 Combination Plan for Alternative 1.

Onsite Cost/ Acre	***Bank Cost/ Acre***	***Cost on Site***	***Cost at a Bank***	
$55,000	$75,000	$10,136,500	$0	
$50,000	$75,000	$100,000	$0	
$0	$130,000	$0	$58,500	
$55,000	$130,000	$0	$5,980,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$68,750	
$0	$50,000	$0	$0	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
		$38,206,500	**$6,107,250**	**$44,313,750**

Table 16. Combination Onsite and Mitigation Bank 3:1 Outputs for Alternative 1.

Combination Onsite and Bank at 3:1					
Increment	***Habitat Restored***				
	Acres on Site	***Acres at Bank***	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	452.9	100	0	462.32	462.32
Oak Woodland	6	0	0	4.8	4.8
Wetlands	0	1.35	0	1.35	1.35
Delta Smelt	0	138	0	138	138
SRA	46	0	0	36.8	36.8
Vernal Pool	0	0.75	0	0.75	0.75
GGS	0	0	0	0	0
Green Sturgeon	20	0	0	20	20
VELB	70	0	0	56	56
Grand Total:	**594.9**	**240.1**	**0**	**720.02**	**720.02**

Table 17. Costs for 3:1 Combination Plan for Alternative 1.

Onsite Cost/ Acre	***Bank Cost/ Acre***	***Cost on Site***	***Cost at a Bank***	
$55,000	$75,000	$24,909,500	$7,500,000	
$50,000	$75,000	$300,000	$0	
$0	$130,000	$0	$175,500	
$55,000	$130,000	$0	$17,940,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$206,250	
$0	$50,000	$0	$0	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
$395,231		**$53,179,500**	**$25,821,750**	**$79,001,250**

The total outputs and costs for mitigation were further calculated out for Alternative 2, the Recommended Plan. The following tables show the total costs and outputs for the five mitigation scenarios.

Table 18. Mitigation Outputs On-/Off-Site for Alternative 2.

Maximized On/Off Site Habitat Development				
Increment	***Habitat Restored***			
	Acres	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	301.2	0	240.96	240.96
Oak Woodland	4	0	3.2	3.2
Wetlands	0	0	0	0
Delta Smelt	0	0	0	0
SRA	46	0	36.8	36.8
Vernal Pools	0	0	0	0
GGS	0	0	0	0
Green Sturgeon	20	0	20	20
VELB	70	0	56	56
Grand Total:	**441.2**		**357.0**	**357.0**

Table 19. Costs for On-/Off-Site for Alternative 2.

Onsite Cost/ Acre			***Cost All Onsite***
$55,000			$16,566,000
$50,000			$200,000
			$0
$55,000			$0
$231	$231/lf-46,000lf	82,325	$19,020,000
			$0
			$0
$150,000			$3,000,000
$85,000			$5,950,000
			$44,736,000

Table 20. Mitigation Outputs at a Mitigation Bank for Alternative 2.

Mitigation Bank				
Increment	***Habitat Restored***			
	Acres	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	301.2	0	301.2	301.2
Oak Woodland	4	0	4	4
Wetlands	1	0	1	1
Delta Smelt	74	0	74	74
SRA	0	0	0	0
Vernal Pool	1	0	1	1
GGS	135	0	135	135
Gren Sturgeon	0	0	0	0
VELB	70	0	70	70
Grand Total:	**586.2**	**0**	**586.2**	**586.2**

Table 21. Costs for Mitigation Bank for Alternative 2.

Bank Cost/ Acre			***Cost at a Bank***
$75,000			$22,590,000
$75,000			$300,000
$130,000			$130,000
$130,000			$9,620,000
$75/LF			$0
$275,000			$275,000
$50,000			$6,750,000
N/A			$0
$4,500	Credit	1715	$7,717,500
			$47,382,500

Table 22. Combination Onsite and Mitigation Bank 2:1 Outputs for Alternative 2.

Combination Onsite and Bank Per BiOp at Recommended Plan					
Increment	*Habitat Restored*				
	Acres on Site	*Acres at Bank*	*AAHU's Without Project*	*AAHU's With Project*	*Net Change in AAHU's*
Riparian	201.2	100	0	260.96	260.96
Oak Woodland	4	0	0	3.2	3.2
Wetlands	0	1	0	1	1
Delta Smelt	0	74	0	74	74
SRA	46	0	0	36.8	36.8
Vernal Pool	0	1	0	1	1
GGS	0	135	0	135	135
Green Sturgeon	20	0	0	20	20
VELB	70	0	0	56	56
Grand Total:	**341.2**	**311**	**0**	**587.96**	**587.96**

Table 23. Costs for 2:1 Combination Plan for Alternative 2.

Onsite Cost/ Acre	*Bank Cost/ Acre*	*Cost on Site*	*Cost at a Bank*	
$55,000	$75,000	$11,066,000	$7,500,000	
$50,000	$75,000	$200,000	$0	
	$130,000	$0	$130,000	
$55,000	$130,000	$0	$9,620,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$275,000	
	$50,000	$0	$6,750,000	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
		$39,236,000	**$24,275,000**	**$63,511,000**

Table 24. Combination Onsite and Mitigation Bank 1:1 Outputs for Alternative 2.

Combination Onsite and Bank at 1:1					
	Habitat Restored				
Increment	*Acres on Site*	*Acres at Bank*	*AAHU's Without Project*	*AAHU's With Project*	*Net Change in AAHU's*
Riparian	150.6		0	120.48	120.48
Oak Woodland	2	0	0	1.6	1.6
Wetlands	0	0.45	0	0.45	0.45
Delta Smelt	0	46	0	46	46
SRA	46	0	0	36.8	36.8
Vernal Pool	0	0.25		0.25	0.25
GGS	0	45	0	45	45
Green Sturgeon	20	0		20	20
VELB	70	0	0	56	56
Grand Total:	**288.6**	**91.7**	**0**	**326.58**	**326.58**

Table 25. Costs for 1:1 Combination Plan for Alternative 2.

Onsite Cost/ Acre	*Bank Cost/ Acre*	*Cost on Site*	*Cost at a Bank*	
$55,000	$75,000	$8,283,000	$0	
$50,000	$75,000	$100,000	$0	
$0	$130,000	$0	$58,500	
$55,000	$130,000	$0	$5,980,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$68,750	
$0	$50,000	$0	$2,250,000	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
		$36,353,000	**$8,357,250**	**$44,710,250**

Table 26. Combination Onsite and Mitigation Bank 3:1 Outputs for Alternative 2.

Combination Onsite and Bank at 3:1					
Increment	***Habitat Restored***				
	Acres on Site	***Acres at Bank***	***AAHU's Without Project***	***AAHU's With Project***	***Net Change in AAHU's***
Riparian	351.8	100	0	381.44	381.44
Oak Woodland	6	0	0	4.8	4.8
Wetlands	0	1.35	0	1.35	1.35
Delta Smelt	0	138	0	138	138
SRA	46	0	0	36.8	36.8
Vernal Pool	0	0.75	0	0.75	0.75
GGS	0	135	0	135	135
Green Sturgeon	20	0	0	20	20
VELB	70	0	0	56	56
Grand Total:	**493.8**	**375.1**	**0**	**774.14**	**774.14**

Table 27. Costs for 3:1 Combination Plan for Alternative 2.

Onsite Cost/ Acre	***Bank Cost/ Acre***	***Cost on Site***	***Cost at a Bank***	
$55,000	$75,000	$19,349,000	$7,500,000	
$50,000	$75,000	$300,000	$0	
$0	$130,000	$0	$175,500	
$55,000	$130,000	$0	$17,940,000	
$231	$75	$19,020,000	$0	
$0	$275,000	$0	$206,250	
$0	$50,000	$0	$6,750,000	
$150,000	$0	$3,000,000	$0	
$85,000	$4,500	$5,950,000	$0	
$395,231		**$47,619,000**	**$32,571,750**	**$80,190,750**

The following pages include the outputs from the CE/ICA IWR Plan software. The Best Buy plans were shown to be the No Action Plan, the Alternative 1 Combination Plan with a 1:1 ratio, and the Alternative 2 Combination Plan with a 1:1 ratio. However, none of these plans accomplish the terms and conditions of the Biological Opinions and thus cannot be implemented and remain in compliance with the Endangered Species Act. As a result, the Recommended Plan remains the Alternative 2 Combination Plan with a 2:1 ratio, because it accomplishes the terms and conditions of the Biological Opinions, and the CE/ICA did determine that it was a cost effective plan.

Table of Contents

Metadata:

Planning Study Name: American River Common Features

Planning Study Description: ARCF GRR

Planning Set Name: CEICA Analysis 3

Planning Set Description: Planning set generated by Cost Effective/Incremental Cost Analysis.

Parent Set Name: Planning Set 1

CE/ICA Analysis Variables:

Output Variable = Output

Cost Variable = Cost

The following section presents a summary of benefit-cost analyses performed during development of the PlanningStudy2. The Institute for Water Resources Planning Suite version IWR Planning Suite 2.0.8.1 (Uncertainty Beta), release 04 Mar 2013 was used to produce information summarized in the following pages. Likewise, the following are metadata for the file(s) from which the information presented in the following pages was produced:

File Name	File Date	Module	Module Version
PlanningStudy2.mdb	12/5/2015	Plan Editor	2.0.8.1

References:

- Rogers, C., Robinson, M., Skaggs, L., & Heisey, S. (2006, November). IWR Planning Suite User's Guide. Alexandria, VA, United States of America: United States Army Corps of Engineers.

- Brandreth, B., & Skaggs, L. (2002, October). Lessons Learned from Cost Effectiveness and Incremental Cost Analyses. *IWR Report 02-R-5* .Alexandria, Virginia, United States of America: U.S. Army Corps of Engineers.

- Orth, K. (1994, October). Cost Effectiveness Analysis for Environmental Planning: Nine EASY Steps. *IWR Report 94-PS-2* . Alexandria, Virginia, United States of America: U.S. Army Corps of Engineers.

- Robinson, R., Hansen, W., Orth, K., & Franco, S. (1995, May). Evaluation of Environmental Investments Procedures Manual. *IWR Report 95-R-1* . Alexandria, Virginia, United States of America: U.S. Army Corps of Engineers.

Benefit-Cost Analysis Variable Definitions:

The following table provides a summary of the variables used during development of benefit-cost analyses performed during development of the PlanningStudy2. The table provides a summary of variables, units, definitions, and any formulas/computations (where relevant) associated with individual variables that are dependent on values of multiple user-provided values costs or benefits.

Planning Study Variable Properties					
Name	**Units**	**Description**	**Type**	**Derived Function (if applicable)**	**Allowable Range**
Cost	$10	Cost in $10	Currency		Any
Output	HU	Output in Habitat Units	Decimal		Any

Costs and Benefits Summary:

The following table provides a summary of average annual equivalent monetary costs and benefits, and average annual non-monetary costs and benefits considered during development of each mitigation alternative in the American River Common Features Project. In addition to annualized costs and benefits considered during development of cost-benefit analyses, total cost and total benefits associated with each alternative are also shown (reflected as present value) for each mitigation alternative.

Total and Average Cost

12/5/2015 3:35:11PM

All Plan Alternatives **Planning Set:** CEICA Analysis 3

Counter	Name	Output HU	Cost $1000	Average Cost
		0.00	0.00	
		308.54	44,313,750.00	143,624.00
1	No Action Plan	326.58	44,710,250.00	136,904.43
2	Alternative 1 Combo 1:1	357.00	44,736,000.00	125,310.92
3	Alternative 2 Combo 1:1	410.90	48,443,000.00	117,894.86
4	Alternative 2 Max Onsite	506.88	60,468,000.00	119,294.51
5	Alternative 1 Max Onsite	518.60	45,687,500.00	88,097.76
6	Alternative 1 Combo 2:1	586.20	47,382,500.00	80,829.92
7	Alternative 1 Max Mitigation Bank	587.96	63,511,000.00	108,019.25
8	Alternative 2 Max Mitigation Bank			
9	Alternative 2 Combo	720.02	79,001,250.00	109,720.91
	Recommended Plan	774.14	80,190,750.00	103,586.88
10	Alternative 1 Combo 3:1			
11	Alternative 2 Combo 3:1			

IWR-PLAN * Plan Of Interest

Incremental Costs and Benefits Summary:

The following table provides a summary of incremental costs and benefits associated with each mitigation alternative considered during development of the American River Common Features Project. For each of the considered mitigation alternatives, it shows the "added" cost associated with delivery of benefits exceeding the "next-best" cost-effective alternative.

Incremental Cost of Best Buy Plan Combinations (Ordered By Output)

12/5/2015 3:35:14PM

Planning Set: American River Common Features GRR

Counter	Plan Alternative	Output (HU)	Cost ($1000)	Average Cost ($1000 / HU)	Incremental Cost ($1000)	Inc. Output (HU)	Inc. Cost Per Output
1	No Action Plan	0.00	0.00				
2	Alternative 1 Combo 1:1	308.54	44,313,750.00	143,624.0034	44,313,750.0000	308.5400	143,624.0034
3	Alternative 2 Combo 1:1	326.58	44,710,250.00	136,904.4338	396,500.0000	18.0400	21,978.9357
4	Alternative 2 Max Onsite	357.00	44,736,000.00	125,310.9244	25,750.0000	30.4200	846.4826
5	Alternative 1 Max Onsite	410.90	48,443,000.00	117,894.8649	3,707,000.0000	53.9000	68,775.5102
6	Alternative 1 Combo 2:1	506.88	60,468,000.00	119,294.5076	12,025,000.0000	95.9800	125,286.5180
7	Alternative 1 Max Mitigation Bank	518.60	45,687,500.00	88,097.7632	-14,780,500.0000	11.7200	-1,261,134.8123
8	Alternative 2 Max Mitigation Bank	586.20	47,382,500.00	80,829.9215	1,695,000.0000	67.6000	25,073.9645
9	Alternative 2 Combo Recommended Plan	587.96	63,511,000.00	108,019.2530	16,128,500.0000	1.7600	9,163,920.4545
10	Alternative 1 Combo 3:1	720.02	79,001,250.00	109,720.9105	15,490,250.0000	132.0600	117,297.0619
11	Alternative 2 Combo 3:1	774.14	80,190,750.00	103,586.8835	1,189,500.0000	54.1200	21,978.9357

Chart of Alternatives:

This chart provides an illustration of costs and benefits associated with alternatives generated during development of the American River Common Features GRR. Alternatives are charted based on their benefit (x-axis) and cost (y-axis) coordinates.

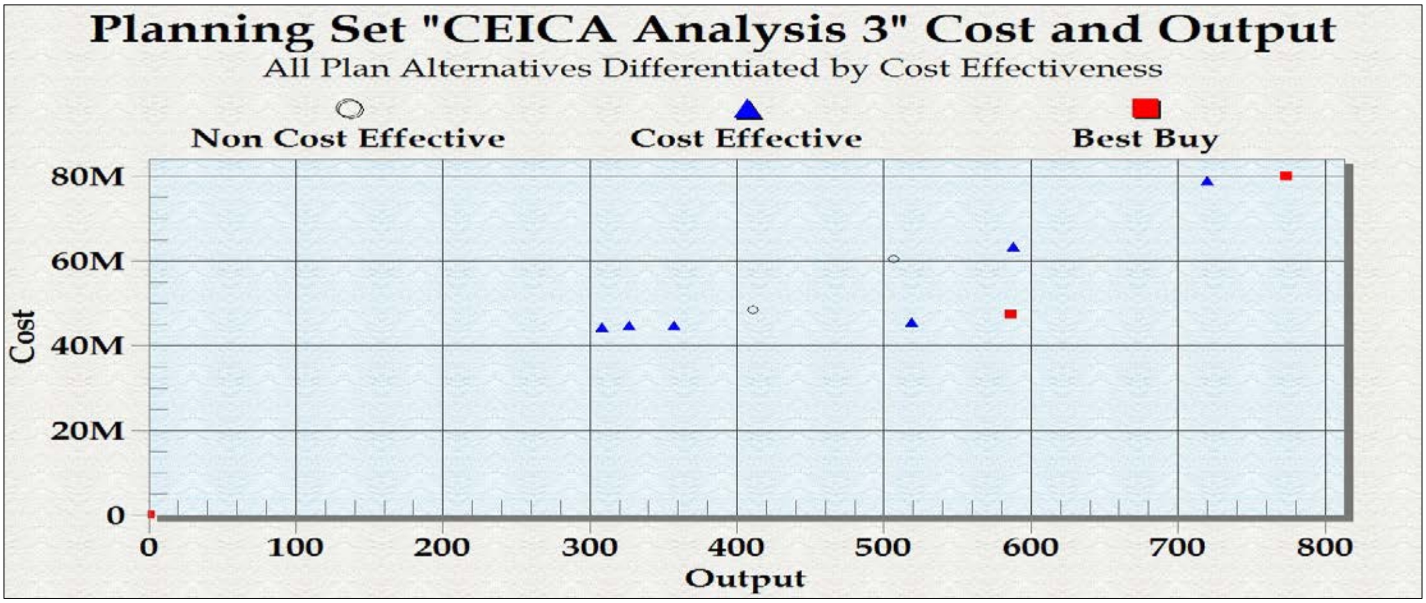


Chart of Cost-Effective Alternatives:

This chart provides an illustration of costs and benefits associated with cost-effective alternatives considered during development of the American River Common Features GRR. Alternatives are charted based on their benefit (x-axis) and cost (y-axis) coordinates. The depicted alternatives have been identified among the most cost-effective of the alternatives considered during development of the study.

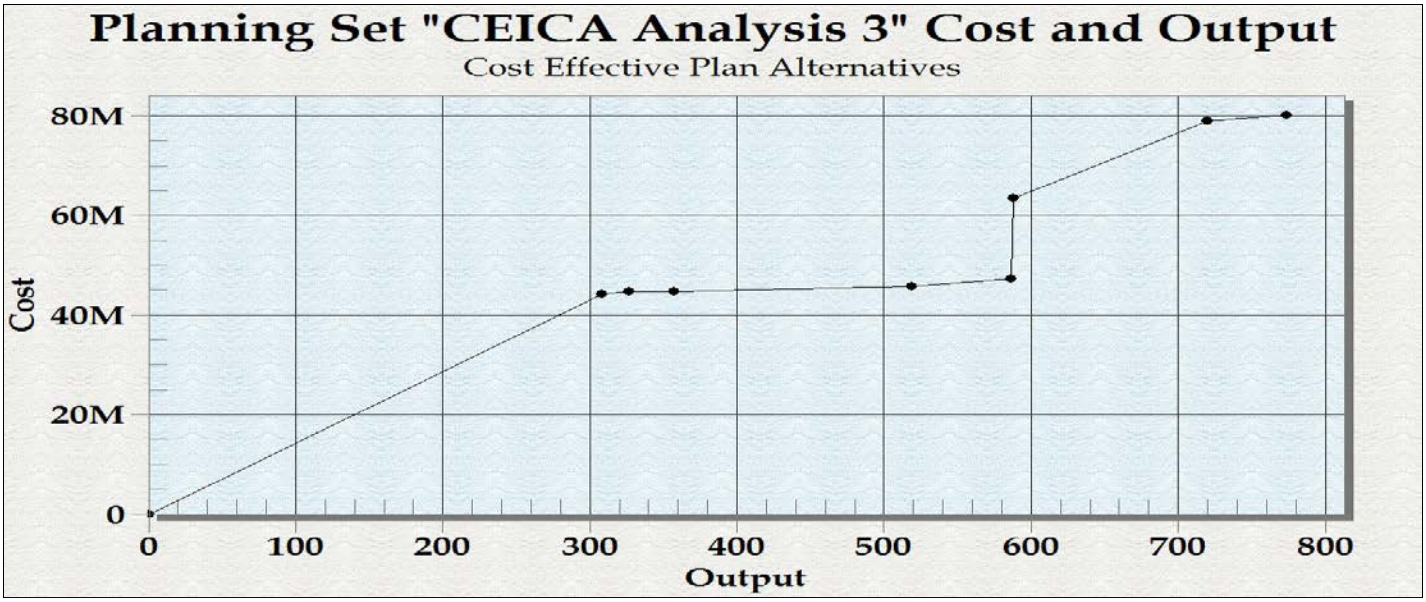
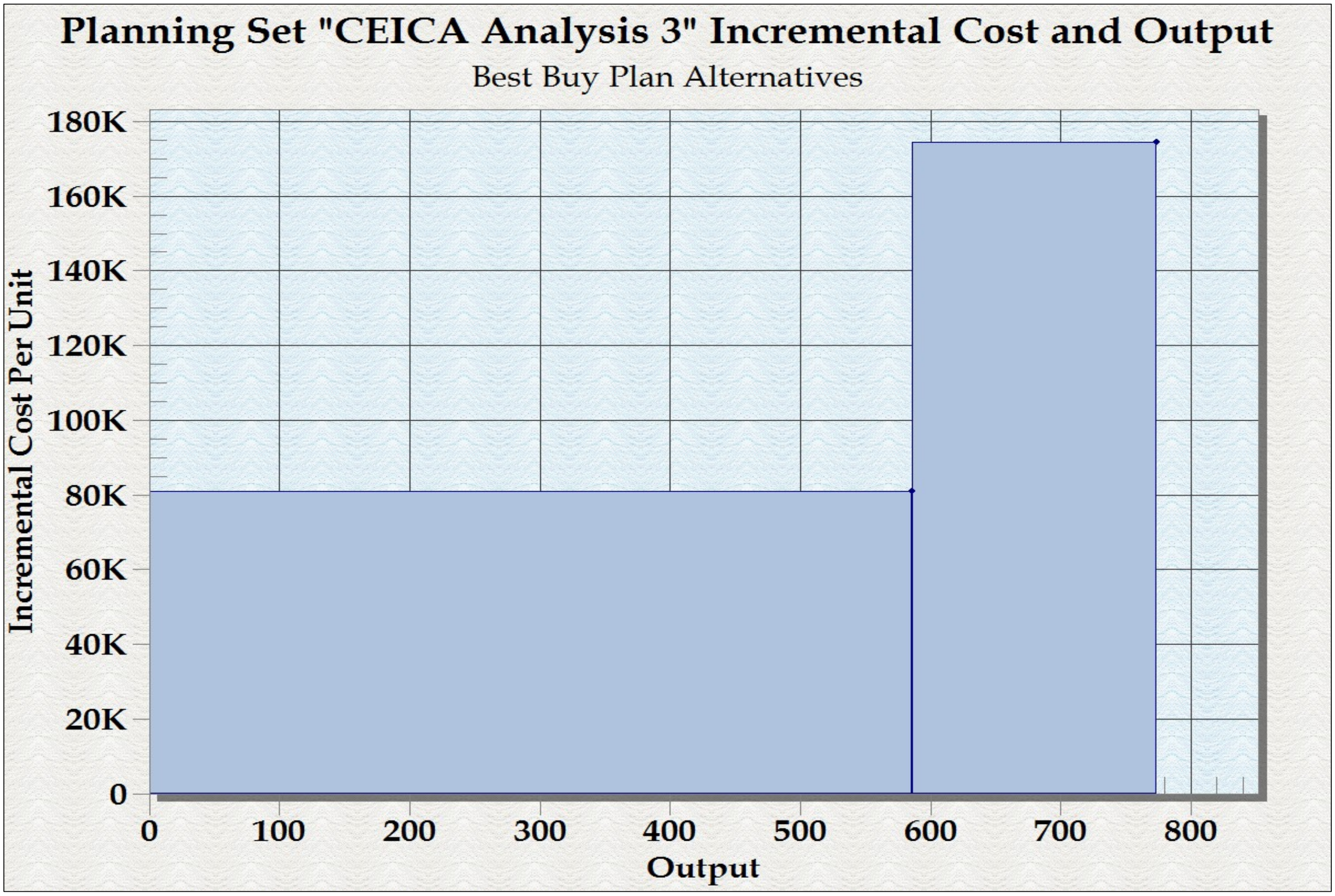


Chart of Incremental Costs and Benefits of Alternatives:

This chart provides an illustration of costs and benefits associated with alternatives considered during development of the American River Common Features GRR. The magnitudes of incremental benefits (width of rectangle) and incremental costs (height of rectangle) are represented to illustrate the relative magnitudes of each alternative's "added" costs associated with benefits exceeding the "next-best" cost-effective alternative.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2014-F-0518

SEP 1 1 2015

Ms. Alicia E Kirchner
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Formal Consultation on the American River Common Features (AFRC) Project, Sacramento County, California

Dear Ms. Kirchner:

This letter is in response to the U.S. Army Corps of Engineers (Corps) April 3, 2015, request for consultation with the U.S. Fish and Wildlife Service (Service) on the proposed American River Common Features General Reevaluation Report (ARCF GRR) project in Sacramento County, California. You request was received by the Service on April 7, 2015. The Corps originally initiated consultation on June 30, 2014; however, the Service responded on July 23, 2014, with a request for additional information regarding the project description and the effects analysis the Corps had completed. The April 3, 2015, letter and biological assessment began the formal consultation period. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

The Federal action on which we are consulting is the ARCF GRR, which includes levee improvements and bank protection along the Sacramento River, levee improvements along Arcade, Magpie, and Dry/Robla Creeks, widening the Sacramento Bypass and Weir, and bank protection along the lower American River. Pursuant to 50 CFR 402.12(j), you submitted a biological assessment for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project may affect and is not likely to adversely affect the vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardi*); may affect likely to adversely affect the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), delta smelt (*Hypomesus transpacificus)* (smelt) and its critical habitat; the giant garter snake (*Thamnophis gigas*); and the yellow-billed cuckoo (*Coccyzus americanus occidentalis*). The project is outside of critical habitat designated for the valley elderberry longhorn beetle and critical habitat proposed for the yellow-billed cuckoo.

The Corps previously consulted with the Service on the Magpie Creek Flood Control Project and on September 15, 2004 a biological opinion regarding effects to the vernal pool fairy shrimp, vernal pool tadpole shrimp, and giant garter snake (File # 1-1-04-F-0132) was provided. The project described in the 2004 biological opinion is exactly the same as the Magpie Creek portion of the project description in the Common Features biological assessment. Because the environmental baseline for vernal pool fairy shrimp and vernal pool tadpole shrimp has not changed from the baseline that was analyzed in the 2004 biological opinion and the project description remains the same, effects to and take of vernal pool fairy shrimp and vernal pool tadpole shrimp are addressed in the September 15, 2004, biological opinion. More recent information regarding the status of the habitat along Magpie Creek for giant garter snake has changed from the 2004 biological opinion. This opinion addresses those changes and any potential effects to the giant garter snake.

Seasonal wetlands, which may provide suitable habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp, occur in the vicinity of the Robla Creek woodland mitigation site A, however any vernal pools in this area would be avoided by these activities. The Corps will implement a 250-foot buffer between vernal pools and vegetation planting. Planting activities will be done in the fall when the wetlands are dry and will use best management practices to ensure that sediment does not enter the seasonal wetlands. The Service concurs that with your determination of may affect, not likely to adversely affect vernal pool fairy shrimp and vernal pool tadpole shrimp at the Robla Creek woodland mitigation site A.

This biological opinion is based on information provided in the Corps' letter requesting consultation and the biological assessment. A complete administrative record is on file at the Service's Sacramento Fish and Wildlife Office.

CONSULTATION HISTORY

September 4, 2013: The Service commented on the April 2013 draft biological assessment.

April 8, 2014: The Service commented on the October 2013 draft biological assessment.

June 30, 2014: The Corps initiated section 7 consultation with the Service.

July 23, 2014: The Service sent a letter in response to the Corps initiation requesting additional information.

April 3, 2015: The Corps provided an updated biological assessment with responses to the Service's July 23, 2014, request for additional information.

August 31, 2015: The Corps provided a revised biological assessment that addressed questions the Service had regarding the project description.

BIOLOGICAL OPINION

Description of the Action

Congress directed the Corps to investigate the feasibility of reducing flood risk of the city of Sacramento. The Corps completed feasibility studies in 1991 and 1996, recommending a concrete gravity flood detention dam on the north fork of the American River at the Auburn site along with levee improvements downstream of Folsom Dam. Other plans evaluated in the report were Folsom Dam improvements and a stepped release plan for Folsom Dam releases. These additional plans also included levee improvements downstream of Folsom Dam. Congress recognized that levee improvements were "common" to all candidate plans in the report and that there was a Federal interest in participating in these "common features." Thus, the ARCF Project was authorized in the Water Resources Development Act (WRDA) of 1996 and a decision on Auburn Dam was deferred to a later date. Major construction components of ARCF in the WRDA 1996 authorization included construction of seepage remediation along about 22 miles of American River levees and construction of levee strengthening and raising of 12 miles of Sacramento River levee in Natomas.

Following the 1986 flood, significant seepage was experienced on the Sacramento River from Verona (upstream end of Natomas) at River Mile (RM) 79 to Freeport at RM 45.5. In addition, both the north and south bank of the American River from RM 0 to about RM 11.4 experienced seepage. Seepage on the Sacramento River was so extensive that Congress, soon after the 1986 flood event, funded remediation in the Sacramento Urban Levee Improvement Project (Sac Urban). The Sac Urban Project constructed shallow seepage cutoff walls from Powerline Road in Natomas at approximately RM 64 down to Freeport.

Shortly thereafter, the Sacramento Valley experienced a flood event in 1997. Considerable seepage occurred on the Sacramento River as well as on the American River. Seepage on the American River was expected because remediation measures had yet to be constructed, but the occurrence of significant seepage on the Sacramento River in the reach remediated as part of the Sac Urban Project was alarming and confirmed that deep underseepage was also of significant concern. As a result, seepage remediation on the American River (then in the late 1990s in the design phase) would need to be designed to remediate both through- and deep underseepage.

In 1999, Congress decided not to authorize Auburn Dam, but instead authorized improvements for Folsom Dam. By doing this, improvements to levees downstream of Folsom Dam could be fine-tuned to work closely with the Folsom improvements being discussed by Congress. Therefore, the ARCF project was modified by WRDA 1999 to include additional necessary features for the American River so that it could safely convey the proposed emergency release of 160,000 cubic feet per second (cfs) from Folsom Dam. Major construction components for the ARCF project in the WRDA 1999 authorization include construction of seepage remediation and levee raise along four stretches of the American River, and construction of levee strengthening and raising of 5.5 miles of Natomas Cross Canal levee in Natomas. All American River features authorized in WRDA 1996 and 1999 have been constructed or are in design analysis for construction within a year or two.

The purpose of the ARCF project is to reduce the flood risk for the city of Sacramento. The following problems were identified within the Sacramento levee system:

- Seepage and underseepage;
- Levee erosion;
- Levee stability;
- Levee overtopping;
- Access for maintenance and flood fighting;
- Vegetation and encroachments;
- Releases from Folsom Dam;
- Floodplain management; and
- Additional upstream storage from existing reservoirs.

In order to evaluate the effects to listed species, the Corps looked at the largest foreseeable footprint. As the Corps moves into the design phase of the project, footprint changes will likely reduce the effects to listed species.

The project is designed to allow for the release of 160,000 cubic feet per second (cfs) from Folsom Dam. The levees along the American River are unable to withstand these maximum flows for extended periods of time without increased risk of erosion and potential failure. The exact location where erosion will occur and to what extent erosion will occur during any given event is unknown. Erosion within the American River Parkway will be addressed as part of the Folsom Dam Water Control Manual Update currently under evaluation and a biological assessment is being prepared to initiate section 7 consultation with both the Service and National Marine Fisheries Service (NMFS). Therefore, the effects of erosion along the lower American River and effects of increased Yolo Bypass flooding frequency due to changes in operations from Folsom Dam are not analyzed in this project description. This is because construction of the American River and Sacramento Bypass measures, which are dependent on releases from Folsom Dam, will not occur until after a biological opinion is received for the Water Control Manual Update. Sacramento River and East Side Tributaries measures are necessary to improve the flood risk management system in the Sacramento area regardless of the change in operation at Folsom Dam and are not dependent on Folsom Dam operations for their implementation. As a result, construction in these areas could occur regardless of the Folsom Dam Water Control Manual Update schedule.

The Corps' project involves the construction of fix-in-place levee remediation measures to address seepage, stability, erosion, and height concerns identified for the Sacramento River and American River levees, Natomas East Main Drainage Canal (NEMDC), Arcade, Dry/Robla, and Magpie Creeks (Figure 1). Most height concerns along the Sacramento River will be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass. Due to the urban nature and proximity of existing development within the American River North and South basins the Corps is planning fix in place remediation. This would improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 1 summarizes the levee problems discussed above and the proposed measure for each waterway.

Sacramento Area Flood Control Agency (SAFCA), the project's local sponsor, will complete some portions of the Federal project. SAFCA is seeking permission from the Corps pursuant to 33 USC §408 (Section 408) for alteration of the Federal levees along the NEMDC and Arcade Creek.

In addition to the proposed levee improvements measures shown in Table 1, the following measures and policies would be addressed during construction:

- The non-Federal (Department of Water Resources (DWR)) will bring the levees into compliance with the Corps' standard levee footprint using a System Wide Implementation Framework (SWIF) process. A SWIF is a plan developed by the levee sponsor(s) and accepted by the Corps to implement system-wide improvements to a levee system (or multiple levee systems within a watershed) to address system-wide issues, including correction of unacceptable inspection items, in a prioritized way to optimize flood risk reduction. The standard levee footprint consists of a 20 foot crown width, 3:1 waterside

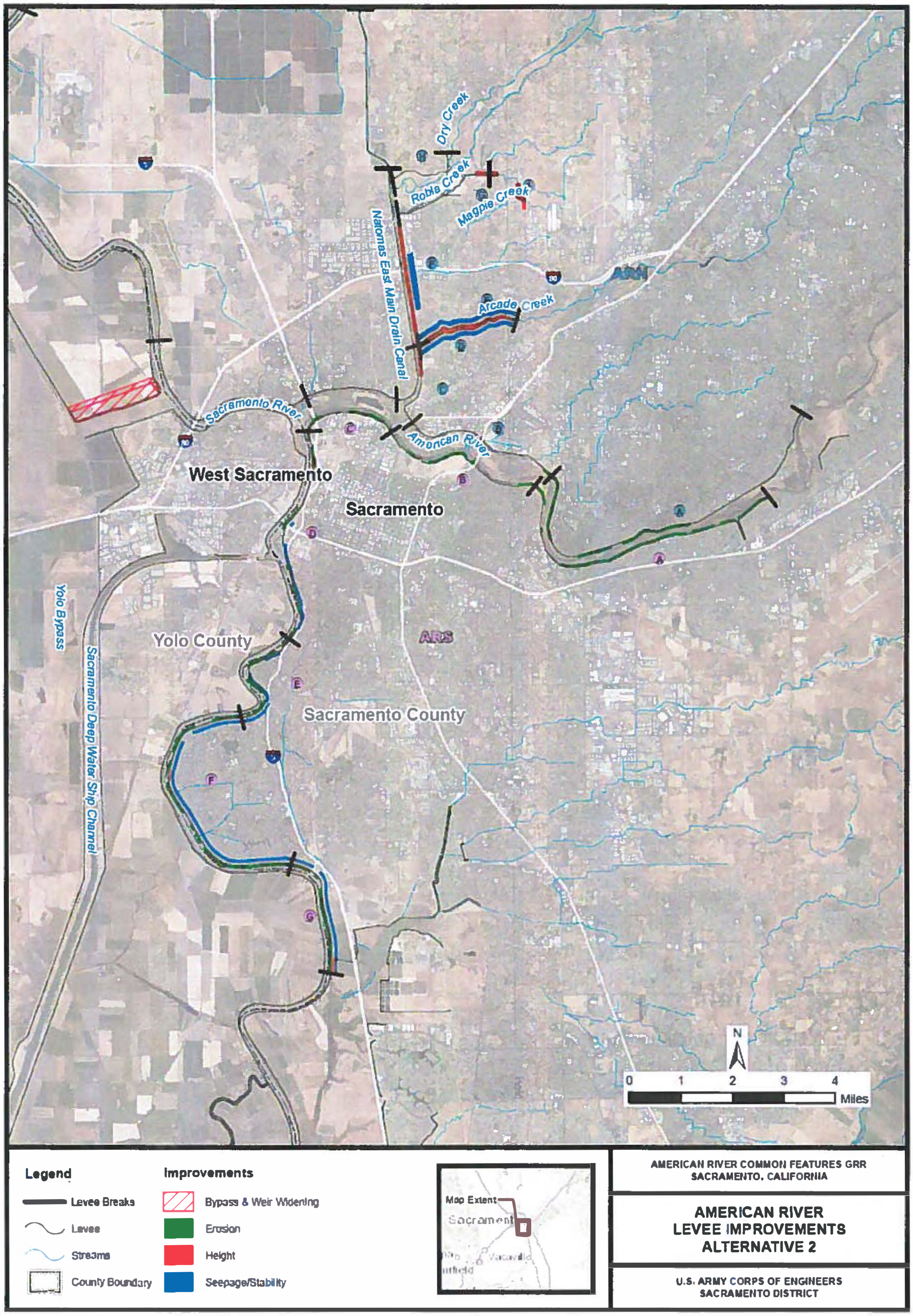


Figure 1. American River Common Features Project Area

Table 1. Remediation by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench (31,000 linear feet)	---
Sacramento River	Cutoff Wall (50,300 linear feet)	Cutoff Wall (50,300 linear feet)	Bank Protection (50,300 linear feet)	Sacramento Bypass and Weir Widening, Levee Raise (1,500 feet)
NEMDC	Cutoff Wall (6,000 linear feet)	Cutoff Wall	---	Floodwall (15,600 linear feet)
Arcade Creek	Cutoff Wall (22,000 linear feet)	Cutoff Wall	---	Floodwall (22,000 linear feet)
Dry/Robla Creeks	---	---	---	Floodwall (2,500 linear feet)
Magpie Creek[2]	---	---	---	Floodwall, Levee Raise

[1]American River seepage, stability, and overtopping measures were addressed in a previous construction project.
[2]In addition to the floodwall, Magpie Creek will include construction of a new levee (3,100 linear feet) along Raley Boulevard south of the creek, and construction of a detention basin on both sides of Raley Boulevard (79 acres). In addition, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

slope and 2:1 landside slope, when possible. If the 3:1 waterside slope is not possible, then a minimum 2:1 waterside slope would be established instead.

- Engineering Technical Letter 1110-2-583 (ETL) vegetation compliance would occur under a SWIF by the local maintaining agency (LMA). The intent of the SWIF is to collaboratively work with the resource agencies and levee sponsors to transition existing levees to Corps standards while maintaining Public Law (PL) 84-99 rehabilitation assistance and adhering to the Act and other environmental laws. The SWIF is a two-step process completed by the applicant that is composed of a letter of intent, which is followed by submission of a SWIF plan. The SWIF process allows eligible local sponsors to implement levee improvements in a prioritized "worst first" way to optimize the achievement of risk reduction. The Corps acknowledges that implementing system-wide improvements will need to be done within a collaborative intergovernmental framework and that it will take time to develop and implement improvements in complex situations. Challenges including ensuring that both environmental and levee safety considerations are adequately served.
- The vegetation requirements for the SWIF include a 15-foot waterside, landside, and vertical vegetation-free zone. Trees that pose an unacceptable risk to levee integrity will be removed and the root balls and roots will be remediated. Trees that do not pose a threat will not be removed. Vegetation on the landside slope would only be removed within the construction

footprint (up to ½ levee degrade) and the remaining vegetation would be dealt with under the SWIF process.

- Utility encroachments will be brought into compliance with Corps policy. Utilities that penetrate the levee would be removed and replaced with one of two fixes: (1) a surface line over the levee prism, or (2) a through-levee line equipped with positive closure devices.
- Private encroachments shall be removed by the non-Federal sponsor prior to construction.
- The Sacramento District of the Corps will pursue a vegetation variance which will allow vegetation on the lower ½ of the levee slope to 15 feet waterward of the waterside levee toe to remain in place. The Sacramento District has conducted an evaluation which examined the safety, structural integrity, and functionality of the levees that will be retained and not compromised if a tree were to fall and result in scouring of the root ball area. The results show that the tree fall and scour did not significantly affect levee performance, and the levee meets Corps seepage and slope stability criteria assuming the entire project is constructed.

American River

Levees along the American River require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed for the American River levees: (1) a maximum of 31,000 linear feet (LF) of bank protection, and (2) a maximum of 65 acres/45,000 LF of launchable rock trench. Both of these measures are described in detail in the subsections below. These numbers are maximized because there is some overlap identified to account for the uncertainty of site-specific conditions. For example, for some reaches both bank protection and launchable rock trench impacts were estimated even though both measures will not be constructed in the same reach.

<u>Bank Protection</u>

This measure consists of placing rock revetment on the river's bank to prevent erosion. It entails installing revetment along the stream bank based on site-specific analysis (Figure 2). When necessary, the eroded portion of the bank will be filled and compacted prior to the rock placement. The sites will be prepared by clearing and stripping of loose material and understory growth prior to construction. In most cases, large vegetation will be permitted to remain at these sites. Temporary access ramps will be constructed, if needed, using imported borrow material that would be trucked on site.

The placement of rock onto the bank will occur from a land based staging area using long reach excavators and loader. The loader brings rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the waterside of the levee.

The revetment will be placed on the existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a planting berm will be constructed in the rock to allow for revegetation of the site. The planting berm varies in width from 5 to 15 feet. In all cases the planting will occur outside the vegetation free zone as required by the ETL.

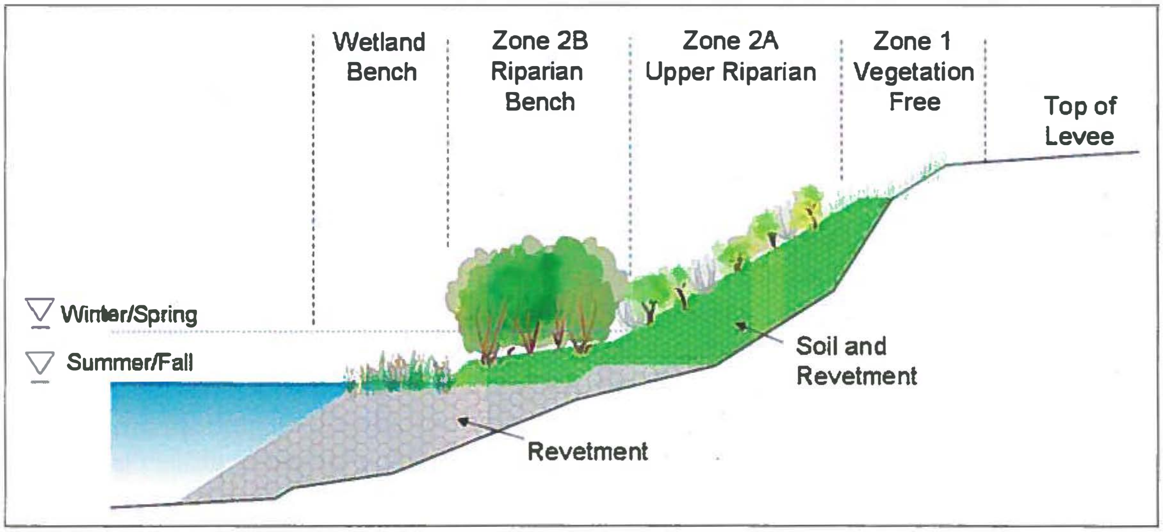


Figure 2. Bank Protection with Planting Bench.

<u>Launchable Rock Trench</u>

For the purposes of this project description, it is assumed that 65 acres of the lower American River will have a launchable rock trench fix. The remainder will be the bank protection described above. This measure includes construction of a launchable rock filled trench, designed to deploy once erosion has removed the bank material beneath it (Figure 3). All launchable rock trenches will be constructed outside of the natural river channel. The vegetation will be removed from the footprint of the trench and the levee slope prior to excavation of the trench. The trench configuration will include a 2:1 landside slope and 1:1 waterside slope and will be excavated at the toe of the existing levee. All soil removed during trench excavation will be stockpiled for potential reuse. The bottom of the trench will be constructed close to the summer mean water surface elevation in order to reduce the rock launching distance and amount of rock required.

After excavation, the trench will be filled with revetment that will be imported from an offsite commercial location. After rock placement the trench will be covered with a minimum of 3 feet of the stockpiled soil for a planting berm. Rock placed on the levee slope will be covered with 2 feet of stockpiled soil. All disturbed areas will be reseeded with native grasses and small shrubs where appropriate. Trees and shrubs could be permitted on the trench if planted outside the specified vegetation free zone as required by the ETL.

Sacramento River

Levees along the Sacramento River require improvements to address seepage, stability, and erosion. About 50,300 LF of bank protection and cutoff wall or slope stability work is proposed for the Sacramento River. In addition, these levees require a total of one mile of intermittent height improvements in order to convey additional flows that exceed current design levels.

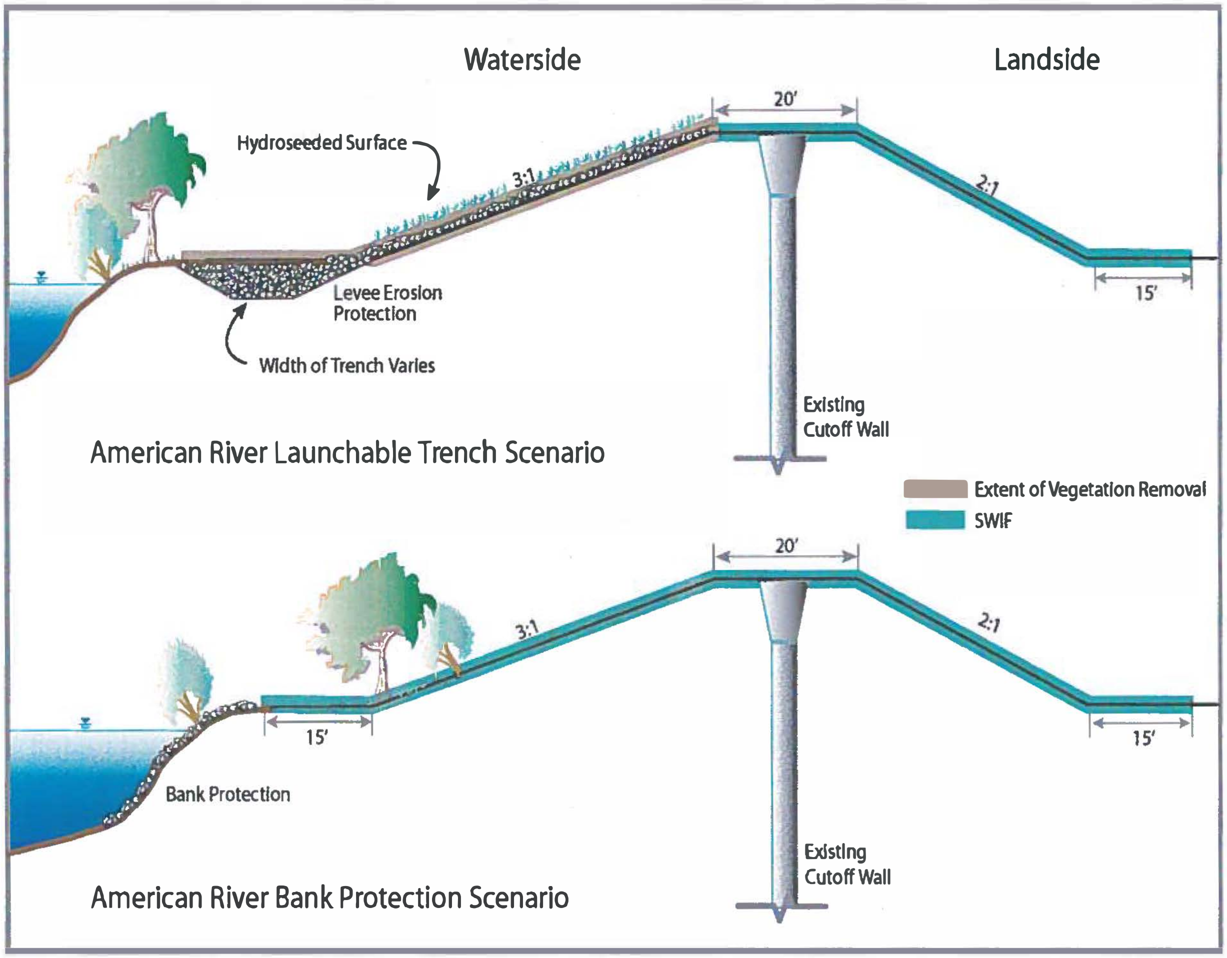


Figure 3. Launchable Rock Trench and Bank Protection.

Where the existing levee does not meet the levee design requirements, as discussed above, slope flattening, crown widening, and/or a minimal amount of levee raise is required. This improvement measure addresses problems with slope stability, geometry, height and levee crest access and maintenance. To begin levee embankment grading, loose material and vegetation understory will be cleared, grubbed, stripped, and where necessary, portions of the existing embankment will be excavated to allow for bench cuts and keyways to tie in additional embankment fill. Excavated and borrow material (from nearby borrow sites) will be stockpiled at staging areas. Haul trucks and front end loaders will bring borrow materials to the site, which will then be spread evenly and compacted according to levee design plans.

The levee will be raised about 1 to 2 feet resulting in the levee footprint extending out a maximum of 5 feet on the landside from the existing levee. The levee crown patrol road will be re-established at the completion of construction.

Cutoff Walls

To address seepage concerns, a cutoff wall will be constructed through the levee crown. The cutoff wall will be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach will depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of about 85 feet. For cutoff walls of greater depth the DSM method will be utilized.

Prior to any cutoff wall construction method, the construction site and any staging areas will be cleared, grubbed, and stripped. The levee crown will be degraded up to half the levee height to create a large enough working platform (about 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids. This method of slurry wall installation will also reduce the risk of slurry mixture following seepage paths and leaking into the river or into landside properties.

Open Trench Cutoff Wall

Under the open trench method, a trench about 3 feet wide will be excavated at the top of levee centerline and into the subsurface materials up to 85 feet deep with a long boom excavator. As the trench is excavated, it is filled with low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench is mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture is backfilled into the trench, displacing the temporary slurry. Once the slurry was hardened, it will be capped and the levee embankment will be reconstructed with impervious or semi-impervious soil.

DSM Cutoff Wall

The DSM method involves a crane supported set of two to four mixing augers used to drill through the levee crown and subsurface to a maximum depth of about 140 feet. As the augers are inserted and withdrawn, a cement bentonite grout will be injected through the augers and mixed with the native soils. An overlapping series of mixed columns will be drilled to create a continuous seepage cutoff barrier. A degrade of up to one half the levee height will be required for construction of the DSM wall. For both methods, once the slurry has hardened it will be capped and the levee embankment will be reconstructed with impervious or semi-impervious soil.

Bank Protection

Proposed bank protection along the Sacramento River will address erosion concerns. Studies have shown that the Sacramento River levees have a medium to high risk of breach due to erosion. Bank protection will be addressed by standard bank protection with planting berm. The standard bank protection measure for the Sacramento River consists of placing rock protection on the bank to prevent erosion. This measure entails filling the eroded portion of the bank, where necessary, and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. Large trees on the lower half of the waterside slope will be protected in place to retain shaded riverine aquatic (SRA) habitat. The sites will be prepared by removing vegetation along the levee slopes at either end of the site for construction of a temporary access ramp, if needed. The ramp will then be constructed using imported commercial borrow material that will be trucked on site.

The placement of rock onto the levee slope will occur from atop the levee and/or from the waterside by means of barges. Rock required within the channel, both below and slightly above the water line at the time of placement, will be placed by an excavator located on a barge. Construction will require two barges: one barge would carry the excavator, while the other barge will hold the stockpile of rock to be placed on the channel slopes. Rock required on the upper portions of the slopes will be placed by an excavator located on top of the levee. Rock placement from atop the levee will require one excavator and one loader for each potential placement site. The loader brings the rock from a permitted source and stockpiles it near the levee in the construction area. The excavator then moves the rock from the stockpile to the waterside of the levee.

The revetment will be placed via the methods discussed above on existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After revetment placement has been completed, a small planting berm will be constructed in the rock to allow for some revegetation of the site.

Natomas East Main Drain Canal

The east levee of the NEMDC requires 6,000 LF of improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A cutoff wall will be constructed at this location to address the seepage and stability problems. The cutoff wall will be constructed by one of the methods described in the Sacramento River section above. SAFCA is proposing to construct 1,700 LF of cutoff wall beginning just south of the confluence of Arcade Creek and extending south along the NEMDC. The Corps will construct the remaining 4,300 LF of cutoff wall.

Arcade Creek

The Arcade Creek levees require improvements to address seepage, slope stability, and overtopping when the event exceeds the current design. A centerline cutoff wall will be constructed to address seepage along 22,000 LF of the Arcade Creek levees. Levees from Rio Linda Boulevard to Marysville Boulevard will have a cutoff wall constructed at the waterside toe of the levee. Construction of the waterside toe cutoff wall will require constructing a work bench along the toe of the levee. Excavation for the bench will extend deep enough below existing grade to remove organic material and soft, unsuitable foundation soils. Bench excavation will also extend into the existing waterside slope of the levee as needed. Riprap will be placed on the waterside benches after construction of the waterside toe cutoff wall. Some portions of the Arcade Creek north levee will require more substantial excavation and reconstruction of the waterside slope to provide a low permeable seepage levee slope barrier. Bench fill material will be integrated with the slope reconstruction fill to provide an integral seepage barrier with the cutoff wall over the full height of the levee slope. A small section of levee will have a sheet pile cutoff wall at the centerline of the levee, rather than the waterside toe cutoff wall.

There is a ditch adjacent to the north levee at the landside toe which provides a shortened seepage path, and could affect the stability of the levee. The ditch will be replaced with a conduit or box culvert and then backfilled. This will lengthen the seepage path and improve the stability of the levee. Additionally, pressure relief wells will be installed along the landside toe of the levee along the north levee west of Norwood Avenue.

The majority of the Arcade Creek levees have existing floodwalls, however there remains a height issue in this reach. A 1 to 4-foot floodwall will allow the levees to pass flood events greater than the current design level. The floodwall will be placed on the waterside hinge point of the levee and will be designed to disturb a minimal amount of waterside slope and levee crown for construction. The waterside slope will be re-established to its existing slope and the levee crown will grade away from the wall and be surfaced with aggregate base.

Dry and Robla Creeks

The Dry and Robla Creeks levees require improvements to address overtopping when flood events exceed the design level. Height improvements will be made with a new floodwall constructed to a height of 4 to 6 feet along 2,500 LF of the south levee. The floodwall will be placed at the waterside hinge point of the levee and will be designed to disturb a minimal amount of waterside slope and levee crown for construction. Construction of the floodwall will be consistent with the description for Arcade Creek above. The waterside slope will be re-established to its existing slope and the levee crown will grade away from the wall and be surfaced with aggregate base.

Magpie Creek Diversion Canal

The Magpie Creek Diversion Canal project description is the same as was described in the September 15, 2004 biological opinion.

Sacramento Weir and Bypass

The Sacramento Weir was completed in 1916. It is the only weir in the Sacramento River Flood Control Project that is manually operated; all others overflow by gravity on their own. It is located along the right bank of the Sacramento River about 4 miles upstream of the Tower Bridge, and about 2 miles upstream from the confluence with the American River. Its primary purpose is to protect the city of Sacramento from excessive flood stages in the Sacramento River channel downstream of the American River. The weir limits flood stages (water surface elevations) in the Sacramento River to project design levels through the Sacramento/West Sacramento area. Downstream of the Sacramento Weir, the design flood capacity of the American River is 5,000 cfs higher than that of the Sacramento River. Flows from the American River channel during a major flood event often exceed the capacity of the Sacramento River downstream of the confluence. When this occurs, floodwaters flow upstream from the mouth of the American River to the Sacramento Weir.

The project design capacity of the weir is 112,000 cfs. It is currently 1,920 feet long and consists of 48 gates to divert floodwaters to the west through the mile-long Sacramento Bypass to the Yolo Bypass. Each gate has 38 vertical wooden plank "needles" (4 inches thick by 1 foot wide by 6 feet long).

Though the weir crest elevation is 24.75 feet, the weir gates are not opened until the river reaches 27.5 feet at the I Street gage with a forecast to continue rising. This gage is about 1,000 feet upstream from the I Street Bridge and about 3,500 feet upstream from the mouth of the American River. The number of gates to be opened is determined by the National Weather Service/DWR river forecasting team to meet either of two criteria: (1) to prevent the stage at the I Street gage from exceeding 29 feet, or (2) to hold the stage at the downstream end of the weir to 27.5 feet (DWR 2010). The weir gates are then closed as rapidly as practicable once the stage at the weir drops below 25 feet. This provides "flushing" flows to re-suspend sediment deposited in the Sacramento River between the Sacramento Weir and the American River during the low flow periods when the weir is open during the peak of the flood event (DWR 2010).

The Sacramento Weir and Bypass will be expanded to roughly twice their current width to accommodate increased bypass flows. The existing north levee of the Sacramento Bypass will be degraded and a new levee would be constructed 1,500 feet to the north. The existing Sacramento Weir will be expanded to match the wider bypass. At this time, it is not known whether the new segment of weir will be constructed consistent with the 1916 design described above, or whether it will be designed to be a gravity-type weir. The new north levee of the bypass will be designed to be consistent with the existing Sacramento Bypass north levee; however, it will also include a 300-foot-wide seepage berm on the landside with a system of relief wells. A hazardous, toxic, and radiological waste site near the existing north levee will be remediated by the non-Federal sponsor prior to construction.

Operation of the new segment of the Sacramento Weir will occur during high water situations only, when the American River flows exceed 115,000 cfs. The existing Sacramento Weir will be operating at the pre-existing conditions described above. There are not expected to be any water quality impacts, though this has not been specifically modeled. The approximate change in water diversions, which are shown in Table 2, will vary based on the size of the flood event. The frequency of water diversion is expected to be the same, dependent on the stream gage at the I Street Bridge reaching 27.5 feet.

The widened portion of the Sacramento Weir will only be operated when the release from Folsom Dam is above 115,000 cfs. With the Folsom Dam improvements in place, releases from Folsom Dam will be above 115,000 cfs for flood events greater than the 100-year event. Therefore, for events up to and including the 100-year event, only the existing weir will be operated per the criteria previously established. For events greater than the 100-year event, when the release from Folsom Dam will go above 115,000 cfs, the new weir will be opened. Therefore, for events up to the 100-year event there will be no change in flow conditions in the Sacramento and Yolo Bypasses.

Table 2. Comparison of 10-, 100-, and 200-year Frequency Flows under Various Conditions

10-Year Event	Existing Condition	Future Without Project Condition	Future With Project Condition
American River	43,000 cfs	72,000 cfs	72,000 cfs
Sacramento Bypass	50,000 cfs	66,000 cfs	66,000 cfs
Yolo Bypass below Sacramento Bypass	270,000 cfs	296,000 cfs	296,000 cfs
100-Year Event	**Existing Condition**	**Future Without Project Condition**	**Future With Project Condition**
American River	145,000 cfs	115,000 cfs	115,000 cfs
Sacramento Bypass	131,000 cfs	115,000 cfs	115,000 cfs
Yolo Bypass below Sacramento Bypass	555,000 cfs	535,000 cfs	535,000 cfs
200-Year Event	**Existing Condition**	**Future Without Project Condition**	**Future With Project Condition**
American River	320,000 cfs	160,000 cfs	160,000 cfs
Sacramento Bypass	183,000 cfs	149,000 cfs	164,000 cfs
Yolo Bypass below Sacramento Bypass	656,000 cfs	631,000 cfs	643,000 cfs

For the 200-year event, there will be an increase in flows in the Sacramento Bypass of about 15,000 cfs. In the Yolo Bypass, this equates to an increase of about 0.10-foot of water surface elevation. During the 200-year event, the Yolo Bypass is already flooded from levee to levee. The addition of these flows will equate to about 0.5-foot of additional width on the Yolo Bypass levee slopes.

High Hazard Levee Encroachment and Vegetation Removal

The National Flood Insurance Program (NFIP) standards for levee accreditation and the State's ULDC both require removal or modification of encroachments that pose an unacceptably high risk to the performance and safety of a levee either by undermining its structural integrity or by interfering with necessary inspection, operation, and maintenance activities. To address this requirement, SAFCA has identified and evaluated all of the encroachments in the NEMDC, Robla Creek, and Arcade Creek area. Each of these encroachments has been evaluated and based on this evaluation the encroachments have been classified as either:

- High-risk – poses a threat to levee integrity, removable prior to the levee being accredited;
- High-risk – impedes operation, maintenance, and inspection, removable within 3 years after the levee is accredited; or
- Low-risk – not identified as high hazard.

High-risk encroachments to be removed are limited to residential landscaping located at 10 locations along the landside of the south and north levees of Arcade Creek and along the Robla Creek south levee.

Vegetation on levees must be modified or removed if it presents an unacceptable risk to the structural integrity or impedes operation and maintenance of the levee. Eight high-risk trees along Arcade Creek have been identified for removal. All of the trees are either nonnative (7) or snags (1). Five are located on the waterside of the levees. These trees are in addition to any trees that will be removed as a result of implementation of levee improvements in the Arcade Creek area.

Utility Relocation

Existing encroachments and penetrations within the NEMDC and Arcade Creek have been inventoried by SAFCA. Many utilities will be avoided, however some utilities may need to be temporarily removed or relocated prior to construction. Temporary bypass pumping may be required for sanitary sewers. SAFCA and the construction contractors will coordinate with utility owners to manage the utilities in advance of construction. Disturbed utilities will be restored after construction consistent with Central Valley Flood Protection Board requirements.

Stormwater Pollution Prevention

Temporary erosion/runoff best management control measures would be implemented during construction to minimize stormwater pollution resulting from erosion and sediment migration from the construction, borrow, and staging areas. These temporary control measures may include implementing construction staging in a manner that minimizes the amount of area disturbed at any one time; secondary containment for storage of fuel and oil; and the management of stockpiles and disturbed areas by means of earth berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures will be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and included in a Stormwater Pollution Prevention Plan (SWPPP).

After completion of construction activities, the temporary facilities (construction trailers and batch plants) will be removed and the site would be restored to pre-project conditions. Site restoration activities for areas disturbed by construction activities, including borrow areas and staging areas, will include a combination of regrading, reseeding, constructing permanent diversion ditches, using straw wattles and bales, and applying straw mulch and other measures deemed appropriate.

Borrow Sites, Haul Routes, and Staging Areas

Borrow Sites - It is estimated that a maximum of 1 million cubic yards (cy) of borrow material will be needed to construct the project. Detailed studies of the borrow needs have not been completed. Actual volumes exported from any single borrow site will be adjusted to match demands for fill. Borrow sites will be selected that avoid effects to endangered species or their habitat.

To identify potential locations for borrow material soil maps and land use maps were obtained for a 20-mile radius surrounding the project area. Except as discussed below for Arcade Creek and NEMDC, eventual borrow site selection will include the following criteria: avoid threatened and endangered species effects and habitat, current land use patterns, and soil types.

Excavation limits on the borrow sites will provide a minimum buffer of 50 feet from the edge of the borrow site boundary. From this setback, the slope from existing grade down to the bottom of the excavation will be no steeper than 3:1. Excavation depths from the borrow sites will be determined based on available suitable material. The borrow sites will be stripped of top material and excavated to appropriate depths. Once material is extracted, borrow sites will be returned to their existing use whenever possible, or these lands could be used to mitigate for project effects, if appropriate.

Because SAFCA has completed more detailed design and studies for work along NEMDC and Arcade Creek the borrow site has been selected. Borrow site 2 is located along the east side of the NEMDC north of where the levee repairs will occur. About 27,000 cubic yards of material will be excavated from the 5.5-acre borrow site in order to construct levee improvements along the NEMDC and Arcade Creek. Following borrow activities the site will be contoured to create about 0.5 acre of tule bench, set an elevation the will provide aquatic habitat all year, 1.0 acre of higher bench with seasonal wetlands, that will flood in the winter and spring, and 3.5 acres of native grassland.

Clean rock will be commercially acquired in order to construct the American and Sacramento River bank protection sites. For the Sacramento River, rock will be acquired from a commercial source in the Bay Area and barged up the Sacramento River to the construction sites. Rock for the American river sites will be acquired from a commercial source within a 50-mile radius and will be hauled in trucks to the construction sites.

Haul Routes – Haul routes will be determined during the design phase and will depend on what borrow sites and staging areas are selected. Haul routes will be selected based on existing commercial routes and levee roads. Haul routes will be selected that avoid effects to federally listed species.

For Arcade Creek and NEMDC, haul trucks will leave borrow site 2 and use East Levee Road from the borrow site down to a point just north of the existing Del Paso/Main Avenue Bridge over NEMDC. Temporary bridges crossing the NEMDC and Arcade Creek will be used to allow haul trucks to reach repair sites. Railroad car undercarriages on temporary abutment supports will be one option for temporary bridge crossings.

Staging Areas – Staging areas will be selected that do not require the removal of vegetation or habitat that is used by threatened or endangered species or effect threatened or endangered species. Four potential staging areas have been identified for improvements along Arcade Creek. All four areas will require little preparation other than surface striping and temporary connection roads and ramps to the levee crown. The primary use of staging areas will be for temporary trailers, parking, and material staging. Additionally, there will need to be space to process material and an area where excavated soils and imported soils will be spread out and processed material. Importing, processing, and exporting material for levee reconstruction will be continuous activities once the work flow is established during the start of the construction season. Staging areas will be returned to pre-project conditions following construction activities unless the owner agrees to some grade raising to help dispose of excess construction soils.

Operation and Maintenance

Operation and maintenance (O&M) of the levees in the Sacramento area are the responsibility of the local maintaining agencies, including the American River Flood Control District, the DWR, and the City of Sacramento. The applicable O&M Manual for the Sacramento area levees is the Standard Operation and Maintenance Manual for the Sacramento Flood Control Project. Typical levee O&M in the Sacramento in the Sacramento area currently includes the following actions:

- Vegetation maintenance up to four times a year by mowing or applying herbicide.
- Control of burrowing rodent activity monthly by baiting with pesticide.
- Slope repair, site-specific and as needed, by re-sloping and compacting.
- Patrol road reconditioning up to once a year by placing, spreading, grading, and compacting aggregate base or substrate.
- Visual inspection at least monthly, by driving on the patrol road on the crown and maintenance roads at the base of the levee.
- Post-construction, groundwater levels will be monitored using the piezometers.

The Corps will work with local maintaining agencies to develop the maintenance activities necessary for long-term operations and maintenance. This will occur during the preconstruction engineering and design phase of the project. The Corps will evaluate if these maintenance activities will affect any Federally-listed species and reinitiate section 7 consultation if there will be adverse effects to listed species. Currently, the Corps only has a project description for activities that will affect valley elderberry longhorn beetle habitat. This is included below.

Following construction, the O&M manual for these reaches will be adjusted to reflect the vegetation variance and the SWIF plan. Under the adjusted O&M manual, large trees that are protected in place under the variance will be allowed to remain on the waterside slopes and additional vegetation will be planted on the planting benches.

Vegetation maintenance includes keeping maintenance roads clear of overhanging branches. Some of the vegetation along the levees includes elderberry shrubs. As part of long-term O&M, elderberry shrubs will be trimmed by the three levee maintenance districts. Table 3 describes the maximum amount of elderberry acreage that will be trimmed each year as a result of O&M. Trimming consists of cutting overhanging branches along the levee slopes on both the landside and waterside. Some shrubs may be located adjacent to the levee with branches hanging over the levee maintenance road. Up to a third of a shrub will be trimmed in a single season. Trimming will occur between November 1 and March 15. Loss of habitat will be offset through the development of a conservation area as described in the conservation measures below. Each year the local maintaining agency will document the amount of valley elderberry longhorn beetle habitat that they have trimmed and report that number to the Corps to ensure compliance with this biological opinion. If the local maintaining agency has a need to exceed the amount of valley elderberry longhorn beetle habitat which needs to be trimmed or affected due to routine maintenance, then they will request the Corps reinitiate consultation on this biological opinion for those actions.

Table 3. O&M by Maintaining Agency

Local Maintaining Agency	Levee Systems Covered	Annual Acreage of Trimmed Elderberry Shrubs*	Total Acreage of Elderberry Shrubs Trimmed over the 50 Year Life of the Project
American River Flood Control District	Lower American River, Dry/Robla Creek, Arcade Creek, NEMDC	0.5	25
Maintenance Area 9	Sacramento River east levee between Sutterville Road and the Beach Lake Levee	0.2	10
City of Sacramento	Sacramento River East Levee between the confluence of the American River and Sutterville Road	0.1	5

*acreage based on an estimated average shrub of 0.027 acre and no more than 1/3 of a shrub trimmed any given year.

Valley Elderberry Longhorn Beetle Habitat

Valley elderberry longhorn beetles are closely associated with elderberry shrubs. In 2011, the Corps conducted surveys and mapped all of the elderberry shrubs on the levees and 15 feet on either side of the levee. Elderberry shrubs were located along the American River and Sacramento River. The Corps counted shrub clusters and used elderberry stem counts from previous projects in the area to estimate a standard number and size of elderberry stems per shrub cluster. Tables 4 and 5 list the stem counts for shrubs along the American River and Sacramento River respectively. While shrubs exist along Arcade Creek or Magpie Creek, the Corps and SAFCA will avoid effects to the beetle by following the conservation measures below.

Table 4. American River Elderberry Shrub Effects and Compensation

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios	Elderberry Plantings	Associated Native Planting	Associated Native Ratios
riparian	> or = 1" & < or = 3"	no	1,998	2	3,996	3,996	1
		yes	0	4	0	0	2
riparian	> 3" & < 5"	no	790	3	2,370	2,370	1
		yes	16	6	96	192	2
Riparian	> or = 5"	no	312	4	1,248	1,248	1
		yes	23	8	184	368	2
TOTAL			**3,139**		**7,894**	**8,174**	
				total basins or credits=	1,606.8		
				total acres for compensation	66.40		

Table 5. Sacramento River Elderberry Shrub Effects and Compensation

Location	Stems	Exit Holes	No. of Stems	Elderberry Ratios	Elderberry Plantings	Associated Native Plantings	Associated Native Ratios
riparian	> or = 1" & < or = 3"	no	104	2	208	208	1
		yes	0	4	0	0	2
riparian	> 3" & < 5"	no	40	3	120	120	1
		yes	1	6	6	12	2
riparian	> or = 5"	no	16	4	64	64	1
		yes	2	8	16	32	2
TOTAL			**163**		**414**	**436**	
				total basins or credits=	85		
				total acres need for compensation	3.51		

Delta Smelt Habitat

The American River lacks suitable turbidity making it unsuitable for delta smelt. Due to the higher temperatures within Arcade Creek, Magpie Creek, and NEMDC it is also unlikely that delta smelt will use these tributaries. Therefore, suitable delta smelt habitat occurs within the Sacramento River in the reach where erosion protection will occur. The Corps has calculated that there will be a complete loss of 14 acres of shallow water habitat due to the placement of riprap and a change of substrate from natural soil to riprap on 32 acres.

Giant Garter Snake Habitat

Giant garter snakes are not known to use large rivers such as the American and Sacramento Rivers. Given the close proximity to urban development, high level of human disturbance, presence of riparian vegetation along the banks of most channel reaches, and lack of extensive marsh or rice to the east, giant garter snakes are unlikely to occur in Arcade Creek, Dry Creek, Robla Creek, Magpie Creek, or the southern section of the NEMDC (south of where Dry Creek enters). North of Dry Creek, the NEMDC has less woody vegetation, less urban development, and large areas of open grassland along the landside of the levee with rice farming occurring to the west of the grasslands. Therefore, there is potential for the snake to occur either in the upland or within the NEMDC north of where Dry Creek enters. Work in this location will involve removal of borrow material at borrow site 2 (5.5 acres of upland habitat).

Habitat for the giant garter snake also exists north of the existing Sacramento Bypass north levee. The land north of the Sacramento Bypass is currently agricultural fields producing row crops and nut orchards. Existing giant garter snake aquatic habitat occurs in drainage ditches and farm canals and the surrounding upland habitat. About 15 acres of aquatic habitat will be filled making it and the associated 30 acres of upland habitat unavailable to the giant garter snake. The Sacramento Bypass also has a toe drain along the levee with 25 acres of aquatic and 50 acres of upland habitat that will be relocated to the toe of the new Sacramento Bypass levee.

Yellow-billed Cuckoo Habitat

Yellow-billed cuckoos use riparian habitat for foraging and nesting. Suitable habitat occurs within the lower American River. The project will affect 65 acres of riparian habitat that could be used by the yellow-billed cuckoo. While riparian habitat occurs along Arcade Creek, Magpie Creek, and NEMDC it is very narrow and cuckoos are not likely to use these areas. Riparian habitat occurs along the Sacramento River and in some areas may be of such a width that a cuckoo could stop and use it during migration, but it is not wide enough to support a nesting pair of cuckoos. The Corps will remove 110 acres of riparian habitat along the Sacramento River and disturb an additional 50 acres of riparian habitat by removing the understory and placing rock around the large trees. The Sacramento Bypass does not have suitable habitat for the yellow-billed cuckoo. But riparian habitat does exist north of the existing Sacramento Weir along the Sacramento River (8 acres). Cuckoos have been observed in the Yolo Bypass in recent years (Ebird 2015).

Conservation Measures

Valley Elderberry Longhorn Beetle

- The Corps assumes complete avoidance of the valley elderberry longhorn beetle when a 100-foot (or wider) buffer is established and maintained around elderberry shrubs.
- When work will occur within the 100-foot buffer, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.
- Any damage done to the buffer area will be restored.
- Buffer areas will continue to be protected after construction.
- No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas.
- Elderberry shrubs that cannot be avoided would be transplanted to an appropriate riparian area at least 100 feet from construction activities.
- Elderberry shrubs will be surveyed prior to construction to ensure that the actual effects match the estimated effects of this biological opinion. If the Corps will effect more valley elderberry longhorn beetle habitat than estimated than they will reinitiate consultation with the Service.
- If possible, elderberry shrubs would be transplanted during their dormant season (November through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation will apply.
- Elderberry compensation will be planted in the American River Parkway. The Corps has six existing sites which are offsetting previous Corps flood control projects along the lower American River and near Folsom Dam. The Corps will find areas within the lower American River parkway which will either expand existing compensation areas or provide for connectivity between conserved valley elderberry longhorn beetle habitat. Sites within the lower American River parkway will be coordinated with Sacramento County Parks and the Service during the design phase of the project. Sites will be designed and developed prior to any effects to valley elderberry

longhorn beetle habitat. The Corps will create 69.91 acres of riparian habitat which supports valley elderberry longhorn beetle within the lower American River parkway for the transplantation of elderberry shrubs. In addition, the local sponsors will create an additional 40 acres of land to benefit the valley elderberry longhorn beetle or purchase 40 acres of credits at a Service approved conservation bank to offset the loss of habitat due to trimming of elderberry shrubs along the lower American River, Sacramento River, Dry/Robla Creeks, Arcade Creek, Magpie Creek, and NEMDC.

- Management of these lands will include all measures specified in the Service's conservation guidelines (1999a) related to weed and litter control, fencing, and the placement of signs.
- Monitoring will occur for 10 consecutive years or for 7 non-consecutive years over a 15-year period. Annual monitoring reports will be submitted to the Service.
- Compensation areas will be protected in perpetuity and have a funding source for maintenance (endowment).

Giant Garter Snake

- Unless approved otherwise by the Service, construction will be initiated only during the giant garter snakes' active period (May 1–October 1, when they are able to move away from disturbance).
- Construction personnel will be given a Service-approved worker environmental awareness program.
- A survey for giant garter snakes will be conducted within 24 hours prior to construction beginning in potential giant garter snake habitat. Should there be any interruption in work for greater than 2 weeks, a biologist will resurvey the area within 24 hours prior to the restart of construction.
- Giant garter snakes encountered during construction will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.
- Habitat temporarily affected for one season (the 5.5 acre borrow site along the NEMDC and the 75 acres along the toe drain of the Sacramento Bypass levee) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants. If for any reason construction extends into another active season the Corps will replace the habitat on-site and purchase credits at a ratio of 1:1 at a Service approved conservation bank.
- Habitat temporarily affected for more than three or more seasons will be restored and twice as much habitat will be created.
- Habitat permanently affected in the Sacramento Bypass in the form of drainage ditches and irrigation canals will be compensated for through the purchase of 135 acres of credits at a Service approved conservation bank.
- One year of monitoring will be conducted for the 80.5 acres that are temporarily affected.

- The Corps will purchase credits at a conservation bank prior to any permanent disturbance of giant garter snake habitat.
- A biological monitor will be on-site during all ground disturbing activities at borrow site 2.
- Exclusionary fencing will be placed, at least 10 days prior to the beginning of ground disturbing activities after May 1, to exclude giant garter snakes from entering areas where upland disturbance (borrow site 2 and Sacramento Bypass) will occur during the active season (May 1 to October 1). Prior to fencing installation, the fence line will be mowed (with a minimum height of 6 inches) in order to conduct a surface survey of potential burrows. Fencing will be installed with a minimum of 6 inches buried in the ground and a minimum of 24 inches above ground. Fence staking will be installed on the inside of the exclusion area. One-way escape funnels will be installed every 50 to 100 feet and sealed along the fence line to provide an escape for any giant garter snake that may be within the exclusion area. The fencing will enclose the entirety of the site, or additional exclusionary fencing can be extended 200 to 400 feet beyond the proposed entrance area. The fencing will be inspected before the start of each work day and maintained by the contractor until completion of the project. The fencing will be removed only when project activities are completed.

Yellow-Billed Cuckoo

- Prior to construction, surveys will be conducted to determine the presence of yellow-billed cuckoos within the project area in accordance with any required Service survey protocols and permits at the time of construction.
- If surveys find cuckoos in the area, vegetation removal will be done outside of the cuckoo nesting season.
- Riparian habitat that is removed due to project construction along the American River will be replanted within the American River parkway. The Corps intends to expand existing conserved riparian lands within the parkway that could support the yellow-billed cuckoo. The design of replacement riparian areas will be coordinated with the Service to ensure that the habitat benefits both valley elderberry longhorn beetles and yellow-billed cuckoos.

Fisheries Conservation Measures

- In-water construction activities (e.g., placement of rock revetment) will be limited to the work window of August 1 through November 30. If the Corps wants to work outside of this window they will consult with National Marine Fisheries Service (NMFS) and/or the Service.
- The Corps will purchase 42 acres of delta smelt credits from a Service-approved conservation bank to off-set the loss of 14 acres of shallow water habitat.
- The Corps will purchase an additional 32 acres of delta smelt credits from a Service-approved conservation bank to off-set the loss of spawning habitat due to the placement of riprap on the river bed.
- Erosion control measures (BMPs), including Storm Water Pollution Prevention Program and Water Pollution Control Program, that minimize soil or sediment from entering the river shall be installed, monitored for effectiveness, and maintained

throughout construction operations to minimize effects to federally listed fish and their designated critical habitat.

- Screen any water pump intakes, as specified by NMFS and the Service screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt.
- The Corps shall include as part of the project, a Riparian Corridor Improvement Plan with the overall goal of maximizing the ecological function and value of the existing levee system within the Sacramento Metropolitan area.

Additional Minimization and Conservation Measures

- Obtain an ETL approved vegetation variance exempting sites from vegetation removal prior to final design and construction phase for the Sacramento River.
- Construction will be scheduled when listed terrestrial and aquatic species will be least likely to occur in the project area. If construction needs to extend into the timeframe that species are present, then coordination/reinitiation with the Service will occur.
- Compensation for impacts to native riparian habitat will occur on a 2:1 basis on-site or in close proximity to the impact area. Riparian vegetation impacted under the SAFCA 408/404 actions will be replaced on a 3:1 canopy cover acreage basis.
- Stockpile all liquid chemicals and supplies at a designated impermeable membrane fuel and refueling station with a 110% containment system.
- Stockpile construction materials such as portable equipment, vehicles, and supplies, at designated construction staging areas and barges, exclusive of any riparian and wetland areas.
- Implement BMPs to prevent slurry from seeping out to the river and require piping systems on the landside of the levee.
- Project related vehicles will observe a 20-mile-per-hour speed limit within construction areas, except on County roads and on State and federal highways.
- Site access will be limited to the smallest area possible in order to minimize disturbance. Litter, debris, unused materials, equipment, and supplies will be removed from the project area daily. Such materials or waste will be deposited at an appropriate disposal or storage site.
- Immediately (within 24 hours) cleanup and report any spills of hazardous materials to the resource agencies. Any such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.
- Designating a Service approved biologist as a point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all employee education program conducted by the Corps.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of the effects assessment, the action area encompasses the Sacramento River from the Sacramento Bypass downstream to River Mile 45, the Yolo Bypass south the confluence of the Sacramento Bypass, the lower American River from Arden Way to the confluence of the Sacramento River, Arcade Creek from Marysville Boulevard to the confluence of the NEMDC, the NEMDC from the south Dry

Creek levee to just south of the NEMDC Arcade Creek confluence, the southern Dry Creek levee between Dry Creek Road and Rose Street, the borrow site along the NEMDC, and any borrow sites. Additionally, we are including a buffer of 300 feet from construction to account for effects to listed species due to dust and noise.

Analytical Framework for the Jeopardy Analysis

The following analysis relies on four components to support the jeopardy determination for the giant garter snake, valley elderberry longhorn beetle, yellow-billed cuckoo, and delta smelt: (1) the *Status of the Species*, which evaluates the species' range-wide condition, the factors responsible for that condition, and their survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on these species; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on these species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the delta smelt, valley elderberry longhorn beetle, giant garter snake, and yellow-billed cuckoo. Additionally, for non-Federal activities in the action area, we will evaluate those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both its survival and recovery in the wild.

The following analysis places an emphasis on using the rang-wide survival and recovery needs of the delta smelt, valley elderberry longhorn beetle, giant garter snake, and yellow-billed cuckoo, and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analytical Framework Adverse Modification

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.2. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this biological opinion relies on four components: (1) the *Status of the Critical Habitat*, which evaluates the range-wide condition of critical habitat for the delta smelt in terms of primary constituent elements (PCE)s, the factors responsible for that condition, and the intended recovery function of the critical habitat at the provincial and range-wide scale; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units and; (4) *Cummulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the delta smelt critical habitat are evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the delta smelt.

The analysis in this biological opinion places an emphasis on using the intended range-wide recovery function of delta smelt critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Status of the Species and Environmental Baseline

Valley Elderberry Longhorn Beetle Status of the Species

Please refer to the *Withdrawl of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife* (Service 2014) for the current status of the species. Ongoing threats to the valley elderberry longhorn beetle include habitat loss due to flood control projects, development projects, and invasive species. While these threats continue to affect the valley elderberry longhorn beetle throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the valley elderberry longhorn beetle.

Valley Elderberry Longhorn Beetle Environmental Baseline

The project footprint along both the Sacramento River and the American River contain riparian vegetation. The beetle is known in numerous locations along the American River parkway (CNDD 2015). Suitable habitat for the beetle in the form of elderberry shrubs occurs within the action area along the Sacramento River, the American River, and Arcade Creek.

Sacramento River - Riparian habitat along the Sacramento River, south of the city of Sacramento, occurs in narrow bands along the riverbank and levee. Generally an overstory layer is present composed of cottonwood, sycamore, and oak trees. Shrubs occur as a mid-story layer including buttonbush, blue elderberry, white alder, and Oregon ash. Elderberry shrubs occur randomly along the reach of river proposed for improvements. The Corps has documented at least 73 elderberry shrubs along the Sacramento River reach where construction is proposed. Natural river processes of erosion and accretion effect elderberry shrubs which is the host plant of the valley elderberry longhorn beetle by eroding away bank and potentially elderberry shrubs. Levee maintenance can adversely affect elderberries within this stretch of the Sacramento River either by pruning or drift of herbicides used along the levee slope.

American River – The valley elderberry longhorn beetles have been identfied along the lower American River Parkway in the CNDDB (2015). Additionally, the Corps has designed and built six sites along the lower American River as habitat for the valley elderberry longhorn beetle. These sites extend from RM 0.9 up to RM 21. Levee maintenance can adversely affect elderberry shrubs, though the largest threat to valley elderberry longhorn beetle is fires that have been started in the parkway and burned habitat that supports valley elderberry longhorn beetles.

Delta Smelt Status of Species

Listing Status: The Service proposed to list the delta smelt as threatened with proposed critical habitat on October 3, 1991 (56 FR 50075). The Service listed the delta smelt as threatened on March 5, 1993 (58 FR 12854), and designated critical habitat for this species on December 19, 1994 (59 FR 65256). The delta smelt was one of eight fish species addressed in the *Recovery Plan for the Sacramento–San Joaquin Delta Native Fishes* (Service 1996). This recovery plan is currently under revision. A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004). The 2004 review affirmed the need to retain the delta smelt as a threatened species. A 12-month finding on a petition to reclassify the delta smelt was completed on April 7, 2010 (75 FR 17667). After reviewing all available scientific and commercial information, the Service determined that re-classifying the delta smelt from a threatened to an endangered species was warranted, but precluded by other higher priority listing actions (Service 2010).

Distribution: The delta smelt is endemic to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta) in California, and is restricted to the area from San Pablo Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties (Moyle 2002). Their range extends from San Pablo Bay upstream to Verona on the Sacramento River and Mossdale on the San Joaquin River. The delta smelt was formerly considered to be one of the most common pelagic fish in the upper Sacramento-San Joaquin Estuary.

Description: Live delta smelt are nearly translucent with a steely-blue sheen to their sides and have been characterized to have a pronounced odor reminiscent of cucumber (Moyle 2002). Although delta smelt have been recorded to reach lengths of up to 120 millimeters (mm) (4.7 in) (Moyle 2002), mean fork length of the delta smelt from 1974 to 1991 was measured to be 64.1 ± 0.1 mm. Since then, catch data from 1992 - 2004 showed mean fork length decreased to 54.1 ± .01 mm (Bennett 2005; Sweetnam 1999). Delta smelt are also identifiable by their relatively large eye to head size (Moyle 2002). Delta smelt have a small, translucent adipose fin located between the dorsal and caudal fins.

The delta smelt is one of six species currently recognized in the *Hypomesus* genus (Bennet 2005). Genetic analyses have confirmed that *H. transpacificus* presently exists as a single intermixing population (Stanley *et al.* 1995; Trenham *et al.* 1998; Fisch *et al.* 2011). Within the genus, delta smelt is most closely related to surf smelt (*H. pretiosis*), a species common along the western coast of North America. Despite morphological similarities, the delta smelt is less-closely related to the wakasagi (*H. nipponensis*), an andadromous western Pacific species introduced to Central Valley reservoirs in 1959, and may be seasonally sympatric with delta smelt in the estuary (Trenham *et al.* 1998). Allozyme studies have demonstrated that wakasagi and delta smelt are genetically distinct and presumably derived from different marine ancestors (Stanley *et al.* 1995).

Life History and Biology

Adult-Spawning: Adult delta smelt spawn during the late winter and spring months, with most spawning occurring during April through mid-May (Moyle 2002). Spawning occurs primarily in sloughs and shallow edge areas in the Delta. Delta smelt spawning has also been recorded in Suisun Marsh and the Napa River (Moyle 2002). Most spawning occurs at temperatures between 12-18°C. Although spawning may occur at temperatures up to 22°C, hatching success of the larvae is very low (Bennett 2005).

Fecundity of females ranges from about 1,200 to 2,600 eggs, and is correlated with female size (Moyle 2002). Moyle *et al.* (1992) considered delta smelt fecundity to be "relatively low." However, based on Winemiller and Rose (1992), delta smelt fecundity is fairly haigh for a fish its size. Captive delta smelt can spawn up to 4-5 times. While most adults do not survive to spawn a second season, a few (<5 percent) do (Moyle 2002; Bennett 2005). Those that do survive are typically larger (90-110 mm Standard Length[sdl]) females that may contribute disproportionately to the population's egg supply (Moyle 2002 and references therein). Two-year-old females may have 3-6 times as many ova as first year spawners.

Most of what is known about delta smelt spawning habitat in the wild is inferred from the location of spent females and young larvae captured in the California Department of Fish and Wildlife Spring Kodiak Trawl (SKT) and 20-mm Survey, respectively. In the laboratory, delta smelt spawned at night (Baskerville-Bridges *et al.* 2000; Mager *et al.* 2004). Other smelts, including marine beach spawning species and estuarine populations and the landlocked Lake Washington longfin smelt, are secretive spawners, entering spawning areas during the night and leaving before dawn. If this behavior is exhibited by delta smelt, then delta smelt distribution based on the SKT, which is conducted during daylight hours in offshore habitats, may reflect general regions of spawning activity, but not actual spawning sites.

Delta smelt spawning has only been directly observed in the laboratory and eggs have not been found in the wild. Consequently, what is known about the mechanics of delta smelt spawning is derived from laboratory observations and observations of related smelt species. Delta smelt eggs are 1 mm diameter and are adhesive and negatively buoyant (Moyle 1976, 2002; Mager *et al.* 2004; Wang 1986, 2007). Laboratory observations indicate that delta smelt are broadcast spawners, discharging eggs and milt close to the bottom over substrates of sand and/or pebble in current (DWR and Reclamation 1994; Brown and Kimmerer 2002; Lindberg *et al.* 2003; Wang 2007). Spawning over gravel or sand can also aid in the oxygenation of delta smelt eggs. Eggs that may have been laid in silt or muddy substrates might get buried or smothered, preventing their oxygenation from water flow (Lindberg pers. comm. 2011). The eggs of surf smelts and other beach spawning smelts adhere to sand particles, which keeps them negatively buoyant but not immobile, as the sand may move ("tumble") with water currents and turbulence (Hay 2007). It is not known whether delta smelt eggs "tumble incubate" in the wild, but tumbling of eggs may moderately disperse them, which might induce predation risk within a localized area.

The locations in the Delta where newly hatched larvae are present, most likely indicates spawning occurrence. The 20-mm trawl has captured small (~5 mm sdl) larvae in Cache Slough, the lower Sacramento River, San Joaquin River, and at the confluence of these two rivers (e.g., 20-mm trawl survey 1 in 2005). Larger larvae and juveniles (size > 23 mm sdl), which are more efficintly sampled by the 20-mm trawl gear, have been captured in Cache Slough and the Sacramento Deep Water Ship Channel in July (e.g. 20-mm trawl survey 9 in 2008). Because they are small fish inhabiting pelagic habitats with strong tidal and river currents, delta smelt larval distribution depends on both the spawning area from which they originate and the effect of transport processes caused by flows. Larval distribution is further affected by water salinity and temperature. Hydrodynamic simulations reveal that tidal action and other factors may cause substantial mixing of water with variable salinity and temperature among regions of the Delta (Monson *et al.* 2007). This could result in rapid dispersion of larvae away from spawning sites.

The timing of spawning may affect delta smelt population dynamics. Lindberg (2011) has suggested that smelt larvae that hatch early, around late February, have an advantage over larvae hatched during late spawning in May. Early season larvae have a longer growing season and may be able to grow larger faster during more favorable habitat conditions in the late winter and early spring. An early growing season may result in higher survivorship and a stronger spawning capability for that generation. Larvae hatched later in the season have a shorter growing season which effectively reduces survivorship and spawning success for the following spawning season.

Larval Development: Mager *et al.* (2004) reported that embryonic development to hatching takes 11-13 days at 14-16° C for delta smelt, and Baskerville-Bridges *et al.* (2000) reported hatching of delta smelt eggs after 8-10 days at temperatures between 15-17° C. Lindberg *et al.* (2003) reported high hatching rates of delta smelt eggs in the laboratory at 15° C, and Wang (2007) reported high hatching rates at temperatures between 14-17° C. Hatching success peaks near 15°C (Bennett 2005) and swim bladder inflation occurring at 60-70 days post hatch at 16-17°C (Mager *et al.* 2004). At hatching and during the succeeding three days, larvae are buoyant, swim actively near the water surface, and do not react to bright direct light (Mager *et al.* 2004). As development continues, newly hatched delta smelt become semi-buoyant and sink in stagnant water. However, larvae are unlikely to encounter stagnant water in the wild.

Growth rates of wild-caught delta smelt larvae are faster than laboratory-cultured individuals. Mager *et al.* (2004) reported growth rates of captive-raised delta smelt reared at near-optimum temperatrues (16-17°C). Their fish were about 12 mm long after 40 days and about 20 mm long after 70 days. In contrast, analyses of otoliths indicated that wild delta smelt larvae were 15-25 mm, or nearly twice as long at 40 days of age (Bennett 2005). By 70 days, most wild fish were 30-40 mm long and beyond the larval stage. This suggests there is a strong selective pressure for rapid larval growth in nature, a situation that is typical for fish in general (Houde 1987). Successful feeding seems to depend on a high density of food organisms and turbidity, and increases with stronger light conditions (Baskerville-Bridges *et al.* 2000; Mager *et al.* 2004; Baskerville-Bridges *et al.* 2004). The food available to larval fishes is constrained by mouth gape and status of fin development. Larval delta smelt cannot capture as many kinds of prey as larger individuals, but all life stages have small gapes that limit their range of potential prey. Prey availability is also constrained by habitat use, which affects what types of prey are encountered. Larval delta smelt are visual feeders. They find and select individual prey organisms and their ability to see prey in the water is enhanced by turbidity (Baskerville-Bridges *et al.* 2004). Thus, delta smelt diets are largely comprised of small crustacea that inhabit the estuary's turbid, low-salinity, open-water habitats (i.e., zooplankton). Larval delta smelt have particularly restricted diets (Nobriga 2002). They do not feed on the full array of zooplankton with which they co-occur; they mainly consume three copepods, *Eurytemora affinis*, *Pseudodiaptomus forbesi*, and freshwater species of the family Cyclopidae. Further, the diets of first-feeding delta smelt larvae are largely restricted to the larval stages of these copepods; older, larger life stages of the copepods are increasingly targeted as the delta smelt larvae grow, their gape increases, and they become stronger swimmers.

The triggers for and duration of delta smelt larval movement from spawning areas to rearing areas are not known. Hay (2007) noted that eulachon larvae are probably flushed into estuaries from upstream spawning areas within the first day after hatching, but downstream movement of delta smelt larvae occurs much later. Most larvae gradually move downstream toward the two parts per thousand (ppt) isohaline (X2). X2 is scaled as the distance in kilometers from the Golden Gate Bridge (Jassby *et al.* 1995).

At all life stages, delta smelt are found in greatest abundance in the water column and usually not in close association with the shoreline. They inhabit open, surface waters of the Delta and Suisun Bay, where they presumably aggregate in loose schools where conditions are favorable (Moyle 2002). In years of moderate to high Delta outflow (above normal to wet water years), delta smelt larvae are abundant in the Napa River, Suisun Bay and Montezuma Slough, but the degree to which these larvae are produced by locally spawning fish versus the degree to which they originate upstream and are transported by tidal currents to the bay and marsh is uncertain.

Juveniles: Young-of-the-year delta smelt rear in the low-salinity zone (LSZ) from late spring through fall and early winter. Once in the rearing area growth is rapid, and juvenile fish are 40-50 mm sdl long by early August (Erkkila *et al.* 1950; Ganssle 1966; Radtke 1966). They reach adult size (55-70 mm sdl) by early fall (Moyle 2002). Delta smelt growth during the fall months slows considerably (only 3-9 mm total), presumably because most of the energy ingested is being directed towards gonadal development (Erkkila *et al.* 1950; Radtke 1966).

Delta Smelt Population Dynamics and Abundance Trends

As a consequence of channelization, water operations, and agriculture in the Delta there has been a change to the physical appearance, water salinity, water clarity, and hydrology in the Delta such that most life stages of the delta smelt are now distributed across a smaller area than historically (Arthur *et al.* 1996; Feyrer *et al.* 2007). Wang (1991) noted in a 1989 and 1990 study of delta smelt larval distribution that, in general, the San Joaquin River was used more intensively for spawning than the Sacramento River. Nobriga *et al.* (2008) found that delta smelt capture probabilities in the Summer Townet Survey (TNS) are highest at specific conductance levels of 1,000 to 5,000 $\mu S\ cm^{-1}$ (approximately 0.6 to 3.0 practical salinity unit [psu]). Similarly, Feyrer *et al.* (2007) found a decreasing relationship between abundance of delta smelt in the Fall Midwater Trawl (FMWT) and specific conductance during September through December. The location of the low salinity zone (LSZ) and changes in delta smelt habitat quality in the San Francisco Estuary can be indexed by changes in X2. The LSZ historically had the highest primary productivity and is where zooplankton populations (on which delta smelt feed) were historically most dense (Knutson and Orsi 1983; Orsi and Mecum 1986). However, this has not always been true since the invasion of the overbite clam (Kimmerer and Orsi 1996). The abundance of many local aquatic species has tended to increase in years when winter-spring outflow has high and Z2 was pushed seaward (Jassby *et al.* 1995), implying that the quantity and quality (overall suitability) of estuarine habitat increases in years when outflows are high. However, delta smelt is not one of the species whose abundance has statistically covaried with winter-spring freshwater flows (Stevens and Miller 1983; Moyle *et al.* 1992; Kimmerer 2002a; Bennett 2005).

The distribution of juvenile delta smelt has also changed over the last several decades. During the years 1970 through 1978, delta smelt catches in the TNS survey declined rapidly to zero in the Central and South Delta and have remained near zero since. A similar shift in FMWT catches occurred after 1981 (Arthur *et al.* 1996). This portion of the Delta has also had a long-term trend increase in water clarity during July through December (Arthur *et al.* 1996; Feyrer *et al.* 2007; Nobriga *et al.* 2008).

The CDFW has conducted several long-term monitoring surveys that have been used to index the relative abundance of delta smelt. The 20-mm Survey has been conducted every year since 1995. This survey targets late-stage delta smelt larvae. Most sampling has occurred April-June. The TNS has been conducted nearly every year since 1959. This survey targets 38-mm striped bass, but collects similar-sized juvenile delta smelt. Most sampling has occurred June-August. The Fall Midwater Trawl Survey has been conducted nearly every year since 1967. This survey also targets age-0 striped bass, but collects delta smelt > 40 mm in length. The FMWT samples monthly, September-December. The relative abundance index data and maps of the sampling stations used in these surveys are available at http://www.CDFW.ca.gov/delta/. The methods that underlie the surveys have been described previously (Stevens and Miller 1983; Moyle *et al.* 1992; Dege and Brown 2004). The delta smelt catch data and relative abundance indices derived from these sampling programs have been used in numerous publications (e.g., Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995; Kimmerer 2002b; Dege and Brown 2004; Bennett 2005; Feyrer *et al.* 2007; Sommer *et al.* 2007; Kimmerer 2008; Newman 2008; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; Mac

Nally *et al.* 2010; Thomson *et al.* 2010; Feyrer *et al.* 2011; Maunder and Deriso 2011). These abundance index time series document the long-term decline of the delta smelt.

Early statistical assessments of delta smelt population dynamics concluded that at best, the relative abundance of the adult delta smelt population had only a very weak influence on subsequent juvenile abundance (Sweetnam and Stevens 1993). Thus, early attempts to describe abundance variation in delta smelt ignored stock-recruit effects and researchers looked for environmental variables that were directly correlated with interannual abundance variation (e.g., Stevens and Miller 1983; Moyle *et al.* 1992; Sweetnam and Stevens 1993; Herbold 1994; Jassby *et al.* 1995). Because delta smelt live in a habitat that varies in size and quality with Delta outflow, the authors cited above searched for a linkage between Delta outflow (or X2) and the TNS and FMWT indices. Generally, these analyses did not find strong support for an outflow-abundance linkage. These analyses led to a prevailing conceptual model that multiple interacting factors had caused the delta smelt decline (Moyle *et al.* 1992; Bennett and Moyle 1996; Bennett 2005). It has also recently been noted that delta smelt's FMWT index is partly influenced by explanation for why few analyses could consistently link springtime environmental conditions to delta smelt's fall index.

One published exception to the multi-factor hypothesis was proposed by Gilbert (2010), who posited that nutrient pollution was the root cause of all the food web and fish assemblage changes that caused the decline of delta smelt and other pelagic fishes. However, the statistical approach she used to support her hypothesis was not appropriate and the untransformed data sets do not support this hypothesized chain of consequences stemming solely from wastewater inputs to the Delta (Jassby *et al.* in press). It is now recognized that delta smelt abundance plays an important role in subsequent abundance (Bennett 2005; Maunder and Deriso 2011). Bennett (2005) assessed (1) the influence of adult stock as indexed by the FMWT versus the next generation of juveniles indexed by the following calendar year's TNS; (2) the influence of the juvenile stock indexed by the TNS versus the subsequent adult stock indexed a few months later in the FMWT; (3) the influence of the FMWT on the following year's FMWT and on the FMWT two years later, and (4) he did the same for the TNS data. He concluded that (1) two-year-old delta smelt might play an important role in delta smelt population dynamics, (2) it was not clear wheter juvenile production was a density-independent or density-dependent function of adult abundance, and (3) adult production was a density-dependent function of juvenile abundance and the carrying capacity of the estuary to support this life-stage transition had declined over time. These conclusions are also supported by Maunder and Deriso (2011).

The concept of density-dependence and how it has affected the delta smelt is important because it may be used as a reason not to protect particular life stages from sources of mortality. Bennet (2005) concluded it was (statistically) unclear whether density-dependence occurs between generations. He also noted that the delta smelt indices strongly suggest that density-dependence has occurred, at least over the long-term, during the juvenile stage. The uncertainty about density-dependence between generations results because statistical assessments of the relationship between the adult stock and the next generation of recruits (juveniles_ result in similar fits for linear (density-independent) and nonlinear (density-dependent) relationships (Bennett 2005; Maunder and Deriso 2011).

One reason for this is that delta smelt population dynamics may have changed over time. Previous papers have reported a delta smelt step-decline during 1981-1982 (Kimmerer 2002a; Thomson *et al.* 2010). Prior to this decline, the stock-recruit data are consistent with "Ricker" type density-dependence where increasing adult abundance resulted in decreased juvenile abundance. Since the decline, recruitment has been positively and essentially linearly related to prior adult abundance, suggesting that reproduction has been basically density-independent for about the past 30 years.

This means that since the early 1980s, more adults translates into more juveniles and fewer adults translates into fewer juveniles without being 'compensated for' by density-dependence. In contrast to the transition among generations, the weight of scientific evidence strongly supports the hypothesis that, at least over the history of Interagency Ecological Program (IEP) fish monitoring, delta smelt has experienced density-dependence during the juvenile stage of its life cycle, i.e., between the summer and fall (Bennett 2005; Maunder and Deriso 2011). This has been inferred because, statistically, the FMWT index does not increase linearly with increases in the summer townet index. Rather, the best-fitting relationships between the summer townet index and the FMWT index show that the FMWT indices approach an asymptote as the summer townet increases or possibly even declines at the highest summer townet indices.

From a species conservation perspective, the most relevant aspect of this juvenile density dependence is that the carrying capacity of the estuary for delta smelt has declined (Bennett 2005). Thus, the delta smelt population decline has occurred for two basic reasons. First, the compensatory density-dependence that historically enabled juvenile abundance to rebound from low adult numbers stopped happening. This change had occurred by the early 1980s as described above. The reason is still not known, but the consequence of the change is that for the past several decades, adult abundance drives juvenile production in a largely density-independent manner. Thus, if numbers of adults or adult fecundity decline, juvenile production will also decline (Kimmerer 2011). Second, because juvenile carrying capacity has declined, juvenile production hits a 'ceiling' at a lower abundance than it once did. This limits adult abundance and possibly per capita fecundity, which cycles around and limits the abundance of the next generation of juveniles. The mechanism causing carrying capacity to decline is likely due to the long-term accumulation of deleterious habitat changes, both physical and biological, during the summer-fall (Bennett *et al.* 2008; Feyrer *et al.* 2007; 2011; Maunder and Deriso 2011).

Habitat

The existing physical appearance and hydrodynamics of the Delta have changed substantially from the environment in which native fish species like delta smelt evolved. The Delta once consisted of tidal marshes with networks of diffuse dendritic channels connected to floodplains of wetlands and upland areas (Moyle 2002). The in-Delta channels were further connected to drainages of larger and smaller rivers and creeks entering the Delta from the upland areas. In the absence of upstream reservoirs, freshwater inflow from smaller rivers and creeks and the Sacramento and San Joaquin Rivers were highly seasonal and more strongly and reliably affected by precipitation patterns than they are today. Consequently, variation in hydrology, salinity, turbidity, and other characteristics of the Delta aquatic ecosystem was greater in the past than it is today (Kimmerer 2002a). For instance, in the early 1900s, the location of maximum salinity intrusion into the Delta during dry periods varied from Chipps Island in the lower Delta to Stockton along the San Joaquin River and Merritt Island in the Sacramento River. Operations of upstream reservoirs have reduced spring flows while releases of water for Delta water export and increased flood control storage have increased late summer and fall inflows (Knowles 2002), though Delta outflows have been tightly constrained during late summer-fall for several decades. The following is a brief description of the changes that have occurred to delta smelt's habitat that are relevant to the environmental baseline for this consultation.

Changes to the LSZ: There have been documented changes to the delta smelt's LSZ habitat that have led to present-day, baseline habitat conditions. The close association of delta smelt with the San Francisco estuary LSZ has been known for many years (Stevens and Miller 1983; Moyle *et al.* 1992). Peterson (2003) developed a conceptual model that hypothesized how, "stationary and dynamic components of estuarine habitats" interacted to influence fisheries production in tidal river estuaries.

Peterson's model suggests that when the dynamic and static aspects of estuarine habitat sufficiently overlap, foraging, growth, density, and survival are all high, and that enables fish production to outpace losses to predators. The result is high levels of successful recruitment of new individuals. The model also hypothesizes that when the dynamic and static aspects of an estuarine habitat do not sufficiently overlap, foraging, growth, density, and survival are impaired such that losses to predators increase and recruitment of new individuals decreases. This model was developed specifically for species spawned in marine environments that were subsequently transported into estuaries. However, the concept of X2, which was developed in the San Francisco estuary to describe how freshwater flow affected estuarine habitat (Jassby *et al.* 1995), played a role in the intellectual development of Peterson's model. The Peterson model also provides a useful framework to conceptualize delta smelt's LSZ habitat.

Currently available information indicates that delta smelt habitat is most suitable for the fish when low-salinity water is near 20°C, highly turbid, oxygen saturated, low in contaminants, supports high densities of calanoid copepods and mysid shrimp (Moyle *et al.* 1992; Lott 1998; Nobriga 2002), and occurs over comparatively static 'landscapes' that support sandy beaches and bathymetric variation that enables the fish and their prey to aggregate (Kimmerer *et al.* 2002a; Bennett *et al.* 2002; Hobbs *et al.* 2006). Almost every component listed above has been degraded over time (see below). The Service has determined that this accumulation of habitat change is the fundamental reason or mechanism that has caused delta smelt to decline.

Alterations to estuarine bathymetry and salinity distribution (~ 1850-present): The position of the LSZ, where delta smelt rear, has changed over the years. The first major change in the LSZ was the conversion of the landscape over which tides oscillate and river flows vary (Moyle *et al.* 2010). The ancestral Delta was a large tidal marsh-floodplain habitat totaling approximately 700,000 acres. Most of the historic wetlands within the system were diked and reclaimed for agriculture or other human uses by 1920 (Atwater *et al.* 1979). Channels were dredged deep (~12 meters[m]) to accommodate shipping traffic from the Pacific Ocean and San Francisco Bay to ports in Sacramento and Stockton. These changes left Suisun Bay and the confluence of the Sacramento-San Joaquin Rivers as the largest and most bathymetrically variable places in the LSZ. This region remained a highly productive nursery for many decades (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995). However, the deepened channels created to support shipping and flood control, requires more freshwater outflow to maintain the LSZ in the large Suisun Bay and River confluence than was once required (Gartrell 2010). The construction of the CVP and SWP not only provided water supply for urban, agricultural and industrial users, but also provided water needed to combat salinity intrusion into the Delta, which was observed by the early 20th century. California's demand for freshwater (keeps) continues to increase, thus seasonal salinity intrusion perpetually reduces the temporal overlap of the LSZ (indexed by X2) within the Suisun Bay (region), especially in the fall (Feyrer *et al.* 2007; 2011). Consequently, the second major habitat change in the Delta has been in the frequency with which the LSZ is maintained in Suisun Bay for any given amount of precipitation. There was a step-decline in the LSZ in 1977 from which it has never recovered for more than a few years at a time. Based on model forecasts of climate change and water demand, this trend is expected to continue (Feyrer *et al.* 2011).

Summer and fall environmental quality has decreased overall in the Delta because outflows are lower and water transparency is higher. These changes may be due to increased upstream water diversions for flooding rice fields (Kawakami *et al.* 2008). The confluence of the Sacramento and San Joaquin Rivers has, as a result, become increasingly important as a rearing location for delta smelt, with physical environmental conditions constricting the species range to a relatively narrow area (Feyrer *et al.* 2007; Nobriga *et al.* 2008). This has increased the likelihood that most of the juvenile population is exposed to chronic and cyclic environmental stressors, or catastrophic events. For instance, all seven delta smelt collected during the September 2007 FMWT survey were captured at statistically significantly higher salinities than what would be expected based upon historical distribution data generated by Feyrer *et al.* (2007). During the same year, the annual bloom of toxic cyanobacteria (Microcystis aeruginosa) spread far downstream to the west Delta and beyond during the summer (Peggy Lehman, pers comm). This has been suggested as an explanation for the anomaly in the distribution of delta smelt relative to water salinity levels (US Bureau of Reclamation 2008).

Bank Protection (Levees): The placement of riprap bank protection has led to the loss of riparian habitat, large woody debris, shallow water habitat, and natural channel migration. Bank stabilization and riprapping has been shown to change natural river processes such as erosion and accretion which reduces habitat complexity; creates a smooth, hydraulically enhanced surface that is not conducive to the habitat requirements of fish including delta smelt; stops woody vegetation from entering the river and reduces the long-term recruitment of large woody debris; inhibits plant growth through a change is substrate; lowers the amount of outside food sources because of the lack of riparian and wetland vegetation for aquatic invertebrates; and increases stream edge velocities which decreases available refuge areas for fish (Service 2000). More than half of the Sacramento River's lower 194 miles have been riprapped, mostly under the Corps Sacramento River bank Protection Project. Today most of the riparian forests and wetlands have been removed and the Sacramento River has been constrained to not allow natural erosion and accretion to occur.

Turbidity: From 1999 to present, the Delta experienced a change in estuarine turbidity that culminated in an estuary-wide step-decline in 1999 (Schoellhamer 2011). For decades, the turbidity of the modified estuary had been sustained by very large sediment deposits resulting mainly from gold mining in the latter 19th century. Sediments continued to accumulate into the mid-20th century, keeping the water relatively turbid even as sediment loads from the Sacramento River basin declined due to dam and levee construction (Wright and Schoellhamer 2005). The flushing of the sediment deposits may also have made the estuary deeper overall and thus a less suitable nursery from the 'static' bathymetric perspective (Schroeter 2008).

Delta smelt are associated with highly turbid waters; there is a negative correlation between the frequency of delta smelt occurrence in survey trawls during the summer, fall and early winter and water clarity. For example, the likelihood of delta smelt occurrence in trawls at a given sampling station decreases with increasing Secchi depth at the stations (Feyrer *et al.* 2007, Nobriga *et al.* 2008). This is very consistent with behavioral observations of captive delta smelt (Nobriga and Herbold 2008). Few daylight trawls catch delta smelt at Secchi depths over 0.5 m and capture probabilities for delta smelt are highest at 0.40 m depth or less. First-feeding delta smelt larvae require relatively turbid (muddy) waters to capture prey, but older fish do not require turbidity to capture prey and very high turbidity may even have some inhibitory effect on prey consumption (Hasenbein *et al.* 2013). Delta smelt may also use turbidity as cover from predators; this was hypothesized based on long-term monitoring of the distribution of fish in the wild (e.g., Feyrer *et al.* 2007) and recently supported by a laboratory experiment (Ferrari *et al.* 2014).

Temperature: Temperature also affects delta smelt distribution. Swanson and Cech (1995) and Swanson *et al.* (2000) indicate delta smelt tolerate temperatures (<8° C to >25° C), however warmer water temperatures >25° C restrict their distribution more than colder water temperatures (Nobriga and Herbold 2008). Delta smelt of all sizes are found in the main channels of the Delta and Suisun Marsh and the open waters of Suisun Bay where the water is well oxygenated and temperatures are usually less than 25° C in summer (Nobriga *et al.* 2008). Currently, delta smelt are subjected to thermally stressful temperatures every summer, and all available regional climate change projections predict central California will be warmer still in the coming decades (Dettinger 2005). We expect warmer estuary temperatures to be yet another significant conservation challenge based on climate change models. Warmer water temperatures would increase delta smelt mortality and constrict suitable habitat throughout the Delta during the summer months. Higher temperatures would shrink delta smelt distribution into the fall, limiting their presence to Suisun Bay and in waters with less than optimal salinities (Brown *et al.* 2013). Water temperatures are presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding the nominal lethal limit of 25°C for short periods. Coldwater fishes begin to have behavioral impairments (Marine and Cech 2004) and lose competitive abilities (Taniguchi *et al.* 1998) prior to reaching their thermal tolerance limits. Thus, the estuary can already be considered thermally stressful to delta smelt and can only become more so if temperatures warm in the coming decades.

Foraging Ecology: Delta smelt feed primarily on small planktonic crustaceans, and occasionally on insect larvae (Moyle 2002). Juvenile-stage delta smelt prey upon copepods, cladocerans, amphipods, and insect larvae (Moyle 2002). Historically, the main prey of delta smelt was the euryhaline copepod *Eurytemora affinis* and the euryhaline mysid *Neomysis mercedis.* The slightly larger *Pseudodiaptomus forbesi* has replaced *E. affinis* as a major prey source of delta smelt since its introduction into the Bay-Delta, especially in summer, when it replaces *E. affinis* in the plankton community (Baxter *et al.* 2008; Moyle 2002). The most common copepod in the estuary now is a small nonnative species, *Limnoithona tetraspina.* It has been suggested that *L. tetraspina* may be an inferior food for pelagic fishes including delta smelt because of its small size and generally sedentary behavior (Bouley and Kimmerer 2006). Experimental studies addressing this issue have suggested that smelt larvae will attack *L. tetraspina* until they grow large enough to successfully capture larger copepods; also, growth rate of delta smelt fed *L. tetraspina* was lower than that of smelt fed the larger copepods (Sullivan *et al.*, unpublished). *L. tetraspina* is sometimes consumed in large numbers by juvenile delta smelt during late summer when this copepod is abundant in the LSZ (Slater and Baxter 2014). *Acartiella sinensis*, a calanoid copepod species that invaded the Delta at the same time as *L. tetraspina*, also occurs at high densities in Suisun Bay and in the western Delta over the last decade. Delta smelt eat these newer copepods, but *Pseudodiaptomus* remains their dominant prey (Baxter *et al.* 2008).

River flows influence estuarine salinity gradients and water residence times and thereby affect both habitat suitability for benthos and the transport of pelagic plankton upon which delta smelt feed. High tributary flow leads to lower residence time of water in the Delta, which generally results in lower plankton biomass (Kimmerer 2004). In contrast, higher residence times, which result from low tributary flows, can result in higher plankton biomass but water diversions, overbite clam grazing (Jassby *et al.* 2002) and possibly contaminants (Baxter *et al.* 2008) remove a lot of plankton biomass when residence times are high. These factors all affect food availability for planktivorous fishes that utilize the zooplankton in Delta channels. Delta smelt cannot occupy much of the Delta anymore during the summer (Nobriga *et al.* 2008). Thus, there is the potential for mismatches between regions of high zooplankton abundance in the Delta and delta smelt distribution now that the overbite clam has decimated LSZ zooplankton densities.

The delta smelt compete with and are prey for several native and introduced fish species in the Delta. The introduced Mississippi silverside may prey on delta smelt eggs and/or larvae and compete for copepod prey (Bennett and Moyle 1996; Bennett 2005). Young striped bass also use the LSZ for rearing and may compete for copepod prey and eat delta smelt. Centrarchid fishes and coded wire tagged Chinook salmon smolts released in the Delta for survival experiments since the early 1980s may potentially also prey on larval delta smelt (Brandes and McLain 2001; Nobriga and Chotkowski 2000). Studies during the early 1960s found delta smelt were only an occasional prey fish for striped bass, black crappie and white catfish (Turner and Kelley 1966). However, delta smelt were a comparatively rare fish even then, so it is not surprising they were a rare prey. Striped bass appear to have switched to piscivorous feeding habits at smaller sizes than they historically did, following severe declines in the abundance of mysid shrimp (Feyrer *et al.* 2003). Nobriga and Feyrer (2008) showed that Mississippi silverside, which is similar in size to delta smelt, was only eaten by subadult striped bass less than 400-mm fork length. While largemouth bass are not pelagic, they have been shown to consume some pelagic fishes (Nobriga and Feyrer 2007).

Other Stressors

Aquatic Macrophytes: For many decades, the Delta's waterways were turbid and growth of submerged plants was apparently unremarkable. That began to change in the mid-1980s, when the Delta was invaded by the non-native plant, *Egeria densa*, a fast-growing aquatic macrophyte that has now taken hold in many shallow habitats throughout the Delta (Brown and Michnuik 2007; Hestir 2010). *Egeria densa* and other non-native species of submerged aquatic vegetation (SAV) grow most rapidly in the summer and late fall when water temperatures are warm (> 20°C) and outflow is relatively low (Hestir 2010). The large canopies formed by these plants have physical and biological consequences for the ecosystem (Kimmerer *et al.* 2008). First, the dense nature of SAV promotes sedimentation of particulate matter from the water column, which increases water transparency that then limits the amount of habitat available for delta smelt (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Second, dense SAV canopies provide habitat for a suite of non-native fishes that occupy the littoral and shallow habitats of the Delta, displacing native fishes (Nobriga *et al.* 2005; Brown and Michniuk 2007). Finally, the rise in SAV colonization over the last three decades has led to a shift in the dominant trophic pathways that fuel fish production in the Delta. Until the latter 1980s, the food web of most fishes was often dominated by mysid shrimp (Feyrer *et al.* 2003) that were subsidized by phytoplankton food sources (Rast and Sutton 1989). Now, most littoral and demeral fishes of the Delta have diets dominated by the epibenthic amphipods that eat SAV detritus or the epiphytic algae attached to SAV (Grimaldo *et al.* 2009).

E. densa and other non-native submerged aquatic vegetation (e.g., *Myriophyllum spicatum*) can affect delta smelt in direct and indirect ways. Directly, submerged aquatic vegetation can over whelm littoral habitats (inter-tidal shoals and beaches) where delta smelt may spawn making them unsuitable for spawning. Indirectly, submerged aquatic vegetation decreases turbidity (by trapping suspended sediment) which has contributed to a decrease in both juvenile and adult smelt habitat (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Increased water transparency may delay feeding and may also make delta smelt more susceptible to predation pressure.

Predators: Delta smelt is a rare fish and has been a rare fish (compared to other species) for at least the past several decades (Nobriga and Herbold 2008). Therefore, it has also been rare in examinations of predator stomach contents. Delta smelt were occasional prey fish for striped bass, black crappie, and white catfish in the early 1960s (Turner and Kelly 1966) but went undetected in a recent study of predator stomach contents (Nobriga and Feyrer 2007). The predator with the highest historical documentation of predation on delta smelt is striped bass (*Morone saxatilis*; Stevens 1963; 1966; Thomas 1967). In these studies, striped bass were confirmed to prey on both juvenile and adult delta smelt. Striped bass are widely distributed in pelagic areas of the San Francisco Bay-Delta and parts of its watershed, and thus striped bass distribution fully encompasses the distribution of delta smelt juveniles and adults (Nobriga *et al.* 2013). Striped bass also tend to aggregate in the vicinity of water diversion structures, where delta smelt are frequently entrained (Nobriga and Feyrer 2007). No inverse correlations between the abundance of striped bass and the relative abundance of delta smelt have been found to date using a variety of statistical approaches (Mac Nally et al 2010; Thomson *et al.* 2010; Maunder and Deriso 2011; Miller *et al.* 2012; Nobriga et al 2013). Although the relative rarity of delta smelt in the estuary food web would presumably make them an incidental prey item for striped bass, it is possible that striped bass abundance and demand for prey are always high enough to limit delta smelt population growth rate (Nobriga *et al.* 2013).

Fish eggs and larvae can be opportunistically preyed upon by many invertebrate and vertebrate animals. There has always been a very long list of potential predators of delta smelt's eggs and larvae. One of these is the nonnative Mississippi silverside (*Menidia audens*), which like delta smelt is and annual fish with a maximum length near 100 mm (4 inches). Mississippi silversides may be both predators and competitors of delta smelt (Bennett 2005). Mississippi silversides were first introduced to the San Francisco Bay-Delta in the mid-1970s, and have increased dramatically in numbers since the mid-1980s. They forage in schools around the shoreline habitats and tidal marsh channels of the San Francisco Bay-Delta, where they are exceptionally common (Matern *et al.* 2002); Nobriga *et al.* 2005; Gewant and Bollens 2012). They readily consume delta smelt larvae in aquarium tests Bennett (20025_ concluded that "delta smelt are at high risk of eggs or larvae co-occur with schools of foraging silversides."

Another known predator is the largemouth bass are freshwater fish that prefer clear waters along shorelines (littoral habitat) with relatively dense water plants (Nobriga and Feyrer 2007; Brown and Michniuk 2007; Baxter *et al.* 2008). This is a suite of habitat characteristics that is distinctly different from those described above for delta smelt. Thus, unlike delta smelt and striped bass, delta smelt and largemouth bass have different habitat requirements (e.g., Nobriga *et al.* 2005) and their distributions do not strongly overlap. However, there has been a major increase in the Delta's largemouth bass population since the early 1990's that is believed to have been facilitated by the spread of the introduced plant *Egeria densa*, which provides rearing habitat for the bass (Baxter *et al.* 2008). Despite increases in largemouth bass populations and habitat, Nobriga and Feyrer (2007) did not find delta smelt as largemouth bass prey. Nor have more recent and extensive surveys of largemouth bass stomach contents. In captivity however, even young juvenile largemouth bass will attempt to consume delta smelt (Ferrari *et al.* 2014) so they presumably represent a predation threat when the species closely co-occur in the wild. In contrast to the situation for striped bass, several researchers have found inverse correlations between the relative abundance of largemouth bass or multi-species indices that included largemouth bass and the relative abundance of delta smelt (MacNally *et al.* 2010; Thomson *et al.* 2010; Maunder and Deriso 2011). At this time however, there is no way to determine whether these correlations are causative (predation by largemouth bass caused delta smelt to decline) or not (delta smelt simply use different habitats than largemouth bass and delta smelt habitat has decreased whil largemouth bass habitat has increased).

Other potential predators of eggs and larvae of smelt in littoral habitats are yelllowfin goby, entrarchids, and Chinook salmon. Potential native predators of juvenile and adult delta smelt would also have included numerous bird and fish species and this may be reflected in delta smelt's annual life-history. Annual fish species, also known as "opportunistic strategists", are adapted to high mortality rates in the adult stage (Winemiller and Rose 1992). This high mortality is usually due to predation or highly unpredictable environmental conditions, both of which could have characterized the ancestral niche of delta smelt.

Predation is a common source of density-dependent mortality in fish populations (Rose *et al.* 2001). Thus, it is possible that predation was a mechanism that historically generated the density-dependence observable in delta smelt population dynamics that has been noted by Bennett (2005) and Maunder and Deriso (2011). As is the case with other fishes, the vulnerability of delta smelt to predators may be influence primarily by habitat suitability. It is widely documented that pelagic fishes, including many smelt species, experience lower predation risks under turbid water conditions (Thetmeyer and Kils 1995; Utne-Palm 2002; Horpilla *et al.* 2004). Growth rates, a result of feeding success plus water temperature, are also well known to affect fishes' cumulative vulnerability to predation (Sogard 1997).

Competition: It has been hypothesized that delta smelt are adversely affected by competition from other introduced fish species that use overlapping habitats, including Mississippi silversides, (Bennett and Moyle 1995) striped bass, and wakasagi (Sweetnam 1999). Laboratory studies show that delta smelt growth is inhibited when reared with Mississippi silversides (Bennett 2005) but there is no empirical evidence to support the conclusion that competition between these species is a factor that influences the abundance of delta smelt in the wild. There is some speculation that the overbite clam competes with delta smelt for copepod nauplii (Nobriga and Herbold 2008). It is unknown how intensively overbite clam grazing and delta smelt directly compete for food, but overbite clam consumption of shared prey resources does have other ecosystem consequences that appear to have affected delta smelt indirectly.

Microcystis: Large blooms of toxic blue-green algae, *Microcystis aeruginosa*, were first detected in the Delta during the summer of 1999 (Lehman *et al.* 2005). Since then *M. aeruginosa* has bloomed each year, forming large colonies throughout most of the Delta and increasingly down into eastern Suisun Bay. Blooms typically occur between late spring and early fall (peak in the summer) when temperatures are above 20°C. *M. aeruginosa* can produce natural toxins that pose animal and human health risks if contacted or ingested directly. It is unclear whether microcystins and other toxins produced by local blooms are acutely toxic to fishes at current concentrations; however, the toxins accumulate in fish and their prey. During the summer of 2005, Age-0 striped bass and Mississippi silversides that were co-occurring with the *Microcystis* bloom showed various forms of liver damage (Lehman *et al.* 2010). When ingested with food, microcystins have been experimentally shown to cause substantial impairment of health in threadfin shad (Acuna *et al.* 2012). In addition, the copepods that delta smelt eat are particularly susceptible to these toxins (Ger 2008; Ger *et al.* 2010). An investigation of food web effects and fish toxicity concluded that even at low abundances, *M. aeruginosa* may impact estuarine fish productivity through both toxicity and food web impacts (Lehman *et al.* 2010). *M. aeruginosa* is most likely to affect juvenile delta smelt during summer blooms. Microcystis blooms may also decrease dissolved oxygen to lethal levels for fish (Saiki *et al.* 1998), although delta smelt do not strongly overlap the densest *Microcystis* concentrations, so dissolved oxygen is not likely a problem. *Microcystis* blooms are a symptom of eutrophication and high ammonia to nitrate ratios in the water.

Contaminants: Contaminants can change ecosystem functions and productivity through numerous pathways. However, contaminant loading and its ecosystem effects within the Delta are not well understood. Although a number of contaminant issues were first investigated during the Pelagic Organism Decline (POD) years, concern over contaminants in the Delta is not new. There are long-standing concerns related to mercury and selenium levels in the watershed, Delta, and San Francisco Bay (Linville *et al.* 2002; Davis *et al.* 2003). Phytoplankton growth rate may, at times, be inhibited by high concentrations of herbicides (Edmunds *et al.* 1999). New evidence indicates that phytoplankton growth rate is chronically inhibited by ammonium concentrations in and upstream of Suisun Bay (Wilkerson *et al.* 2006, Dugdale *et al.* 2007). Contaminant-related toxicity to invertebrates has been noted in water and sediments from the Delta and associated watersheds (e.g., Kuivila and Foe 1995, Giddings 2000, Werner *et al.* 2000, Weston *et al.* 2004). Undiluted drain water from agricultural drains in the San Joaquin River watershed can be acutely toxic (quickly lethal) to fish and have chronic effects on growth (Saiki *et al.* 1992).

Evidence for mortality of young striped bass due to discharge of agricultural drainage water containing rice herbicides into the Sacramento River (Bailey *et al.* 1994) led to new regulations for

water discharges. Bio assays using caged Sacramento sucker (Catostomus occidentalis) have revealed deoxyribonucleic acid strand breakage associated with runoff events in the watershed and Delta (Whitehead *et al.* 2004). Kuivila and Moon (2004) found that peak desities of larval and juvenile delta smelt sometimes coincided in time and space with elevated concentrations of dissolved pesticides in the spring. These periods of co-occurrence lasted for up to 2-3 weeks, but concentrations of individual pesticides were low and much less than would be expected to cause acute mortality. However, the effects of exposure to the complex mixtures of pesticides actually present are unknown.
Current science suggests the possible link between contaminants and the POD may be the effects of contaminant exposure on prey items, resulting in an indirect effect on the survival of POD species (Johnson *et al.* 2010). The POD investigators initiated several studies beginning in 2005 to address the possible role of contaminants and disease in the declines of Delta fish and other aquatic species. Their primary study consists of twice-monthly monitoring of ambient water toxicity at fifteen sites in the Delta and Suisun Bay. In 2005 and 2006, standard bioassays using the amphipod *Hyalella azteca* had low (<5 percent) frequency of occurrence of toxicity (Werner *et al.* 2008). The results indicated that 2007, a dry year, showed a higher incidence of toxic events than in the previous (wetter) year, 2006 (Werner *et al.* 2010). Parallel testing with the addition of piperonyl butoxide, an enzyme inhibitor, indicated that both organophosphate and pyrethroid pesticides may have contributed to the pulses of toxicity. Most of the tests that were positive for *H. azteca* toxicity have come from water samples from the lower Sacramento River.

Pyrethroids are of particular concern because of their widespread use, and their tendency to be genotoxic (DNA damaging) to fishes at low doses (in the range of micrograms per liter) (Campana *et al.* 1999). The pyrethroid esfenvalerate is associated with delayed spawning and reduced larval survival of bluegill sunfish (*Lepomis macrochirus*) (Tanner and Knuth 1996) and increased susceptibility of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) to disease (Clifford *et al.* 2005). In addition, synthetic pyrethroids may interfere with nerve cell function, which could eventually result in paralysis (Bradbury and Coats 1989; Shafer and Meyer 2004). Weston and Lydy (2010) found the largest source of pyrethroids flowing into the Delta to be coming from the Sacramento Regional Waste water Treatment Plant, where only secondary treatment occurs. Their data not only indicate the presence of these contaminants, but the concentrations found exceeded acute toxicity thresholds for the amphipod *Hyalella azteca.* This is of substantial concern because the use of insecticides flowing into the Delta. Furthermore, this was not the case for the Stockton Wastewater Treatment facility, where tertiary treatment occurs, suggesting that different treatment methods may remove or etain pyretroids differently (Baxter *et al.* 2010).

In conjunction with the POD investigation, larval delta smelt bioassays were conducted simultaneously with a subset of the invertebrate bioassays. The water samples for these tests were collected from six sites within the Delta during May-August of 2006 and 2007. Results from 2006 indicated that delta smelt are highly sensitive to high levels of ammonia, low turbidity, and low salinity. There is some preliminary indication that reduced survival may be due to disease organisms (Werner *et al.* 2008). No significant mortality of larval delta smelt was found in the 2006 bioassays, but there were two instances of significant mortality in June and July of 2007. In both cases, the water samples were collected from sites along the Sacramento River and had relatively low turbidity and salinity levels and moderate levels of ammonia. It is also important to note that no significant *H. azteca* mortality was detected in these water samples. While H. Azteca tests are very useful for detecting biologically relevant levels of water column toxicity for zooplankton, interpretation of the *H. azteca* test results with respect to fish should proceed with great caution. The relevance of the bioassay results to field conditions remains to be determined. Werner *et al.* (2010b) conducted *in situ* testing in the laboratory and compared contaminant sensitivity of delta smelt to common bioassay organisms, including *H. azteca*. The investigations included contaminants commonly observed in the

Delta, such as organophosphate and pyrethroid insecticides, copper, and total ammonia. In the laboratory, delta smelt were 1.8 to >11 times more sensitive thatn fathead minnow to ammonia, copper and all insecticides tested (except permethrin). The invertebrates tested were more sensitive to contaminants than delta smelt or fathead minnows. *Eurytemora affinis* and *Ceriodaphnia dubia* were the most sensitive to total ammonia. *C. dubia* was the most sensitive to copper and organophosphates pesticides. *H. azteca* was the most sensitive test organism to pyrethroids. Toxicity was not detected for the Sacramento River at Hood or the San Joaquin River at Rough and Ready Island during the 2009 in situ testing period. Delta smelt survival was low in treatment and control waters. Werner *et al.* (2010b) concluded that larval smelt may be too sensitive to salinity, temperature and transport stress for *in situ* exposures and recommended using surrogate species in future tests.

Persistent confinement of the spawning population of delta smelt to the Sacramento River increases the likelihood that a substantial portion of the spawners will be affected by a catastrophic event or localized chronic threat. For instance, large volumes of highly concentrated ammonia released into the Sacramento River from the Sacramento Regional County Sanitation District may affect embryo survival or inhibit prey production. Further, agricultural field in the Yolo Bypass and surrounding areas are regularly sprayed by pesticides, and water samples taken from Cache Slough sometimes exhibited toxicity to *H. azteca* (Werner *et al.* 2008; 2010). The thresholds of toxicity for delta smelt for most of the known contaminants have not been determined, but the exposure to a combination of different compounds increases the likelihood of adverse effects. The extent to which delta smelt larvae are exposed to contaminants varies with flow entering the Delta. Flow pulses during spawning increase exposure to many pesticides (Kuivila and Moon 2004) but decrease ammonia concentrations from wastewater treatment plants.

The POD investigations into potential contaminant effects also include the use of biomarkers that have been used previously to evaluate toxic effects on POD fishes (Bennett and Moyle 1996, Bennett 2005). The results to date have been mixed. A pathogen survey of 105 adult delta smelt, sampled from January through May, at several sites in the Delta, found that disease did not appear to overtly influence the health of the surveyed population for that year (Foott and Bigelow 2010). Histopathological and viral evaluation of young longfin smelt collected in 2006 indicated no histological abnormalities associated with exposure to toxics or disease (Foott *et al.* 2006). There was also no evidence of viral infection or high parasite loads. Similarly, young threadfin shad showed no histological evidence of contaminant effects or of viral infections (Foott *et al.* 2006). Parasites were noted in threadfin shad gills at a high frequency but the infections were not considered severe. Both longfin smelt and threadfin shad were considered healthy in 2006. Adult delta smelt collected from the Delta during the winter of 2005 also were considered healthy, showing little histopathological evidence for starvation or disease (Teh 2007). However, there was some evidence of low frequency endocrine disruption. In 2005, nine of 144 (six percent) of adult delta smelt males sampled were intersex, having immature oocytes in their testes (Teh 2007). Bennett (2005) reported that about 10 percent of the delta smelt analyzed for histopathological anomalies in 1999-2000 showed evidence of deleterious contaminant exposure. In contrast, 30-60 percent of these fish had liver glycogen depletion consistent with food limitation.

In contrast, preliminary histopathological analyses have found evidence of significant disease in other species and for POD species collected from other areas of the estuary. Massive intestinal infections with an unidentified myxosporean were found in yellowfin goby (*Acanthogobius flavimanus*) collected from Suisun Marsh. Severe viral infection was also found in Mississippi silverside and juvenile delta smelt collected from Suisun Bay during summer 2005. Lastly, preliminary evidence suggests that contaminants and disease may impair survival of age-0 striped bass. Baxter *et al.* 2008 found high occurrence and severity of parasitic infections, inflammatory conditions, and muscle degeneration in young striped bass collected in 2005; levels were lower in 2006. Several biomarkers of contaminant exposure including P450 activity (i.e., detoxification enzymes in liver), acetylcholinesterase activity (i.e., enzyme activity in brain), and vitellogenin induction (i.e., presence of egg yolk protein in blood of males) were also reported from striped bass collected in 2006 (Ostrach 2008).

Delta smelt can also be exposed to other toxic substances. Recent toxicological research has provided dose-response curves for several contaminants (Connon *et al.* 2009; 2011). This research has also shown that gene expression changes and impairment of delta smelt swimming performance occur at contaminant concentrations lower than levels that cause mortality.

Climate Change: Climate change is likely already impacting the delta smelt. Climate change may affect the delta smelt directly by creating physiological stress, the primary impacts of climate change on the species are expected to be through changes in the availability and distribution of delta smelt habitat.

The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years of being a typical period for such measurements (IPCC 2013a). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (for example, temperature or precipitation) that persists for an extended period, whether the change is due to natural variability or human activity (IPCC 2013a). Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has increased since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions.

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has increased since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (for these and other examples, see Solomon *et al.* 2007;; IPCC 2013b;; IPCC 2014). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (Solomon *et al.* 2007; IPCC 2013b). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), whom concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (Meehl *et al.* 2007, entire; Ganguly *et al.* 2009; Prinn *et al.* 2011). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increasing global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (Meehl *et al.* 2007; Ganguly *et al.* 2009; Prinn *et al.* 2011; IPCC 2013b). See IPCC 2013b (entire), for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation.

Current Drought Conditions and Relative Abundance: California is experiencing its fourth consecutive dry water-year due to low rainfall and low snowpack. On January 17, 2014, the Governor of California declared a State of Emergency due to the drought and directed state officials to take all necessary actions to make water immediately available (Office of the Governor 2014). As of June 2015, the Governor's drought declaration remains in place and the current drought conditions are comparable to the driest years on record in California. The severity of California's drought has been exacerbated by record warm temperatures and below-normal precipitation in 2015, resulting in a severely reduced snowpack. During the last two years, Federal and state governments (Bureau of Reclamation and California Department of Water Resources) have taken actions to ensure the reduced water quality and supply does not reach a level of concern for human health and safety, while complying with biological opinions. The actions taken include the 2015 placement of a salinity rock barrier on West False River and numerous Temporary Urgency Change Orders to modify requirements under Decision 1641 to meet certain water quality objectives, reduction of river flows caused by low reservoir storage, and river temperature requirements.

Drought conditions and some drought management actions have decreased suitable and available aquatic habitat in the Delta for delta smelt breeding and survival, thereby reducing the overall population in the Delta. Fish surveys indicate that the relative abundance of delta smelt is very low. In the last five years, the FMWT, TNS, and 20mm survey results have produced some of the lowest adult and larval delta smelt abundance indexes on record (CDFW 2013, 2014, 2015). The 2014 FMWT abundance index which determines the relative population status for the delta smelt was set at 9, which is the lowest index on record. The low index numbers and relatively few occurrences represent the additive impact of drought to the delta smelt and its habitat.

Status of the Delta Smelt Critical Habitat

The Service designated critical habitat for the delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code) (Service 1994).

Conservation Role of Delta Smelt Critical Habitat

The Service's primary objective in designating critical habitat was to identify the key components of delta smelt habitat that support successful spawning, larval and juvenile transport, rearing, and adult migration. Delta smelt are endemic to the Bay-Delta and the vast majority only live one year. Thus, regardless of annual hydrology, the Delta must provide suitable habitat all year, every year. Different regions of the Delta provide different habitat conditions for different life stages, but those habitat conditions must be present when needed, and have sufficient connectivity to provide migratory pathways and the flow of energy, materials and organisms among the habitat components. The entire Delta and Suisun Bay are designated as critical habitat; over the course of a year, the entire habitat is occupied.

Description of the Primary Constituent Elements

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements (PCEs) essential to the conservation of the species:

Primary Constituent Element 1: "Physical habitat" is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary's low-salinity zone (LSZ) (Bennett *et al.* 2002, Hobbs *et al.* 2006).

Primary Constituent Element 2: "Water" is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

Primary Constituent Element 3: "River flow" is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and Old and Middle Rivers flow influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones. River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

Primary Constituent Element 4: "Salinity" is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5-6.0 psu (parts per thousand salinity) (Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995, Kimmerer 2002a). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from San Pablo Bay (45 kilometers) to as far upstream as Rio Vista on the Sacramento River (95 kilometers). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle. In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.

Overview of Delta Smelt Habitat Requirements and the Primary Constituent Elements

Delta smelt live their entire lives in the tidally-influenced fresh- and brackish waters of the San Francisco Estuary (Moyle 2002). Delta smelt are an open-water, or pelagic, species. They do not associate strongly with structure. They may use nearshore habitats for spawning (PCE #1), but free-swimming life stages mainly occupy offshore waters (PCE #2). Thus, the distribution of the population is strongly influenced by river flows through the estuary (PCE #3) because the quantity of fresh water flowing through the estuary changes the amount and location of suitable low-salinity, open-water habitat (PCE #4). This is true for all life stages. During periods of high river flow into the estuary, delta smelt distribution can transiently extend as far west as the Napa River and San Pablo Bay. Delta smelt distribution is highly constricted near the Sacramento-San Joaquin river confluence during periods of low river flow into the estuary (Feyrer *et al.* 2007). In the 1994 designation of critical habitat, the best available science held that the delta smelt population was responding to variation in spring X2.

Alterations to Estuarine Bathymetry (PCE # 1) (~ 1850-present)

The first major change in the LSZ was the conversion of the landscape over which tides oscillate and river flows vary (Nichols *et al.* 1986). The ancestral Delta was a large tidal marsh-floodplain habitat totaling approximately 300,000 acres. Most of the wetlands were diked and reclaimed for agriculture or other human use by the 1920s. The physical habitat modifications of the Delta and Suisun Bay were mostly due to land reclamation and urbanization. Water conveyance projects and river channelization have had some influence on the regional physical habitat by armoring levees with riprap, building conveyance channels like the Delta Cross Channel, storage reservoirs like Clifton Court Forebay, and by building and operating temporary barriers in the south Delta and permanent gates and water distribution systems in Suisun Marsh.

In the 1930s to 1960s, the shipping channels were dredged deeper (~12 m) to accommodate shipping traffic from the Pacific Ocean and San Francisco Bay to ports in Sacramento and Stockton. These changes left Suisun Bay and the Sacramento-San Joaquin river confluence region as the largest and most bathymetrically variable places in the LSZ. This region remained a highly productive nursery for many decades (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995). However, the deeper landscape created to support shipping and flood control requires more freshwater outflow to maintain the LSZ in the large Suisun Bay/river confluence region than was once required (Gartrell 2010).

Seasonal salinity intrusion reduces the temporal overlap of the LSZ (indexed by X2) with the Suisun Bay region, especially in the fall (Feyrer *et al.* 2007, 2010). Thus, the second major change has been in the frequency with which the LSZ is maintained in Suisun Bay for any given amount of precipitation. This metric showed a step-decline in 1977 from which it has never recovered for more than a few years at a time. Based on model forecasts of climate change and water demand, this trend is expected to continue (Feyrer *et al.* 2011). As such this alteration of PCE # 1 also affects the other PCEs, particularly PCE # 4. The major landscape factor affecting this interaction was the dredging of shipping channels.

Spawning delta smelt require all four PCEs, but spawners and embryos are the life stage that is believed to most require a specific structural component of habitat. Spawning delta smelt require sandy or small gravel substrates for egg deposition (Bennett 2005). The major invasive species effect on physical habitat is the dense growth of submerged aquatic vegetation in the Delta. These plants carpet large areas in parts of the Delta such as Frank's Tract. The vegetation beds act as mechanical filters removing turbidity and possibly other water quality components as the tides and river flows move water over them (Hestir 2010). Thus, the proliferation of submerged aquatic plants has likely also reduced the area of nearshore habitat suitable for delta smelt spawning.

Alterations to Water (PCE # 2)

PCE # 2 is primarily referring to a few key water quality components (other than salinity) that influence spawning and rearing habitat suitability for delta smelt. Research to date indicates that water quality conditions are more important than physical habitat conditions for predicting where delta smelt occur (Feyrer *et al.* 2007; Nobriga *et al.* 2008) probably because delta smelt is a pelagic fish except during its egg/embryo stage. However, the interaction of water quality and bathymetry is thought to generally affect estuarine habitat suitability (Peterson 2003) and there is evidence that delta smelt habitat is optimized when appropriate water quality conditions overlap the Suisun Bay region (Moyle *et al.* 1992; Hobbs *et al.* 2006; Feyrer *et al.* 2011). This is discussed further in the section about PCE # 4 (salinity).

Changing predation pressure (1879 to present): Noting is known about the historical predators of delta smelt or their possible influence on delta smelt. Fish eggs and larvae can be opportunistically preyed upon by many invertebrate and vertebrate animals so there has always been a very long list of potential predators of delta smelt's eggs and larvae. Potential native predators of juvenile and adult delta smelt would also have included numerous bird and fish species and this may be reflected in delta smelt's annual life-history. Annual fish species, also known as "opportunistic strategists", are adapted to high mortality rates in the adult stage (Winemiller and Rose 1992). This high mortality is usually due to predation or highly unpredictable environmental conditions, both of which could have characterized the ancestral niche of delta smelt.

The introduction of striped bass into the San Francisco Estuary in 1879 added a permanently resident, large piscivorous fish to the low-salinity zone: a habitat that is not known to have had an equivalent predator prior to the establishment of striped bass (Moyle 2002). This likely changed predation rates on delta smelt, but there are no data available to confirm this hypothesis. For many decades the estuary supported higher striped bass and delta smelt numbers than it does currently. This is evidence that delta smelt is able to successfully coexist with striped bass.

The current influence of striped bass and other predators on delta smelt population dynamics is also not known mainly because quantitative descriptions of predator impacts on rare prey are extremely difficult to generate. Delta smelt were observed in the stomach contents of striped bass and other fishes in the 1960s (Stevens 1963; Turner and Kelley 1966), but have not been observed in more recent studies (Feyrer *et al.* 2003; Nobriga and Feyrer 2007). Predation is a common source of density-dependent mortality in fish populations (Rose *et al.* 2001). Thus, it is possible that predation was a mechanism that historically generated the density-dependence observed in delta smelt population dynamics (Bennett 2005; Maunder and Deriso 2011). Because it is generally true for fishes, the vulnerability of delta smelt to predators is influenced primarily by habitat conditions. Turbidity may be a key mediatory of delta smelt's vulnerability to predators (Nobriga *et al.* 2005; 2008). Growth rates, an interactive outcome of feeding success and water temperature, are also well known to affect fishes' cumulative vulnerability to predation (Sogard 1997). Thus, predation rate is best characterized as an aspect food web function linked to PCE # 2.

Food web alterations attributable to the overbite clam (1987-present): The next major change to PCE #2 occurred following the invasion of the estuary by overbite clam (*Corbula amurensis*). The overbite clam was first detected in 1986 and from 1987-1990 its influence on the ecosystem became evident. Since 1987, there has been a step-decline in phytoplankton biomass (Alpine and Cloern 1992; Jassby *et al.* 2002). Phytoplankton in the LSZ is an important component of the pelagic food web that delta smelt are a part of because a key part of the diet of delta smelt's prey is phytoplankton. Not only does the overbite clam reduce food for delta smelt's prey, it can also graze directly on the larval stages of the copepods eaten by delta smelt (e.g., Kimmerer *et al.* 1994). The grazing pressure applied by the overbite clam rippled through the historical zooplankton community that fueled fishery production in the LSZ (Kimmerer and Orsi 1996; Orsi and Mecum 1996; Kimmerer 2002b; Feyrer *et al.* 2003). This major change in the way energy moved through the ecosystem has likely facilitated the numerous invasions of the estuary by suppressing the production of historically dominant zooplankton, which increases the opportunity for invasion by other species that are less dependent on high densities of LSZ phytoplankton.

The distribution and abundance of several LSZ fishes have changed since 1987 (Kimmerer 2002b; Kimmereer 2006; Rosenfield and Baxter 2007; Mac Nally *et al.* 2010). Surprisingly, the changes in phytoplankton and zooplankton production have not been as evident for delta smelt as for other organisms (Kimmer 2002b; Kimmerer 2006; Sommer *et al.* 2007; Mac Nally *et al.* 2010). Nonetheless, delta smelt collected in the FMWT have been persistently smaller since the overbite clam invasion (Sweetnam 1999; Bennett 2005). This is evidence for reduced growth rates that could have been caused by food web changes stemming from overbite clam grazing. The Service considers the prey density aspect of the estuarine food web to be a component of PCE #3 ("Water"). The Central Valley Project and State Water Project entrain some food web production (about 4.5 percent on a daily average basis was attributed to all water diversions in the Delta; Jassby *et al.* 2002). However, prey densities have been most strongly affected by clam grazing (Kimmerer *et al.* 1994; Jassby *et al.* 2002). Urban wastewater input, *Microcystis* blooms, and pesticide loads may also impair the production of zooplankton eaten by delta smelt or eaten by delta smelt's prey (Wilkerson *et al.* 2006; Dugdale *et al.* 2007; Jassby 2008; Ger *et al.* 2009; Werner *et al.* 2010).

Proliferation of submerged aquatic vegetation (1980s to present): For many decades, the Delta's waterways were turbid and the growth of submerged plants was apparently unremarkable. That began to change in the mid-1980s, when the Delta was invaded by non-native plant *Egeria densa*, a fast-growing aquarium plant that has taken hold in many shallow habitats (Brown and Michnuik 2007; Hestir 2010). *Egeria densa* and other non-native species of submerged aquatic vegetation (SAV) grow most rapidly in the summer and late fall when water temperatures are warm (>20°C) and outflow is relatively low (Hestir 2010). The large canopies formed by these plants have physical and biological consequences for the ecosystem (Kimmerer *et al.* 2008). First, dense SAV promotes water transparency. Increased water transparency leads to a loss of habitat for delta smelt (Feyrer *et al.* 2007; Nobriga *et al.* 2008). Second, dense SAV canopies provide habitat for a suite of non-native fishes, including largemouth bass, which now dominate many shallow habitats of the Delta and displace native fishes (Nobriga *et al.* 2005; Brown and Michniuk 2007). Finally, SAV colonization over the last three decades has led to a shift in the dominant freshwater food web pathways and that fuel fish production (Grimaldo *et al.* 2009b). It is noteworthy that SAV-dominated habitats are comparatively productive (Nobriga *et al.* 2005; Grimaldo *et al.* 2009b), but most of the productivity they generate remains in the nearshore environment and therefore does not contribute much to pelagic fish production (Grimaldo *et al.* 2009b).

Reduced turbidity (1999-present): The next major change was a change in estuarine turbidity that culminated in an estuary-wide step-decline in 1999 (Schoellhamer 2011). For decades, the turbidity of the modified estuary had been sustained by very large sediment deposits resulting mainly from gold mining in the latter 19th century. The sediments continued to accumulate into the mid-20th century, keeping the water relatively turbid even as sediment loads from the Sacramento River basin declined due to dam and levee construction (Wright and Schoellhamer 2004). The flushing of the sediment deposits may also have made the estuary deeper overall and thus a less suitable nursery from the 'static' bathymetric perspective (Schroeter 2008). Delta smelt larvae require turbidity to initiate feeding (Baskerville-Bridges *et al.* 2004), and as explained above, older fish are thought to use turbidity as cover from predators. Thus, turbidity is an aspect of PCE # 2 which is a necessary water quality aspect of delta smelt's critical habitat.

Dams and armored levees have contributed to the long-term decline in sediment load to the estuary (Wright and Schoellhamer 2004) and to the clearing of estuary water. This is a long-term effect that stemmed from building and maintaining infrastructure. Opportunities to substantively address this change are limited due to the extreme Central Valley flood and water supply risks that will result from decommissioning dams or removing levees.

Changing water temperature (present through long-term climate forecasts): Delta smelt is already subjected to thermally stressful temperatures every summer in the Delta. Water temperatures are presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding the nominal lethal limit of 25°C for short periods. Coldwater fishes begin to have behavioral impairments (Marine and Cech 2004) and lose competitive abilities (Taniguchi *et al.* 1998) prior to reaching their thermal tolerance limits. Thus, the estuary can already be considered thermally stressful to delta smelt and can only become more so if temperatures warm in the coming decades.

All available regional climate change projections predict central California will be warmer still in the coming decades (Dettinger 2005). It is expected that warmer estuary temperatures will be yet another significant conservation challenge (Brown *et al.* 2013; Cloern *et al.* 2011). This is true because they will limit abiotic habitat suitability further than indicated by flow-based projection (e.g., Feyrer *et al.* 2011). In addition, warmer water temperatures mean that higher prey densities will be required just to maintain present-day growth rates, which are already lower than they once were (Sweetnam 1999; Bennett 2005). Water temperature is mainly affected by climate variation, both as air temperature and as flood and drought scale flow variation (Kimmer 2004; Wagner *et al.* 2011).

Sensitivities to contaminants (ongoing): Delta smelt's spawning migration coincides with early winter rains (Sommer *et al.* 2011). This 'first-flush' of inflow to the Delta brings sediment-bound pesticides with it (Bergamaschi *et al.* 2001), and peak densities of larvae and juveniles can co-occur with numerous pesticides (Kuivila and Moon 2004). Bennett (2005) reported that about 10 percent of the delta smelt analyzed for histopathological anomalies in 1999-2000 showed evidence of deleterious contaminant exposure, but this was low compared to the 30-60 percent of these fish that appeared to be food-limited.

Delta smelt can also be exposed to other toxic substances. Recent toxicological research has provided dose-response curves for several contaminants (Connon *et al.* 2009; 2011). This research has also shown the gene expression changes and impairment of delta smelt swimming performance occur at contaminant concentrations lower than levels that cause mortality. Climate scale flow variation (e.g., flood versus drought scale variation) affects the amount of methyl mercury (Darryl Slotton presentation) entering the ecosystem and may have some influence on the meaningful dilution of ammonium from urban wastewater inputs (Dick Dugdale presentation).

Invasive species may also affect PCE #2 by changing contaminant dynamics. For instance, *Microcystis* blooms generate toxic compounds that can kill delta smelt prey (Ger *et al.* 2009) and accumulate in the estuarine food web (Lehman *et al.* 2010). A second example is the biomagnification of selenium in the food web by *Corbula* (Stewart *et al.* 2004). This has been considered a potential issue for the clam's predators – namely sturgeon, splittail, and diving ducks (Richman and Lovvorn 2004; Stewart *et al.* 2004). However, it is not known whether this change in selenium dynamics negatively affects delta smelt and other fishes that do not directly prey on the clams.

Alterations of River Flows (PCE # 3)

This PCE refers to the transport flows that help guide young delta smelt from spawning habitats to rearing habitats, and to flows that guide adult delta smelt from rearing habitats to spawning habitats. Delta outflow also has some influence on delta smelt's supporting food web (Jassby *et al.* 2002; Kimmerer 2002a) and it affects abiotic habitat suitability as well (Feyrer *et al.* 2007; 2011). The latter is expanded upon in the discussion of PCE # 4. The environmental driver with the strongest influence on PCE # 3 is highly dependent on the time-scale being considered. The tide has the largest influence on flow velocities and directions in delta smelt's critical habitat at very short timescales (minutes to days), whereas interannual variation in precipitation and runoff has the largest influence on flows into and through the Delta at very long timescales (years to decades), and sometimes at shorter time scales (days to weeks) during major storm events. Changes to flow regimes can have the largest influence on PCE #3 at timescales of weeks to seasons. This is particularly true during periods of low natural inflow, for instance during the fall and during droughts, and in the south Delta where Old and Middle River flows are often managed using changes in export flow rates.

Entrainment into water export diversions (1951 to present): The amount of water diverted from the estuary has generally increased over time, and most of the increase during the 1950s and 1960s was due to CVP exports and since the latter 1960s, SWP exports. There are two basic potential fishery impacts that result from water diversion from the Delta: ecosystemic impacts and direct entrainment. From the ecosystemic perspective, water diversions are unnatural 'predators' because they 'consume' organisms at every trophic level in the ecosystem from phytoplankton (Jassby *et al.* 2002) to fish (Kimmerer 2008). Unlike natural predators which typically shift their prey use over time in association with changes in prey fish density (Nobriga and Feyrer 2008), fractional entrainment losses of fishes to diversions are functions of water and demand (e.g., Grimaldo *et al.* 2009). Thus, water diversions not only elevate 'predation' mortality in an aquatic system, but they can do so in an atypical, density-independent manner. Diversions and fish collection facilities in the south Delta are very large structures which attract large aggregations of actual predatory fish and prey on smaller species like delta smelt before they reach the fish salvage facilities and within these facilities (Gingras 1997).

Estimated entrainment losses of delta smelt to SWP and CVP diversions can be substantial in some years (Kimmerer 2008). Given the delta smelt's current density-independent population dynamics, even a statistically indiscernible entrainment effect on the population is likely to cause the species to continue to decline (Kimmerer 2011). The entrainment losses of delta smelt are not generally observed until they reach the early juvenile stage (~20-30 mm in length), but combinations of 20-mm Survey distribution data and hydrodynamic modeling provide evidence that their risk of entrainment into the CVP and SWP diversions can be described by any of several indices that integrate Delta inflow and export flow (Kimmerer and Nobriga 2008; Kimmerer 2008; Service 2008; Grimaldo *et al.* 2009).

Delta smelt entrainment losses estimated from survey data and hydrodynamics can also be substantial in some years (Kimmerer 2008), though it is possible that Kimmerer may have overestimated them (Miller 2011). Nonetheless, increasing higher outflow (or lower X2) moves the bulk of the larval population increasingly west, which results in fewer larvae distributed in the south Delta where they are at highest risk of entrainment. At the same time, indices like the export to inflow ratio or Old and Middle river flow are useful metrics for gauging the effect of exports on the south Delta.

The risk of delta smelt entrainment into smaller agricultural irrigation diversions used mainly to irrigate crops within the Delta is also related to flow conditions. These in-Delta irrigation diversions generally have mean flow rates less than 1 cubic meter per second (Nobriga *et al.* 2004). The lower the Delta outflow, the higher the proportion of the young delta smelt population that overlaps the array of irrigation diversions in the Delta (Kimmerer and Nobriga 2008). However, the irrigation diversions are not currently considered to represent a substantial source of mortality because they individually draw small quantities of water relative to channel volumes (Nobriga *et al.* 2004).

In Suisun Marsh, water diversions are largely made to support waterfowl production. Some Suisun Marsh diversions are larger for the size of channels they are in than most of the agricultural irrigation diversions in the Delta. Based on hydrodynamic simulations, proximity to water diversions in the marsh is expected to correlate strongly with entrainment (Culberson *et al.* 2004), and substantial delta smelt losses have been reported when these diversions are not screened (Pickard *et al.* 1982). Entrainment risk for delta smelt in western Suisun Marsh is considered low because the habitat surrounding the diversions is often too saline (Enos *et al.* 2007).
Salinity PCE # 4

The core delta smelt habitat, is the LSZ (Moyle *et al.* 1992; Bennett 2005). The LSZ is where freshwater transitions into brackish water; the LSZ is defined as the area of the estuary where salinity ranges from 0.5-6.0 psu (Kimmerer 2004). This area is always moving due to tidal and river flow variation. The 2 psu isohaline is a specific location within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention, changes in the location of the LSZ are described in terms of the distance from the Golden Gate Bridge to the 2 psu isohaline (X2); X2 is an indicator of habitat suitability for many of the estuary's organisms and it is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995; Kimmerer 2002b; Kimmerer *et al.* 2009). The LSZ expands and moves downstream when river flows into the estuary are high (Kimmerer *et al.* 2009). Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from as far downstream of San Pablo Bay (45 km) to as far upstream as Rio Vista on the Sacramento River (95 km).

Larval delta smelt tend to reside somewhat landward (upstream) of X2 (Dege and Brown 2004), but the center of juvenile distribution tends to be very near X2 until the fish start making spawning migrations in the winter (Feyrer *et al.* 2011; Sommer *et al.* 2011). Because of this association between the distribution of salinity in the estuary and the distribution of the delta smelt population, the tidal and river flows that comprise PCE # 3 affect PCE # 4.

The expansion and contraction of the LSZ affects the areal extent of abiotic habitat for delta smelt, both during spring (Kimmerer *et al.* 2009) and fall (Feyrer *et al.* 2007; 2011). In the spring, most delta smelt are larvae or young juveniles and the LSZ is typically maintained over the expansive Suisun Bay region. Thus, abiotic habitat "limitation" is unlikely and no consistent influence of spring X2 variation on later stage abundance estimates has been reported to date (Jassby *et al.* 1995; Bennett 2005; Kimmerer *et al.* 2009). In fact, historical maxima in juvenile abundance according to CDFW's TNS occurred in low outflow years when abiotic habitat area was comparatively low (Kimmerer 2002a; Kimmerer *et al.* 2009).

In contrast, during fall delta smelt are late stage juveniles and for the past decade or more, the LSZ has been persistently constricted by low Delta outflow. Fall habitat conditions affect delta smelt distribution and the concurrent FMWT abundance index (Feyrer *et al.* 2007; 2011). However, the quantitative life cycle models developed to date have not found evidence for a year over year effect of fall LSZ location on delta smelt population dynamics (Mac Nally *et al.* 2010; Thompson *et al.* 2010; Maunder and Deriso 2011).

It is now recognized that some delta smelt occur year-round in the Cache Slough region including the Sacramento Deep Water Shipping Channel and Liberty Island (Kimmerer 2011; Miller 2011; Sommer *et al.* 2011). The latter has been a consistently available habitat only since 1997. This region is often lower in salinity than 0.6 psu, the lower formal limit of the LSZ as defined by Kimmerer (2004). Delta smelt likely use it because it is one of the most turbid habitats remaining in the Delta (Nobriga *et al.* 2005). A recent population genetic study found no evidence that delta smelt inhabiting this region are unique compared to delta smelt using the LSZ-proper (Fisch *et al.*

2011), therefore it is likely that individual delta smelt migrate between the LSZ and the Cache Slough region. This is consistent with the high summer water temperatures observed there, which might compel individual delta smelt to seek out cooler habitats within and outside the Cache Slough region.

Delta Smelt Environmental Baseline

The portions of the Action Area that fall within the range of delta smelt include the Sacramento River east levee, south of Sacramento and the Sacramento Weir. Delta smelt typically migrate up into this area as early as December and move out in the spring and summer. The proposed project contains habitat components that can be used for feeding, spawning, rearing, and movement. Some amount of erosion protection has already occurred within the action area. Additionally, the Corps has a project which will place rock along 31,000 linear feet of the right bank of the Sacramento River immediately across the river and extending upstream from the proposed project footprint. Compensation for the placement of this rock will be through the development of a setback levee that will provide 118 acres of newly created shallow water habitat.

Giant Garter Snake Status of the Species

For the most recent assessment of the species' range-wide status please refer to the *Giant Garter Snake (Thamnophis gigas) 5-year Review: Summary and Evaluation* (Service 2012) for the current status of the species. Ongoing threats to giant garter snake include habitat loss from water transfers, rice fallowing due to drought conditions, habitat disturbance and loss from irrigation and drainage ditch maintenance, climate change, and invasive species. While these threats continue to effect the giant garter snake throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the giant garter snake.

Giant Garter Snake Environmental Baseline

The *Draft Recovery Plan for the Giant Garter Snake* (Service 1999b) subdivides the range of the species into four recovery units. Each recovery unit includes populations. The action area for the proposed project is located within the Yolo Basin-Willow Slough unit and the American Basin unit. According to the 2012, 5-year review (Service 2012) the abundance and distribution of giant garter snakes has not changed significantly. Within the Action Area habitat loss and fragmentation is the most significant threat to the giant garter snake. Urbanizing areas within the Action Area include Sacramento and West Sacramento. Habitat loss through water transfers and rice fallowing also negatively affects giant garter snakes. In the Sacramento Valley, rice has served as a substitute for the large amounts of historical wetlands that used to exist in the Central Valley. Loss of this habitat has been shown to reduce or exclude giant garter snakes compared to areas which are actively irrigated in rice (Wylie *et al.* 2002a, b, 2004).

Flood control maintenance and agricultural activities can reduce and prevent the establishment of vegetation and burrows needed by the giant garter snake for cover and shelter on canals, levees, and agricultural ditches. This can also reduce the prey base for giant garter snake, affecting their feeding. Additionally, clearing, scraping and/or re-contouring canals, ditches, and levees, destroys burrows and crevices that are used as over-wintering habitat and during the summer for thermoregulation, shedding, and giving birth. These activities are being conducted by local maintaining agencies throughout the Action Area.

Other factors which effect the giant garter snake population in the Action Area include vehicular mortality particularly where canals or aquatic habitat are bordered by roads such as the crown of the levees. Non-native predators such as game fish, bull frogs (*Rana catesbiana*), and domestic cats can affect giant garter snake populations (Service 1999b). This can be particularly detrimental to young and juvenile giant garter snakes. All of the Action Area has non-native predators occurring in it.

Snakes have been located within the Yolo Bypass within 2 miles of the Sacramento Bypass. Numerous irrigation and drainage canals exist which provide connectivity from the Sacramento Bypass and areas that are known to support snakes in the Yolo Bypass. A snake observed 0.5 mile to the west of the NEMDC along Elkhorn Boulevard in 1996 (CNDDB 2015). Borrow site 2's northern boundary is Elkhorn Boulevard on the east side of the NEMDC. Giant garter snakes could be using the NEMDC for aquatic habitat and the surrounding grasslands for uplands.

Western Yellow-Billed Cuckoo Status of the Species

For the most recent assessment of the species range-wide status please refer to the October 3, 2014, *Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus occidentalis)* (79 FR 59991). Ongoing threats to the yellow-billed cuckoo include habitat loss from flood control projects and maintenance, alterations to hydrology, climate change, and invasive species. While these threats continue to affect the yellow-billed cuckoo throughout its range, no project, to date, has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the yellow-billed cuckoo.

Western Yellow-Billed Cuckoo Baseline

Yellow-billed cuckoo detections have occurred most frequently in the upper Sacramento River where levees are setback from the river or do not exist. Additionally, the last 20 years has seen a large amount of riparian restoration occur in the upper Sacramento River. Habitat in the action area tends to be more narrow and linear than in the upper Sacramento River. Levees were constructed close to the bank of the Sacramento River leaving narrow bands of small patch sizes. Construction of the setback levee along the right bank of the Sacramento River as part of the West Sacramento Flood Control Project will provide some wider patches of riparian habitat that will benefit the yellow-billed cuckoo. The American River has a wider floodplain due to levees being setback from the channel. There are some patches large enough to support nesting yellow-billed cuckoos, though cuckoos have not been observed nesting along the American River.

Effects of the Proposed Action

Valley Elderberry Longhorn Beetle

Vegetation removal, including elderberries could cause mortality of any beetle larvae within the elderberry shrub. Transplanting the shrubs between November 1 and February 15, when the shrubs are dormant, will minimize the likelihood of killing larvae within the shrub. Transplanting the shrub could still result in mortality to larvae within the shrub, particularly if the shrub does not survive transplantation. Proper care of the transplants through watering in the initial years can minimize this loss and increase the likelihood that the shrub will survive and provide continued habitat for the valley elderberry longhorn beetle.

Construction that occurs near elderberry shrubs that will be protected in place can kill adult beetles if construction equipment is operating between the months of March and June when valley elderberry longhorn beetles have emerged from the elderberry shrubs and are locating mates for reproduction. Fencing the area which contains riparian habitat, specifically elderberry shrubs, and keeping a minimum of a 20 foot buffer from the dripline of the elderberry shrub will keep construction equipment from driving too close to the shrubs and minimize the number of beetles that might be struck or run over by equipment.

Transplanting elderberry shrubs out of the construction footprint has the potential to affect valley elderberry longhorn beetle dispersal if there is potential to remove large areas of elderberry shrubs. The Corps has provided maps of where existing valley elderberry longhorn beetle habitat exists and where shrubs will be removed due to the project. Along the Sacramento River, 13 elderberry shrubs distributed within 70 acres of riparian habitat will be transplanted as part of the project, however during surveys the Corps has documented an additional 60 elderberry shrubs that will be protected in place along the Sacramento River. The Corps has also proposed to include elderberry shrub plantings along the bank repair footprint where the elevation is suitable so the shrubs are not inundated too frequently. Along the American River, 250 elderberry shrubs distributed within 65 acres of riparian habitat will be transplanted as part of the project. The American River has many conservation sites and the Corps has proposed to offset the removal of elderberry shrubs through development of additional sites and enlargement of existing sites in the lower American River Parkway. The Corps is proposing to create an additional 69.91 acres of habitat for the valley elderberry longhorn beetle in the lower American River Parkway.

Trimming of elderberry shrubs can result in the loss of some habitat for the valley elderberry longhorn beetle. Unlike transplantation however, the shrub remains within the riparian corridor and can provide habitat for the beetle during dispersal. There is potential for one of the pruned stems to contain the larvae of the valley elderberry longhorn beetle. While elderberry shrubs do resprout readily, there is a temporal loss of habitat for the beetle and as part of the maintenance any resprouted stems will be removed in order to provide maintenance equipment access. To offset these effects the local maintaining agencies have proposed to create a 40-acre conservation area for the valley elderberry longhorn beetle. This area will be selected as described in the preceding paragraph. This will ensure habitat connectivity and help with long-term maintenance and monitoring of these lands.

Delta Smelt

Construction along the Sacramento River will place bank protection along a 50,300 linear foot section of the left bank of the Sacramento River. Delta smelt are a pelagic species that is typically found in the center of the channel. However, as described in the status of the species they do spawn on sandy beaches in shallow water habitat (0 to 3 meters) and in this portion of the Sacramento River are found close to the banks. The rock footprint will change the substrate along the 50,300 linear feet of 33 acres of shallow water habitat. Additionally 13 acres are being converted from riverine bank edge to a rock wedge. Construction related effects to individual delta smelt will be avoided because construction is occurring between August 1 and November 30, a time when delta smelt are located further downstream in the Delta and Suisun Bay. Effects due to increasing sediment downstream of the work area will be minimized through the conservation measures involving monitoring water quality during construction to ensure that effects do not extend into the portion of the Delta that delta smelt occupies during the late summer/fall period. Construction to widen the Sacramento Weir will occur on the landside of the existing Sacramento River right bank levee. Upon completion of the weir extension the levee removed between August 1 and November 30 avoiding effects to delta smelt habitat.

The primary negative effect of the project on potential spawning habitat is the change of substrate from sand to riprap. Rock used for bank protection is large enough to retard erosional forces of the river and therefore has interstitial spaces. Should delta smelt spawn over this riprap substrate, it is very likely that any eggs will fall into these interstitial spaces resulting in the loss of eggs and potentially causing fertilization to not occur if the eggs fall into the interstitial spaces. The Corps has proposed to offset this loss of spawning potential in these areas through the purchase of 33 acres of credits at a Service-approved delta smelt conservation bank. The placement of rock will permanently narrow the channel by 13 acres through the change of riverine edge to rock wedge. Rock slope protection limits the lateral mobility of a river channel, increases flow velocities (Sedell *et al.* 1990), limit sediment transport, and eliminates bankside refugia areas (Gregory *et al.* 1991). Rock placement can also affect primary productivity through the loss of vegetation. The Corps will protect large trees in place and plant riparian benches at the conclusion of the rock placement to replace the loss of vegetation. Planting benches and vegetation planting will also help to offset the increased velocities that the bank protection sites will experience due to the smoother rock surface. To offset the complete loss of riverine edge habitat the Corps has proposed to purchase 39 acres of credits at a Service-approved delta smelt conservation bank for a total of 72 acres of credits.

The Corps has proposed to evaluate effects to listed species including delta smelt when long-term maintenance activities for the Sacramento River can be described. If maintenance activities will affect delta smelt the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the delta smelt from any long-term levee maintenance activities.

Delta Smelt Critical Habitat

This opinion on the critical habitat for the delta smelt does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR § 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U. S. Fish and Wildlife Service* (No. 03-35279) to complete the following analysis with respect to the proposed critical habitat.

Implementation of the proposed project will affect PCE #1 Physical Habitat as described under the environmental baseline section above. The placement of rock will change the substrate of shallow water habitat for 46 acres. Any loss of shallow water habitat will be compensated through the purchase of credits at a delta smelt conservation bank. It is expected that planting the sites post-construction will replace any loss of primary productivity within the Sacramento River water column.

Giant Garter Snake

Borrow Site 2 – Upland habitat will be disturbed at borrow site 2 (5.5 acres) when heavy equipment is brought in to remove soil for the Arcade Creek levee repair. Removal of soil from the site will result in the crushing of burrows that snakes use for aestivating and thermoregulation. Fencing the borrow site prior to borrow excavation will minimize the likelihood that snakes will be in the borrow site when construction equipment begins to mobilize. Fencing the site will temporarily (one active season) exclude the use of the area for giant garter snake. This could result in snakes having to move further distances to find upland refugia in the summer months and expose them to predation or other sources of mortality such as being run over by a vehicle on the levee road on the opposite side of the NEMDC. Because the aquatic habitat will not be disturbed by the project, there will not be any effects on the snake's ability to forage.

Upon completion of the project, the site will restored and re-graded to create three habitat types. The creation of additional tule marsh along the edge of the canal will benefit giant garter snakes that may be using the NEMDC as it will provide cover, an area for prey production, and refugia from predators. Additionally, the seasonal wetland bench will only provide aquatic habitat in the winter months when the snake is typically in burrows. The wetland bench will provide some upland habitat for the giant garter snake during the summer when the snake is active in the form of basking habitat and if dried wetland vegetation remains some refugia from predators; however, because the site will be flooded in the winter it will not serve as overwintering habitat for the snake. The remaining 3.5 acres of the borrow site will be restored to native grassland and will function as summer upland refugia and basking and in the winter serve as overwintering habitat for the snake.

Sacramento Bypass – Enlarging the Sacramento Bypass and Weir will result in both permanent and temporary effects to giant garter snake habitat. Construction of the widened bypass will have similar effects to giant garter snake as the work along borrow site 2. Snakes could be crushed by heavy equipment, entombed in refugia when burrows collapse, and exposed to increased predation because they may have to travel further to find habitat that is unavailable to them due to the project. The 25 acres of aquatic habitat and 50 acres of upland habitat that will be temporarily affected because of the relocation of a levee toe drain will be replaced within one year of construction. The Corps has committed to creating a toe drain that closely mimics the existing aquatic and upland habitat along the northern levee of the Sacramento Bypass. The effects of crushing snakes and exposing them to increased predation will be minimized through the use of the conservation measures described in the project description above.

Permanently, 15 acres of aquatic and 30 acres of upland habitat will be lost through the removal of drainage ditches and farm canals in the area that is currently outside of the bypass footprint. The Corps has committed to offsetting the loss of this habitat through the purchase of 135 acres of giant garter snake credits at a Service-approved conservation bank. Conservation banks provide protection, conservation easement, and funding, endowment, in perpetuity for the giant garter snake. These long-term protections and location of the conservation banks all contribute to the long-term recovery of the giant garter snake.

Operation of the expanded Sacramento Weir and Bypass will result in an increase of water surface elevation of approximately 0.5-foot on the levee slopes on either side of the Yolo Bypass. However, when this increase occurs, during a 200-year flood event, the Yolo Bypass levees already contain water up to 21 feet deep. As a result, giant garter snake burrows would likely already be saturated before the additional water associated with the widened Sacramento Bypass is a factor. The additional 0.5-foot resulting from this action would not significantly change the timing or duration of this flooding and would not result in further impacts to giant garter snake habitat.

The Corps has proposed to evaluate effects to listed species including giant garter snake when long-term maintenance activities for the Sacramento Bypass can be described. If maintenance activities will affect giant garter snakes the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the giant garter snake from any long-term levee maintenance activities.

Yellow-Billed Cuckoo

Sacramento River – The Corps is planning on removing 70 acres of riparian habitat along the Sacramento River. The riparian corridor in this section of the Sacramento River is narrow (about 100 feet wide) because the levees were constructed so close to the edge of the channel bank. This is too narrow for the yellow-billed cuckoo to nest, however it is possible for the yellow-billed cuckoo to use this as a stopover when migrating to the Central Valley to breed. Vegetation removal will reduce the width of the riparian corridor from 100 feet to 40 feet on average. The Corps proposal to plant the bank protection sites will create a 25-foot wide planting berm leaving a loss of about 35 feet of riparian corridor. The Corps proposes to offset the loss of the 70 acres of riparian through the creation of 140 acres of riparian habitat along the lower American River.

American River – The construction of launchable rock trench will remove 65 acres of riparian habitat along the lower American River. The lower American River does have habitat patches large enough to support nesting yellow-billed cuckoos. Large patches of habitat will not be removed; rather a strip will be removed adjacent to the levee which could reduce the size of some of the potential nesting areas. To compensate for this the Corps is proposing to plant 130 acres along the lower American River. As described in the conservation measures, the Corps will develop a Riparian Conservation Plan that will determine the best locations to develop additional riparian habitat. The conservation areas will provide both habitat for yellow-billed cuckoo and valley elderberry longhorn. The areas will also ensure that there is a net increase of potential yellow-billed cuckoo nesting habitat along the lower American River Parkway. There will be a temporal loss of habitat because riparian habitat can take up to 20 years to develop.

In addition to the habitat loss for both the Sacramento and American Rivers, construction itself has the potential to adversely affect yellow-billed cuckoos. Construction that occurs when the cuckoo is in the Sacramento Valley has the potential to harass the bird due to noise. To minimize effects to the cuckoo due to construction noise the Corps conservation measure to do protocol level surveys prior to beginning construction will enable the Corps to determine if yellow-billed cuckoos are nesting near the construction footprint. The Corps has committed to avoid construction near an active yellow-billed cuckoo nest. However, cuckoos that could be foraging in the area could be harassed due to construction activities and noise and move to other locations in the lower American River parkway which could expose individual cuckoos to increased predation.

The Corps has proposed to evaluate effects to listed species including yellow-billed cuckoo when long-term maintenance activities for the Sacramento River and American River can be described. If maintenance activities will affect yellow-billed cuckoos the Corps will reinitiate consultation with the Service. Therefore, this biological opinion does not address effects to the yellow-billed cuckoo from any long-term levee maintenance activities.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Valley Elderberry Longhorn Beetle

Non-Federal adverse effects to the valley elderberry longhorn beetle include effects from nearby pesticide spraying drifting into valley elderberry longhorn beetle habitat and levee and channel maintenance. In the areas of the urbanized areas of the American and Sacramento Rivers human started fires is by far the largest effect to valley elderberry longhorn beetles. Over the last several years numerous fires have burned portions of the American River Parkway.

Delta Smelt

Adverse effects to delta smelt may result from point and non-point source chemical contaminant discharges within the action area. These contaminants include but are not limited to ammonia and free ammonium ion, numerous pesticides and herbicides from agricultural activities, and oil and gasoline product discharges. Oil and gasoline product discharges may be introduced into the Sacramento River from shipping and boating activities and from urban activities and runoff. Other future, non-Federal actions within the action area that are likely to occur and may adversely affect delta smelt include: the dumping of domestic and industrial garbage that decreases water quality; oil and gas development and production that may affect aquatic habitat and may introduce pollutants into the water; agricultural activities, including burning or removal of vegetation on levees that reduce riparian and wetland habitats that contribute to the quality of habitat used by delta smelt; and livestock grazing activities that may degrade or reduce riparian and wetland habitats that contribute to the quantity and quality of habitat used by delta smelt.

San Francisco Bay-Delta Climate Change

The effects of climate change do not act in isolation; they are anticipated to exacerbate existing threats to delta smelt. We considered the potential effects of climate change on the delta smelt based on projections derived from various modeling scenarios. A series of publications (Feyrer *et al.* 2011; Cloern *et al.* 2011; Brown *et al.* 2013) have modeled future impacts of climate change in the Delta and projected how this will affect delta smelt. These models used the B1 and A2 scenarios from the 2007 IPCC report. Each scenario included both a warmer-wetter and warmer-dryer sub scenario. Modeled predictions presented in these publications are based on current baseline conditions (no increased outflow, no breeching of levees) which may or may not change in the future. Temperature increases are likely to lead to a continued rise in sea level, further increasing salinity which will increasingly restrict delta smelt's already limited geographic range (Feyrer *et al.* 2011; Cloern *et al.* 2011; Brown *et al.* 2013). Higher air temperatures will reduce snowpacks, melt snow earlier in the winter or spring, and increase water temperatures. These changes will likely alter freshwater flows, possibly shifting and condensing the timing and location of delta smelt reproduction (Brown *et al.* 2013).

Projections indicate that temperature and precipitation changes will diminish snowpack, changing the availability of natural water supplies (Reclamation 2011). Warming may result in more precipitation falling as rain and less storage as snow. This would result in increased rain on snow events and increase winter runoff with an associated decrease in runoff for the remainder of the year (Reclamation 2011). Sacramento Valley Ecoregion projections include a 27 percent decrease in annual freshwater flows and earlier snowmelts, with increased freshwater flows in January and February but reduced throughout the rest of the year (PRBO Conservation Science 2011). Earlier seasonal warming increases the likelihood of rain-on-snow events, which are associated with mid-winter floods. Smaller snowpacks that melt earlier in the year may result in increased drought frequency and severity (Rieman and Isaak 2010). Thus overall, these changes may lead to increased frequency of flood and drought cycles during the 21st century (Reclamation 2011).

Sea level rise is likely to increase the frequency and range of saltwater intrusion. Salinity within the northern San Francisco Bay is projected to rise by 4.5 by the end of the century (Cloern *et al.* 2011). Elevated salinity levels could push the position of X2 farther up the estuary if outflows were not increased to compensate for it. Fall X2 mean values are projected to increase by a mean of about 7 km to the area of Antioch for a distance of about 90 km from the Golden Gate Bridge by 2100 (Brown *et al.* 2013). This increase in the position of X2 in the fall is expected to result in a decrease in suitable physical habitat (Brown *et al.* 2013) if current levees and channel structures are maintained. A decrease in spring habitat due to the movement of X2 upstream due to sea level rise is also expected to result from climate change.

We expect warmer estuary temperatures to be yet another significant conservation challenge based on climate change models. Mean annual water temperatures within the upper Sacramento River portion of the Bay-Delta estuary are expected to approach or exceed 14 °C during the second half of this century (Cloern *et al.* 2011). Warmer water temperatures could reduce delta smelt growth, increase delta smelt mortality and constrict suitable habitat within the estuary during the summer months. Due to warming temperatures, delta smelt are projected to spawn an average of 10 to 25 days earlier in the season depending on the location (Brown *et al.* 2013). Also due to expected temperature increases, total number of high mortality days is expected to increase for all IPCC climate change scenarios (Brown *et al.* 2013). The number of stress days is expected to be stable or decrease partly because many stress days will become high mortality days. This could lead to delta smelt being forced to grow under highly stressful conditions during summer and fall with less time to mature because of advanced spawning (Brown *et al.* 2013). Growth rates have been shown to slow as water temperatures increase therefore requiring delta smelt to consume more food to reach growth rates that are normal at lower water temperatures (Rose *et al.* 2013a). Delta smelt are already often smaller than they used to be (Sweetnam 1999; Bennett 2005) and expected temperature increases due to climate change will likely further slow growth rates.

At the same time, warmer water will tend to move the spawning season earlier in the year (Brown *et al.* 2013). That means the fish will have to grow faster still to compensate for that shorter growing season to produce even as many eggs as they do now – and that may already be a serious limitation on their population fecundity (Rose *et al.* 2013b). Higher temperatures may restrict delta smelt distribution into the fall, limiting their presence in Suisun Bay for more than just salinity reasons and force greater inhabitation of cooler high salinity waters (Brown *et al.* 2013). Water temperatures are already presently above 20°C for most of the summer in core habitat areas, sometimes even exceeding 25 °C for short periods.

The delta smelt is currently at the southern limit of the inland distribution of the family Osmeridae along the eastern Pacific coast. That indicates that this region was already about as warm as that fish family can handle. Increased temperatures associated with climate change may result in a habitat in the Bay-Delta that is outside of the species ecological tolerance limits.

Giant Garter Snake

The Service is aware of other projects currently under review by the State, county, and local authorities where biological surveys have documented the occurrence of federally-listed species. These projects include such actions as urban expansion, water transfer projects that may not have a Federal nexus, and continued agricultural development. The cumulative effects of these known actions pose a significant threat to the eventual recovery of the species. Additionally, an undetermined number of future land use conversions and routine agricultural practices are not subject to Federal permitting processes and may alter the habitat or increase incidental take of snakes, and are, therefore, cumulative to the proposed project. For example other cumulative effects include: (1) unpredictable fluctuations in aquatic habitat due to water management and diversions; (2) dredging and clearing of vegetation from irrigation canals; (3) discing or mowing upland habitat; (4) increased vehicular traffic on access roads adjacent to aquatic habitat; (5) use of burrow fumigants on levees and other potential upland refugia; (6) human intrusion into habitat; (7) use of inappropriate plastic erosion control netting (Stuart *et al.* 2001); (8) riprapping or lining of canals and stream banks; (9) fluctuations in acreages of rice production due to market conditions or water availability; (10) ornamental cultivation; (11) routine grounds maintenance of upland habitat; (12) contaminated runoff from agriculture and urbanization; (13) maintenance of non-Federal flood control structures; and (14) predation by feral animals and pets. Specific cumulative effects related to the proposed project include maintenance activities and/or an increased potential for vandalism, which may degrade or destroy habitat or cause unpredictable fluctuations in habitat.

Yellow-Billed Cuckoo

Habitat that is currently occupied by the yellow-billed cuckoo occurs on public and privately owned lands. Activities on non-Federal lands that may affect the yellow-billed cuckoo include the construction and maintenance of recreational hiking and bicycle trails; restoration of native riparian habitat; transportation related projects like construction and maintenance of State, county, and private roads and bridges; flood channel maintenance by the State water resources agencies, and conversion of riparian habitat to agriculture on private lands.

Conclusion

After reviewing the current status of the valley elderberry longhorn beetle, delta smelt, giant garter snake and yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed ARFC project, and the cumulative effects on these species, it is the Service's biological opinion that the proposed AFRC project, is not likely to jeopardize the continued existence of these species. The Service reached this conclusion because the project-related effects to the species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the conservation measures proposed by the Corps including: creating additional riparian habitat for the valley elderberry longhorn beetle and the yellow-billed cuckoo; purchasing credits at conservation banks for giant garter snake and delta smelt; and restoring any temporarily affected habitat to pre-project conditions.

After reviewing the current status of designated critical habitat for delta smelt, the environmental baseline of critical habitat in the action area, the effects of the proposed ARFC project, and the cumulative effects, it is the Service's biological opinion that the proposed ARFC project, as proposed, is not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the delta smelt critical habitat, to serve its intended conservation role for the species based on the Corps proposal to purchase credits at a conservation bank for permanent effects to the substrate of the Sacramento River. The effects to delta smelt critical habitat are small and discrete, relative to the entire area designated, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the delta smelt.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by Service regulations at 50 CFR 17.3 as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the same regulations as an act which actually kills or injures wildlife. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps and SAFCA so that become binding conditions of any contract issued for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require their contractor or SAFCA or to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take

Valley Elderberry Longhorn Beetle

The Service anticipates that incidental take of valley elderberry longhorn beetle will be difficult to detect due to its life history and ecology. Specifically, valley elderberry longhorn beetles can be difficult to locate due to the fact that a majority of their life cycle is spent in the elderberry shrub and finding a dead or injured individual is unlikely due to their relatively small size. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities; therefore, the Service is authorizing take incidental to the proposed action as harm, harassment, injury, and mortality of all valley elderberry longhorn beetles within 263 shrubs that will be transplanted as a result of construction and 40 acres of elderberry shrubs that will be trimmed for maintenance purposes over the project's 50 year life.

Delta Smelt

The Service expects that incidental take of delta smelt will be difficult to detect or quantify for the following reasons: the small size of adults, their occurrence in turbid aquatic habitat makes them difficult to detect, and the low likelihood of finding dead or impaired specimens. The Service anticipates that the extent of incidental take will be minimized due to the proposed conservation measures and low relative abundance. Due to the difficulty in quantifying the number of delta smelt that will be taken as a result of the proposed action, the number of acres of affected habitat becomes a surrogate for the species that will be taken. The Service anticipates that all individual adult delta smelt in the 46 acres of the action area may be subject to incidental take in the form of harm as described in this biological opinion. Incidental take of delta smelt for maintenance activities is not covered in this biological opinion.

Giant Garter Snake

The Service anticipates that incidental take of the snake will be difficult to detect or quantify for the following reasons: snakes are cryptically colored, secretive, and known to be sensitive to human activities. Snakes may avoid detection by retreating to burrows, soil crevices, vegetation, and other cover. Individual snakes are difficult to detect unless they are observed, undisturbed, at a distance. Most close-range observations represent chance encounters that are difficult to predict. It is not possible to make an accurate estimate of the number of snakes that will be harassed during construction activities, including in staging areas and roads carrying vehicular traffic. In instances when take is difficult to detect, the Service may estimate take in numbers of species per acre of habitat lost or degraded as a result of the action as a surrogate measure for quantifying individuals.

Therefore, the Service anticipates the number of giant garter snakes that may be found in 125.5 acres of aquatic and upland habitat will be harmed or killed as a result of habitat modification due to the proposed project. Incidental take of giant garter snake for maintenance activities is not covered in this biological opinion.

Yellow-Billed Cuckoo

The Service anticipates that incidental take of yellow-billed cuckoo will be difficult to detect due to its life history and ecology. Specifically, yellow-billed cuckoos can be difficult to locate due to their cryptic appearance and behavior and finding a dead or injured individual is unlikely. There is a risk of harm and harassment as a result of proposed construction activities and operations and maintenance of the restoration plantings; therefore, the Service is authorizing take incidental to the proposed action as harm of all yellow-billed cuckoos within 135 acres. Incidental take of yellow-billed cuckoo for maintenance activities is not covered in this biological opinion.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

All necessary and appropriate measure to avoid or minimize effects on the species resulting from implementation of this project have been incorporated into the project's proposed conservation measures. Therefore, the Service believes the following reasonable and prudent measure is necessary and appropriate to minimize incidental take of the species.

1. All conservation measures, as described in the biological assessment and restated here in the Project Description section of this biological opinion, shall be fully implemented and adhered to. Further, this reasonable and prudent measure shall be supplemented by the terms and conditions below.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are nondiscretionary.

1. The Corps shall include full implementation and adherence to the conservation measures as a condition of any permit or contract issued for the project.

2. The Corps will develop a Riparian Planting Plan. The plan will evaluate locations for riparian vegetation planting based on land use in the lower American River Parkway, effects from future projects, such as the reoperation of Folsom Dam, where existing riparian and valley elderberry longhorn beetle habitat exists, creating and maintaining connectivity between large riparian patches, and coordination with Sacramento County Parks. The plan will maximize habitat quality for both the valley elderberry longhorn beetle and the yellow-billed cuckoo.

3. In order to monitor whether the amount or extent of incidental take anticipated from implementation of the project is approached or exceeded, the Corps shall adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, the Corps must immediately reinitiate formal consultation as per 50 CFR 402.16.

   (a) For those components of the action that will result in habitat degradation or modification whereby incidental take in the form of harm is anticipated, the Corps will provide monthly updates to the Service with a precise accounting of the total acreage of habitat impacted. Updates shall also include any information about changes in project implementation that result in habitat disturbance not described in the Project Description and not analyzed in this biological opinion.

   (b) For those components of the action that may result in direct encounters between listed species and project workers and their equipment whereby incidental take in the form of harassment, harm, injury, or death is anticipated, the Corps shall immediately contact the Service's Sacramento Fish and Wildlife Office (SFWO) at (916) 414-6600 to report the encounter. If the encounter occurs after normal working hours, the Corps shall contact the SFWO at the earliest possible opportunity the next working day. When injured or killed individuals of the listed species are found, the Corps shall follow the steps outlined in the Salvage and Disposition of Individuals section below.

   (c) Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as a Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it. The bag containing the specimen must be frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen. The Service contact persons are the Habitat Conservation Division Chief at the Sacramento Fish and Wildlife Office at (916) 414-6600; the Assistant Field Supervisor of ESA/Regulatory Division at the Bay Delta Fish and Wildlife Office at (916) 930-5603; and the Resident Agent-in-Charge of the Service's Office of Law Enforcement at (916) 569-8444.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. The Service recommends the Corps develop and implement restoration measures in areas designated in the Delta Fishes Recovery Plan (Service 1996) the Giant Garter Snake Recovery Plan (1999) and the Valley Elderberry Longhorn Beetle Recovery Plan (1984).

2. The Corps and SAFCA should develop and implement projects that support DWR's Central Valley Flood System Conservation Strategy. This document provides goals and measurable objectives and potential projects which could be implemented in a manner that while improving the riverine ecosystem also will improve the flood system.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation with the Corps on the American River Common Features GRR Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions regarding this biological opinion, please contact Jennifer Hobbs (jennifer_hobbs@fws.gov or (916) 414-6541) or Doug Weinrich, Assistant Field Supervisor at the letterhead address, (916) 414-6600.

Sincerely,

Jennifer M. Norris
Field Supervisor

cc:
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

SEP 9 2015

Refer to NMFS No: WCR-2014-1377

Ms. Alicia Kirchner
Department of the Army
United States Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, for the American River Common Features General Reevaluation Report (Common Features GRR)

Dear Ms. Kirchner:

Thank you for your letter of April 3, 2015, providing an updated biological assessment and requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the Common Features GRR.

This letter also transmits NMFS's essential fish habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*).

Based on the best available scientific and commercial information, the Biological Opinion (BO) concludes that the Common Features GRR is not likely to jeopardize the continued existence of the federally listed threatened Central Valley (CV) spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), endangered Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*), threatened California CV steelhead distinct population segment (DPS) (*O. mykiss*), or the threatened Southern DPS (sDPS) of North American green sturgeon (*Acipenser medirostris*) and is not likely to destroy or adversely modify their designated critical habitats. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

The EFH consultation concludes that the proposed action would adversely affect the EFH of Pacific salmon in the action area. The EFH consultation adopts the ESA reasonable and prudent measures and associated terms and conditions from the BO and includes additional conservation recommendations specific to the adverse effects to fall- and late fall-run Chinook salmon (*O. tshawytscha*) EFH.

The U.S. Army Corps of Engineers (Corps) has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed written response to NMFS within 30 days of receipt of these conservation recommendations, and 10 days in advance of any action, that includes a description of measures adopted by the Corps for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920(j)). If unable to complete a final response within 30 days, the Corps should provide an interim written response within 30 days before submitting its final response. In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the Common Features GRR and the measures needed to avoid, minimize, or mitigate (also referred to as compensate by NMFS) such effects.

Please contact Howard Brown at the NMFS California Central Valley Office, 916-930-3608, or at Howard.Brown@noaa.gov, if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

for Maria Rea
William W. Stelle, Jr.
Regional Administrator

Enclosure

CC: CHRON File: 151422WCR2014SA00215

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation.

Common Features GRR
NMFS Consultation Number: 151422WCR2015SA00215

Action Agency: U.S. Army Corps of Engineers (Corps)

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
CV spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	No
Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*)	Endangered	Yes	No	No
California CV steelhead DPS (*O. mykiss*)	Threatened	Yes	No	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	No	No	Yes

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: Maria Rea

for William W. Stelle, Jr.
Regional Administrator

Date:

List of Acronyms

BA	Biological Assessment
BCSSRP	Battle Creek Salmon and Steelhead Restoration Program
BMP	Best Management Practices
BO	Biological Opinion
BSSCP	Bentonite Slurry Spill Contingency Plan
CCV	California Central Valley
CDFG	California Department of Fish and Game
CDFW	California Department of Fish Wildlife
CEQA	California Environmental Quality Act
cfs	Cubic Feet per Second
CNFH	Coleman National Fish Hatchery
Corps	US Army Corps of Engineers
CRR	Cohort Replacement Rate
CV	Central Valley
CVP	Central Valley Project
CVFPB	Central Valley Flood Protection Board
CWA	Clean Water Act
CWT	Coded Wire Tag
dbh	Diameter at Breast Height
DCC	Delta Cross Channel
Delta	Sacramento-San Joaquin Delta
DO	Dissolved Oxygen
DPS	distinct population segment
DWR	California Department of Water Resources
DWSC	Deep Water Ship Channel
EFH	Essential Fish Habitat
EIP	Early Implementation Project
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ETL	Engineering Technical Letter
FRFH	Feather River Fish Hatchery
GCID	Glenn-Colusa Irrigation District
GRS	General Reevaluation Study
HU	Hydrologic Unit
ITS	Incidental Take Statement
IWM	Instream Woody Material
JPE	Juvenile Production Estimate
Kelts	Post-Spawning Steelhead
lf	Linear Feet
LSNFH	Livingston Stone National Fish Hatchery
LWM	Large Woody Material
mm	millimeter

MMP	Mitigation and Monitoring Plan
MSA	Magnuson-Stevens Fishery Conservation and Management Act
nDPS	Northern Distinct Population Segment
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTUs	Nephelometric Turbidity Units
O&M	Operation and Maintenance
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	primary constituent elements
PL	Public Law
PVA	Population Viability Analysis
RBDD	Red Bluff Diversion Dam
RD	Reclamation District
Reclamation	United States Department of the Interior, Bureau of Reclamation
RM	River Mile
RWQB	Regional Water Quality Control Board
SAM	Standard Assessment Methodology
SDFPF	Skinner Delta Fish Protection Facility
sDPS	Southern Distinct Population Segment
SJRRP	San Joaquin River Restoration Program
SPCCP	Spill Prevention, Control, and Counter-Measure Plan
SRA	Shaded Riverine Aquatic
SRBPP	Sacramento River Bank Protection Project
SRFCP	Sacramento River Flood Control Project
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCP	Temperature Compliance Point
TFCF	Tracy Fish Collection Facility
TRT	Technical Review Team
USACE	United State Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VSP	Viable Salmonid Populations
VVR	Vegetation Variance Request
WRDA	Water Resources Development Act
WRI	Weighted Species Response Index
WRO	Water Rights Order
WSAFCA	West Sacramento Area Flood Control Agency

Note: Throughout this document there are references cited as CDFG. This refers to the California Department of Fish and Game. This name was changed to California Department of Fish and Wildlife on January 1, 2013. However, for consistency on publications, references prior to January 1, 2013, will remain CDFG.

INTRODUCTION

The U.S. Army Corps of Engineers (Corps) proposes to implement flood risk management improvements under the American River Common Features General Reevaluation Report (Common Features GRR). The purpose of this Biological Opinion (BO) is to analyze the potential effects of repairing the levees in the Sacramento Metropolitan area (including both the Sacramento and American Rivers), widening the Sacramento Weir and Bypass, and diverting more flows into the Yolo Bypass on listed threatened or endangered species and on designated critical habitat, within the project's area of effect (action area).

1.1 Common Features GRR Project Study Area

The Common Features GRR project study area is located within the Sacramento and American River Watersheds. The Sacramento River watershed covers approximately 26,000 square miles in central and northern California. Major tributaries of the Sacramento River include the Feather, Yuba, and American Rivers. The American River Watershed covers about 2,100 square miles northeast of the city of Sacramento and includes portions of Placer, El Dorado, Alpine, and Sacramento counties. The American River watershed includes Folsom Dam and Reservoir; inflowing rivers and streams, including the North, South, and Middle forks of the American River; and the lower American River downstream of Folsom Dam to its confluence with the Sacramento River in the city of Sacramento. The Sacramento and American Rivers, in the Sacramento area, form a flood plain covering roughly 110,000 acres at their confluence. The flood plain includes most of the developed portions of the city of Sacramento. Figure 1 shows the study area.

The Common Features GRR study area includes:

1. Approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River.
2. The east bank of the Dry, and Robla Creeks and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries).
3. The east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee.
4. The Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento (Figure 1).

The action area for the ARCF GRR project includes the American River from below Folsom Dam to the confluence with the Sacramento River and the Sacramento River from the Sacramento Bypass down to below Freeport. In addition the action area includes the East Side Tributaries: Dry and Robla Creeks, and the Magpie Creek Diversion Channel.

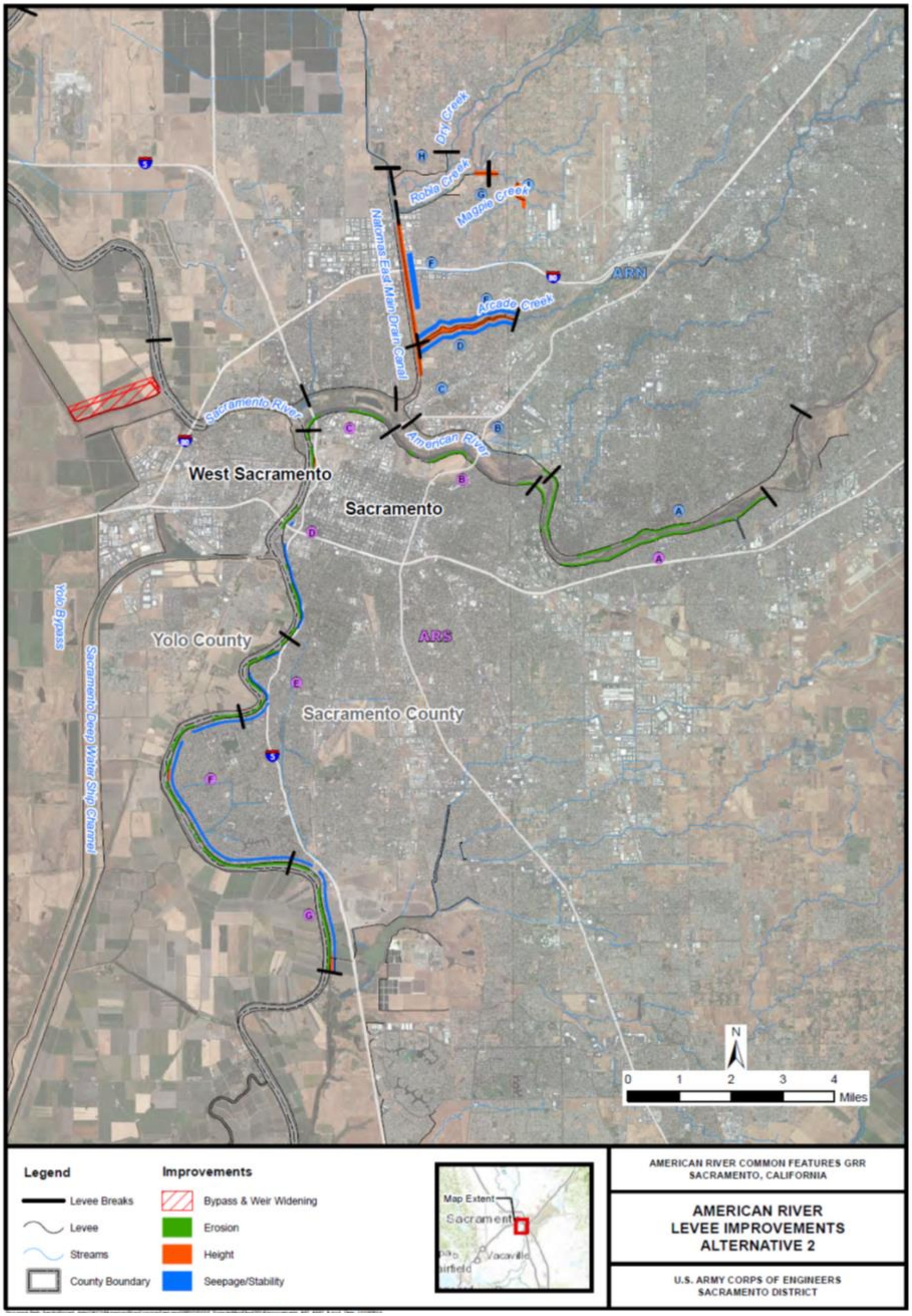

Figure 1. Common Features GRR Study Area (Corps 2014).

1.2 Background, Authority and Policy

The National Marine Fisheries Service (NMFS) prepared the BO and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 *et seq*.), and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 *et seq*.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System, https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS California Central Valley Office.

1.2.1 Background

After the flood of 1986, Congress directed the Corps to investigate the feasibility of reducing flood risk to the city of Sacramento. The Corps completed feasibility studies in 1991 and 1996, recommending a concrete gravity flood detention dam on the north fork of the American River at the Auburn site along with levee improvements downstream of Folsom Dam. Other plans evaluated in the report were Folsom Dam improvements and a stepped release plan for Folsom Dam releases. These additional plans also included levee improvements downstream of Folsom Dam. Congress recognized that levee improvements were "common" to all candidate plans in the report and that there was a Federal interest in participating in these "common features." Thus, the ARCF Project was authorized in WRDA 1996 and a decision on Auburn Dam was deferred to a later date. Major construction components for ARCF in the WRDA 1996 authorization include construction of seepage remediation along approximately 22 miles of American River levees and construction of levee strengthening and raising of 12 miles of Sacramento River levee in Natomas.

Following the flood of 1986, significant seepage was experienced on the Sacramento River from Verona (upstream end of Natomas) at River Mile (RM) 79 to Freeport at RM 45.5. In addition, both the north and south bank of the American River from RM 0 to approximately RM 11.4 experienced seepage. Seepage on the Sacramento River was so extensive that Congress, soon after the 1986 flood event, funded remediation in the Sacramento Urban Levee Improvement Project (Sac Urban). The Sac Urban Project constructed shallow seepage cutoff walls from Powerline Road in Natomas at approximately RM 64 down to Freeport.

In 1999, Congress decided not to authorize Auburn Dam but instead to authorize improvements for Folsom Dam. By doing this, improvements to levees downstream of Folsom Dam could be fine-tuned to work closely with the Folsom Dam improvements being discussed by Congress. Therefore, the Common Features project was modified by WRDA 1999 to include additional necessary features for the American River so that it could safely convey the proposed emergency release of 160,000 cfs from Folsom Dam. Major construction components for the Common Features project in the WRDA 1999 authorization include construction of seepage remediation and levee raises along four stretches of the American River, and construction of levee strengthening and raising of 5.5 miles of Natomas Cross Canal levee in Natomas. All American River features authorized in WRDA 1996 and 1999 have been constructed or are in design analysis for construction within a year or two.

Because of the considerable cost increase of seepage remediation on the American River, all funds appropriated by Congress throughout the late 1990s and the early part of the 2000s were used for construction activities on the American River instead of for design efforts in the Natomas Basin. Combining this with the recognition that all work in the Natomas Basin would also require significantly more effort than was anticipated at the time of authorization, it was decided in 2002 that a general reevaluation study would be required for at least the Natomas Basin portion of the ARCF project. This general reevaluation started in 2006.

At approximately the same time that the reevaluation study was beginning, the Folsom Dam Post Authorization Change report (PAC) was being completed by the Sacramento District. Results of this study showed that additional levee improvements were needed on the American River and on the Sacramento River below the American River in order to truly capture the benefits of the Folsom Dam projects. These levee improvements consisted primarily of addressing erosion concerns on the American River and seepage, stability, erosion, and height concerns on the Sacramento River below the American River.

There are three additional flood management Corps projects related to the Common Features GRR that provide additional context. The Corps initiated consultation for the West Sacramento GRS project in early 2015. Many of the proposed elements associated with the West Sacramento GRS are anticipated to be similar in nature to proposed elements with the Common Features GRR. The project area will include the opposite bank (west bank) of the Sacramento River from the West Sacramento GRS. Potential impacts associated with vegetation removal and bank armoring associated with the West Sacramento GRS could further degrade this area of the Sacramento River watershed. These potential impacts in combination with potential impacts associated with the West Sacramento GRR could degrade the overall health of the lower Sacramento River watershed.

The Corps has initiated consultation for the Sacramento Bank Protection Project Phase II project. Sacramento Bank Protection Project Phase II will cover up to 80,000 lf of bank protection as part of the SRFCP. A number of the potential bank protection sites are located in the general vicinity of the Common Features GRR.

Under the Water Resources Development Act of 1999, Pub. L. No. 106-53, § 366, 113 Stat. 269, 319-320 (1999) (WRDA 1999), Congress authorized improvements to Folsom Dam to control a 200-year flood event with a peak release of 160,000 cfs. WRDA 1999 also authorized the Folsom Dam Modification Project to modify the existing outlets to allow for higher releases earlier in flood events. At the same time, Congress also directed the Corps to review additional modifications to the flood storage of Folsom Dam, indicating that Congress was looking at maximizing the use of Folsom Dam to reduce flood risk prior to consideration of any additional upstream storage on the American River. The Folsom Dam Raise Project was subsequently authorized by Congress in 2004. The project is designed to allow for the release of 160,000 cubic feet per second (cfs) from Folsom Dam. The levees along the American River are unable to withstand these maximum flows for extended periods of time without increased risk of erosion and potential failure. Erosion within the American River Parkway is being addressed as part of the Folsom Reoperation project currently under evaluation and a biological assessment is being prepared to initiate Section 7 consultation with both USFWS and NMFS. These projects have the potential to increase the bank armoring and could exacerbate any impacts associated with the Common Features GRR.

1.2.2 Authority and Policy

According to the Corps' BA, they have no discretion in regards to the continuing existence and operation of the flood control structures of the SRFCP. They assert to have responsibility to maintain Civil Works structures so that they continue to serve their congressionally authorized purposes is inherent in the authority to construct them and is, according to the Corps, non-discretionary. The Corps also asserts that only Congressional actions to de-authorize the structures can alter or terminate this responsibility and thereby allow the maintenance of the structures to cease.

The Corps BA also claims that it has a non-discretionary duty to maintain the SRFCP and the fact the Corps perpetuates the projects existence is not an action subject to consultation. The Federal government maintains oversight but has no ownership of or direct responsibilities for performing maintenance of the Federal levee system, except for few select features that continue to be owned and operated by the Corps. However, the Corps asserts they do have discretion in regard to how and where maintenance actions are performed. The discretion lies within the authorities of the SRBPP and section 408 of the Rivers and Harbors Act. The Corps is seeking additional authorities that will include discretion over future flood risk reduction projects associated with the West Sacramento GRS and the Common Features GRR.

Considering these exceptions, the Corps maintains that the majority of levees, channels, and related flood risk management structures are owned, operated, and maintained by the State of California and local levee and reclamation districts as governed by Corps Operations and Maintenance (O&M) manuals. The Corps points to the May 1955 Standard O&M manual for the SRFCP as the primary O&M manual for the area. The levees of the West Sacramento and Common Features Projects are part of the SRFCP and therefore covered in the 1955 O&M manual.

The BA states that following completion of construction, the Corps will prepare a supplement to the 1955 O&M manual which will specify maintenance requirements for these projects. Because the Corps does have discretion in how and when levee maintenance activities are performed (as opposed to the results of maintenance), maintenance is a discretionary activity that is part of the proposed action subject to consultation.

Typical maintenance activities would include vegetation control through mowing, herbicide application, and/or slope dragging; rodent control; patrol road maintenance; and erosion control and repair. Vegetation control typically would be performed twice a year. Herbicide and bait station application would be conducted under county permit by experts licensed by the state for pest control. Erosion control and slope repair activities would include re-sloping and compacting; fill and repair of damage from rodent burrows would be treated similarly.

To meet Federal Flood Control Regulations (33 CFR 208.10) and state requirements (California Water Code Section 8370), the Federal Flood Risk Management facilities are inspected four times annually, at intervals not exceeding 90 days. The California Department of Water Resources (DWR) would inspect the system twice a year, and the local maintaining authorities would inspect it twice a year and immediately following major high water events. The findings of these inspections would be reported to the Central Valley Flood Protection Board's (CVFPB) Chief Engineer through DWR's Flood Project Integrity and Inspection Branch.

Each federal agency has an obligation to insure that any discretionary action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify its critical habitat. Furthermore, under Section 2 of the ESA, it is declared that all Federal agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA. In regards to species and critical habitat compensation, the Corps has the authority to compensate prior to or concurrent with project construction impacts. This authority is given under WRDA 1986 (33 USC §§ 2201–2330).

The Common Features Project is being proposed in accordance with the principles that have been outlined in the Corps' SMART Planning Guide (Corps 2013). SMART Planning requires that all feasibility studies should be completed within a target of 18 months (to no more than three years at the greatest), at a cost of no more than $3 million, utilizing 3 levels of vertical team coordination, and of a "reasonable" report size. All designs associated with the Common Features GRR use the largest footprint to evaluate affects to listed species. The larger footprint will look at the maximum extent the project could affect species in the action area.

The Corps proposes to construct the Common Features Project levee improvement measures to comply with the Engineering Technical Letter (ETL) 1110-2-571 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures. The vegetation requirements include a vegetation-free zone on the levee slopes and crown, 15 feet from both landside and waterside levee toes, and 8 feet vertically.

The levees within the study area require seepage, slope stability, height, and erosion improvements in order to meet Corps levee safety criteria. In order to protect existing vegetation and allow for revegetation to occur, the Corps must apply for and issue itself with a vegetation variance. The vegetation variance will be sought during the preconstruction engineering and design phase to allow vegetation to remain on the lower 2/3 of the waterside slope and out 15 feet from the waterside toe. If the Corps grants itself a variance, the variance would allow for vegetation to remain in these areas. No vegetation would be permitted on the landside slope or within 15 feet of the landside toe. To show that the safety, structural integrity, and functionality of the levee would be retained with a variance, an evaluation of underseepage and waterside embankment slope stability was completed by Corps engineers.

The Corps' preliminary analysis for the vegetation variance was conducted by analyzing two index points. These two index points were chosen for the vegetation variance analyses because they were considered to be representative of the most critical channel and levee geometry, underseepage, slope stability conditions, and vegetation conditions of the respective basins. The analysis incorporated tree fall and scour on the cross-section geometry of the index points by using a maximum depth of scour for cottonwoods as approximately 11.0 feet; the associated soil removed was projected at a 2:1 slope from the base of the scour toward both the landside, and waterside slopes. The base scour width was equal to the maximum potential diameter at breast height (dbh) of cottonwoods (12.0 feet) projected horizontally at a depth of 11.0 feet below the existing ground profile. The results show that the tree fall and scour did not significantly affect levee performance and that the levee would meet Corps seepage and slope stability criteria when the seepage and slope stability improvement measures are in place ("with-project" conditions). Therefore, it is a reasonable conclusion that allowing vegetation to remain on the lower waterside levee slope would not affect the safety, structural integrity, and functionality of the Sacramento River levee.

As a result of the geotechnical analysis, the Corps would request a vegetation variance of themselves for the Sacramento River, Dry/Robala Creeks, Arcade Creek, and Magpie Creek portions of the project. In many cases along the American River levees, the levee is far enough back from the water's edge to allow vegetation providing shaded riverine aquatic cover to remain on the bank with no vegetation variance necessary. However, the Sacramento Weir and Bypass levees would be constructed in compliance with the Corps ETL as these would be new levees. No vegetation removal would be required within the existing or expanded Sacramento Bypass. There will be no Vegetation Variance requested for the American River sites and will require removal of vegetation and will therefore comply with the ETL. Refer to Table 1 for reach specific information regarding presence or absence of a vegetation variance.

Table 1: Summary of ETL compliance Method by Waterway.

	Vegetation Variance	**SWIF**
Sacramento River (lower ½ of levee slope which is outside construction footprint)		
Waterside	X	
Landside		X
American River		
Trench Landside[1]		X
Bank Protection		X
North Area Tributaries[2]		
NEMDC	X	X
Dry/Robla Creeks	X	X
Arcade Creek	X	X
Magpie Creek[3]	X	X

1 The waterside footprint for the trench construction would require removal of vegetation and therefore compliance with the ETL.
2 A variance is included for these tributaries waterside slopes outside of the construction footprint, and a SWIF would be prepared by the non-Federal partners for the landside slopes and access.
3 The new levee constructed along Raley Boulevard would be constructed in compliance with the ETL.

In addition to the Vegetation variance, this project will implement the System Wide Improvement Framework (SWIF). The SWIF is an agreement between the Corps and the non-Federal sponsor that allows the local maintain agency (LMA) to defer compliance with ETL 1110-2-583. In an effort to modernize the levee system to meet current engineering standards, vegetation and encroachment issues (including landside levee access) in the study area will be resolved through a combination of construction actions associated with implementation of the recommended plan and formal agreements. The formal agreements involve the integrated use of a SWIF agreement with the LMA and a variance from vegetation standards in ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.

Under the SWIF agreement, the LMA would address landside vegetation and encroachment issues (including landside levee access) through the implementation of their standard operation and maintenance (O&M) actions over time. Therefore, vegetation not impacted by project construction would be addressed by the LMA in accordance with the State's Levee Vegetation Management Strategy in the Central Valley Flood Protection Plan (CVFPP) over the next 20 to 40 years. The SWIF will be planned and implemented by the non-Federal sponsor and includes the following criteria:

- An engineering inspection and evaluation shall be conducted to identify trees and other woody vegetation (alive or dead) on the levee and within 15 feet of the levee toe that pose an unacceptable threat to the integrity of the levee. Identified trees shall be removed and associated root balls and roots shall be appropriately remediated. Based on the engineering inspection and evaluation, trees and other woody vegetation that do not pose an unacceptable threat need not be removed.

- In cases of levee repair or improvement projects, vegetation within the project footprint shall be removed as part of construction activities.

- Trees and other woody vegetation that are not removed must be monitored as part of routine levee maintenance to identify changed conditions that cause any of these remaining trees and other woody vegetation to pose an unacceptable threat to levee integrity. Otherwise, such trees and woody vegetation are to be maintained according to the levee vegetation management criteria included in the CVFPP which establish a vegetation management zone (including the landside levee slope, crown and upper 1/3 of the waterside slope) in which trees are trimmed up to 5 feet above the ground (12-foot clearance above the crown road) and thinned for visibility and access while brush, trees and other woody vegetation less than four inches in diameter at breast height, weeds or other such vegetation over 12 inches high are to be removed in an authorized manner.

The standard O&M activities will be adjusted to reflect any vegetation variance. Under the adjusted O&M manual, large trees that were protected in place under the variance will be allowed to remain on the waterside slopes, but smaller shrubs will be removed and grasses will be regularly mowed to allow for inspection and access.

The ARCF project was authorized by Section 106(a)(1) of the Water Resources Development Act (WRDA) of 1996, (Public Law [PL] 104-303) (110 Stat. 3658, 3662-3663), as amended by Section 130 of the Energy and Water Development and Related Agencies Appropriations Act of 2008, (PL 110-161) (121 Stat. 1844, 1947). Additional authority was provided in Sections 366 and 566 of WRDA 1999, (PL 106-53), (113 Stat. 269, 319-20. The current estimated cost of the authorized project is $274,100,000. In accordance with Section 902 of WRDA 1986 (Pub. L. 99-662, § 902, Nov. 17, 1986, 100 Stat. 4183), the allowable cost limit is $284,000,000.

1.3 Consultation History

NMFS received a request for initiation of consultation on July 1, 2014. However, the initial request did not contain an appropriate effects determination. The Biological Assessment (BA) was missing necessary information to perform a species impact analysis. NMFS reviewed the biological assessment provided with the initiation letter and concluded it lacked sufficient detail to determine the extent to which the proposed project may affect federally listed species and their designated critical habitats. In addition, NMFS found that the information provided with the letter was incomplete and lacked all the information necessary to initiate section 7 consultation on the proposed project, as outlined in the regulations governing interagency consultation (50 CFR §402.12). On September 9th, 2014 NMFS sent an insufficiency letter outlining the information needs to initiate consultation.

On April 3, 2015 NMFS received a new request for initiation of consultation. The request included the North Sacramento Streams projects that were to be conducted by SAFCA. In the April 3, 2015 letter the Corps requested concurrence from NMFS that the Common Features GRR will adversely affect threatened Central Valley (CV) spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), endangered Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*), threatened California CV (CCV) steelhead distinct population segment (DPS) (*O. mykiss*), and threatened Southern DPS (sDPS) of North American green sturgeon (*Acipenser medirostris*), and their designated critical habitats. Additionally, the Corps has determined that the Common Features Project may adversely affect Essential Fish Habitat (EFH) pursuant to the Magnuson-Stevens Fishery Management Act. The Corps also states that there is an expectation that the Common Features GRR may benefit long-term EFH quality in the action area.

After phone conversations, emails, and an inter-agency meeting on April 21, 2015 the Corps agreed to send a letter advising that the North Sacramento Streams projects would be separated from the Common Features GRR for a separate consultation, and that new SAM analysis models needed to be run. NMFS informed the Corps that consultation could not begin until the letter was received and SAM analysis completed.

May 14, 2015 another interagency meeting that included the Corps and NMFS occurred for the revised SAM analysis. NMFS again informed the Corps that consultation could not begin until the letter was received and SAM analysis completed. NMFS and the Corps agreed that the following information should be included in the letter transmitting the new Standard Assessment Methodology (SAM) analysis Memo:

1. Establish that for all of the three reaches what Sac Bank approximation was used for all SAM runs. Meaning the sites constructed near to the sites to be constructed, those specifications were used for the with-construction conditions, remember to add to the SAM analysis memo we are working on.

2. Add all green sturgeon life stages to the SAM analysis for site C since it is in Green Sturgeon Critical habitat.

3. Add green sturgeon juvenile rearing habitat SAM analysis for all America River sites.

4. Add justification for not including certain life history stages to the SAM analysis.

5. Addition of a discussion for the purchase of mitigation credits appropriate for each site.

6. Addition of numbers for fall-run juvenile migration all water levels for EFH.

7. Incorporate 60% IWM into the SAM analysis.

8. Incorporate a discussion of possibly incorporating 80% IWM.

9. Incorporation of plantings (*i.e.* button bush) at the lowest/Fall water line to increase the value.

June 11, 2015 NMFS received email with Draft memo of new Sam analysis information which included a new reach of the Sacramento bypass and weir and NMFS initiated consultation.

August 24, 2015 NMFS met with the Corps and received new conservation measures to add to the project description.

August 28, 2015. NMFS received a letter from the Corps officially providing the revised project description and new Green Sturgeon conservation measures.

1.4 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The Corps has identified a number of problems associated with the flood risk management system protecting the city of West Sacramento and surrounding areas. There is a high probability that flows in the American and Sacramento Rivers will stress the network of levees protecting Sacramento to the point that levees could fail. Such a levee failure would flood a highly urbanized area.

Levees in the Common Features GRR action area require improvements to address seepage, stability, erosion, and height concerns identified for the American River levees, Dry/Robla, and Magpie Creeks. The levees along the Sacramento River would be improved to address identified seepage, stability, erosion, and a minimal amount of height concerns. Most height concerns along the Sacramento River would be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass. The measures proposed to improve the levees consist of: (1) bank protection or launchable rock trenches, (2) install cutoff walls, (3) levee raise, (4) construct floodwalls, (5) raise floodwalls, (6) construct new levee, (7) acquire property to create a flood detention basin, (8) widen and raise a bridge crossing, (9) remove a culvert, (10) widen the Sacramento Weir and Bypass, (11) construction of a new weir, and 12) removal of existing levee. The above measures will be implemented by fixing levees in place or constructing adjacent levees. It is possible that sheet pile walls, jet grouting, and relief wells will be used at various locations so they are also described below. Once a levee is modified, regardless of the measure implemented for the alternative, the levee will be brought into compliance with Corps levee design criteria.

For more details on the potential levee repairs listed above and in Table 2, refer to the American River Common Features General Reevaluation Report North Sacramento Streams Levee Improvement Project, specifically Chapter 2 (Corps 2015a).

In addition to the proposed levee improvements measures, the following measures and policies will apply to all of the levee repair alternatives, and will be addressed during construction:

1. Utility encroachments such as structures, certain vegetation, power poles, pump stations, and levee penetrations (*e.g.*, pipes, conduits, cables) will be brought into compliance with applicable Corps policy or removed depending on type and location. This measure will include the demolition of such features and relocation or reconstruction as appropriate on a case-by-case basis (or retrofit to comply with standards). Utilities replacements will occur via one of two methods: (1) a surface line over the levee prism, or (2) a through-levee line equipped with positive closure devices.

2. Private encroachments shall be removed by the non-federal sponsor prior or property owner prior to construction.

The O&M of the levees in the Sacramento area are the responsibility of the local maintaining agencies, including the American River Flood Control District, Maintenance Area 9, The California Department of Water Resources (DWR), and the City of Sacramento. The applicable O&M Manual for the Sacramento levees is the Standard O&M Manual for the Sacramento River Flood Control Project. Typical levee O&M in the Sacramento area includes the following actions:

1. Vegetation maintenance up to four times a year by mowing or applying herbicide.

2. Control of burrowing rodent activity monthly by baiting with pesticide.

3. Slope repair, site-specific and as needed, by re-sloping and compacting.

4. Patrol road reconditioning up to once a year by placing, spreading, grading, and compacting aggregate base or substrate.

5. Visual inspection at least monthly, by driving on the patrol road on the crown and maintenance roads at the base of the levee.

6. Post-construction, groundwater levels would be monitored using the piezometers.

Flood risk reduction construction activities will primarily occur during the April 15 to October 31 time frame, although extension of the CVFPB encroachment permit may be sought if weather conditions permit. However, construction activities, including, but not limited to, structure and vegetation removal, roadway removal and replacement, revegetation, and utility removal and replacement, regardless of the construction season will be subject to the conditions of environmental and encroachment permits and authorizations to be issued by the California Department of Fish and Wildlife (CDFW), CV Regional Water Quality Control Board (RWQCB), CVFPB, the Corps, US Fish and Wildlife Service (USFWS), NMFS, Yolo County, City of West Sacramento, and others.

Construction of the Common Features Project is proposed to take approximately 13 years if each reach is constructed sequentially. The construction reaches have been prioritized based on a variety of factors, including the condition of the levee, the potential damages that will occur due to levee failure, and construction feasibility considerations, such as the availability of equipment at any given time. A summary of the flood risk reduction measures proposed as part of this study are included in Table 2.

Table 2. Proposed Measures for the Common Features GRR Project.

Waterway/Location	Extent of Action	Proposed Measure
American River	North and south levees from the confluence with the Sacramento River upstream for approximately 12 miles.	• Construct bank protection or launchable rock trenches
Sacramento River	East levee from the American River to Morrison Creek.	• Install cutoff walls • Construct bank protection • Construct levee raise
Dry/Robla Creek		• Raise floodwalls
Magpie Creek Diversion Canal	Upstream of Raley Boulevard	• Construct floodwalls
Magpie Creek area	South of Raley Boulevard	• Construct new levee
Magpie Creek area	East of Raley Boulevard	• Acquire property to create a flood detention basin • Widen the Raley Boulevard/Magpie Creek bridge and raise the elevation of the roadway • Remove the Don Julio Creek culvert
Sacramento Weir and Bypass	North bypass levee to 1,500 feet north.	• Widen the Sacramento Weir and Bypass by approximately 1,500 feet • Construct a new section of weir and levee • Remove the existing Sacramento Bypass north levee

The tentative schedule of construction is shown in Table 3. The durations are for construction activities only, and do not include the time needed for design, right-of-way, utility relocation, *etc*.

Table 3. Common Features GRR Project Construction Schedule.

PRIORITY	WATERWAY	REACH	YEAR OF PROJECT CONSTRUCTION												
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Sacramento River	ARS F													
2	Sacramento River	ARS E													
3	American River	ARS A													
4	Sacramento River	ARS G													
5	Sacramento River	ARS D													
6	American River	ARS B													
7	American River	ARN A													
8	American River	ARS C													
9	American River	ARN B													
10	Sacramento Weir & Bypass	--													
11	Dry/Robla Creek	ARN G													
12	Magpie Creek	ARN I													

Analysis of total linear feet (lf) of shaded riverine aquatic (SRA) habitat was conducted using Google Earth Pro for the reaches only associated with bank protection on the American and Sacramento Rivers in the Common Features GRR action area (Table 4). However, site specific conditions at proposed bank protection sites will evaluate SRA habitat values using the SAM method of analysis to determine impacts and onsite compensation value based on actual designs. The East Side Tributaries were not evaluated because no bank erosion protection is planned. It should be noted however that there is minimal, if any, SRA associated with the tributaries in the reaches where construction is proposed, except Arcade Creek. It is not anticipated that trees would need to be removed within the Sacramento Bypass as a result of the levee relocation effort, since the footprint of the expanded Bypass area is open farmland with no trees present. However, trees along the Sacramento River would be removed to construct the new 1,500 foot Sacramento Weir.

Identification of individual reaches in the Common Features GRR action area can be seen in Figure 1. American River North (ARN) reaches A through I includes the north side of the American River and the East Side Tributaries. American River South (ARS) reaches A through G includes the south side of the American River and the east side of the Sacramento River.

Table 4. SRA Reach Specific Summary

AMERICAN RIVER		SACRAMENTO RIVER	
REACH	**LINEAR FEET (lf) of SRA**	**REACH**	**LINEAR FEET (lf) of SRA**
A	31,174	D	9,643
B	7,259	E	7,709
C	6,934	F	21,263
		G	11,689
		Sac Weir	1,500
Total	**45,367**	**Total**	**51,804**

1.11 Vegetation Policy Compliance

Vegetation removal under the Common Features GRR project would be limited to no more than the upper one-half of the waterside of the levees therefore leaving the lower one-half or more of the trees in place on the Sacramento River within the study area. SRA would not be compromised, thus maximizing existing SRA values in the study area. No vegetation removal would be required within the existing or expanded Sacramento Bypass. New levees (such as setback levees) would be designed to be compliant with Corps levee vegetation policy. Consistent with the Central Valley Flood Protection Plan (CVFPP) guidance. Any vegetation removed as part of direct construction activities would not be replaced onsite if possible.

1.12 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). In this case, there are no interrelated or interdependent actions.

The Folsom Dam Raise Project and subsequent Folsom Reoperation Project have the potential to increase the bank armoring and could exacerbate any impacts associated with the common Features GRR, but are not interrelated or interdependent actions because neither project depends on the other for their justification and they both have independent utility. The erosion issues within the American River Parkway is being addressed as part of the Folsom Reoperation Project currently under evaluation and a biological assessment is being prepared to initiate Section 7 consultation with both USFWS and NMFS.

1.13 Conservation Actions

The Corps will seek to avoid and minimize construction effects on listed species and their critical habitat to the extent feasible, and will implement on-site, and off-site compensation actions as necessary. Compensation time is the time required for on-site plantings to provide significant amounts of shade or structural complexity. Depending on project impacts, a project may incorporate various habitat and species benefits to compensate for short-term losses in habitat for listed species. Long-term compensation to offset short-term losses is generally not an option for the loss of critical habitats under the ESA (USFWS 1998a). The Corps uses the following compensation time periods (based loosely on life expectancy) as guidelines for compensation:

- Green sturgeon, 15 years;
- Chinook salmon, 5 years; and
- Central Valley steelhead, 4 years (Corps 2012).

1. Obtain an ETL approved vegetation variance exempting sites from vegetation removal prior to final design and construction phase for the Sacramento River.
2. Minimize the removal of existing vegetation in the proposed project area. Any disturbance or removal of vegetation will be replaced with native riparian vegetation, outside of the vegetation-free zone, as established in the ETL.
3. Implement best management practices (BMPs) to prevent slurry seeping out to river and require piping system on land side only.
4. The Corps will incorporate compensation for SRA habitat losses either by project constructed compensation sites or in combination with purchase of credits at a NMFS approved conservation bank where appropriate.
5. The Corps will seek an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower one-third of the waterside of the levee prior to final construction and design phase. Construction may require removal of vegetation on the upper two-thirds of the waterside and landside slope. Full ETL compliance will occur on some of the American River reaches.
6. The Corps will use a rock soil mixture to facilitate re-vegetation of the project sites that require bank protection work. A (70:30) rock to soil ratio will be implemented. The soil-rock mixture will be placed on top of the of the rock revetment along the Sacramento River levees to allow native riparian vegetation to be planted to insure that SRA habitat lost is replaced or enhanced.
7. In addition to an approved vegetation variance, the Corps will minimize the removal of existing vegetation in the proposed project area. Disturbance or removal of trees or larger woody vegetation will be replaced with native riparian species, outside of the vegetation-free zone, as established in the ETL.
8. Levee repair designs will be analogous to those developed for an SRBPP repair site. These levee repair designs include installation of IWM, native vegetation planting, incorporation of soil with the rock, *etc*.
9. Construction will be scheduled when listed terrestrial and aquatic species will be least likely to occur in the project area. If construction needs to extend into the timeframe that species are present coordination with the resource agencies will occur.

10. Stockpile construction materials such as portable equipment, vehicles, and supplies, at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.
11. Stockpile all liquid chemicals and supplies at a designated impermeable membrane fuel and refueling station with a containment system.
12. Erosion control measures including Storm Water Pollution Prevention Program (SWPPP) and Water Pollution Control Program that minimize soil or sediment from entering the river. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations to minimize effects to Federally listed fish and their designated critical habitat.
13. Site access will be limited to the smallest area possible in order to minimize disturbance.
14. Litter, debris, unused materials, equipment, and supplies will be removed from the project area daily. Such materials or waste will be deposited at an appropriate disposal or storage site.
15. Immediately (within 24 hours) cleanup and report any spills of hazardous materials to the resource agencies. Any such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.
16. Designating a Corps-appointed representative as the point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all employee education program conducted by the Corps.
17. Vegetation removed as a part of ETL compliance will be compensated on site, outside of the vegetation-free zone, to the extent feasible. When on-site compensation is not feasible, compensation is proposed at local conservation banks with available credits. If credits are not available locally, then compensation is proposed to occur within the West Sacramento city limits.
18. The Corps will compensate for any short and longer term impacts through additional onsite compensation, purchase of compensatory conservation credits, or development of suitable created aquatic habitat.
19. Screen any water pump intakes.
20. The Corps will work with local cost share sponsors to ensure GRR-related future flood risk reduction actions related to widening the Sacramento Weir shall fully mitigate upstream and downstream fish passage effects at the weir and within the spillway basin.
21. The goal is to ensure that adult CV spring-run and Sacramento River inter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are able to migrate upstream while the weir is spilling into the bypass and that juvenile stranding in the spillway basin is minimized to the maximum extent possible.
22. The Corps shall ensure the widening of the Sacramento Bypass is designed and constructed to minimize stranding of fish in the depressions wound within the bypass though grading or construction of drainage channels.
23. The goal is to ensure that the bypass is designed and constructed in a manner that reduces adult and juvenile stranding to the maximum extent possible.

A number of measures will be applied to the entire Common Features Project or specific actions, and other measures may be appropriate at specific locations within the Common Features Project study area. Avoidance activities to be implemented during final design and construction may include, but are not limited to, the following:

1. Identifying all habitats utilized by listed terrestrial, wetland, and plant species in the potentially affected project areas. To the extent practicable efforts will be made to minimize effects by modifying engineering design to avoid potential direct and indirect effects.
2. Incorporating sensitive habitat information into project bid specifications.
3. Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
4. Minimizing vegetation removal to the extent feasible.
5. Minimizing, to the extent possible, grubbing and contouring activities.
6. Where feasible compensating for impacts close to where impacts have occurred.

1.14 Additional Conservation Measures for sDPS Green Sturgeon

Through collaboration with NMFS, the Corps has updated the project description in the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and will implement the following additional measures that have been coordinated with NMFS to reduce impacts to green sturgeon habitat.

1. The Corp's final Environmental Impact Statement/Environmental Impact Report for the American River Common Features GRR shall include a proposal to develop a green sturgeon habitat, mitigation, and monitoring plan (HMMP) with the specific elements that are described below.

   The goal of the developing the HMMP is to ensure that adverse impacts of future American River Common Features GRR projects on sDPS green sturgeon are fully mitigated in order to maintain the growth, survival and recovery of the species in the study area.

2. The green sturgeon HMMP shall be developed in coordination with the IEP green sturgeon project work team and consulted on with NMFS prior to the construction of any work within the designated critical habitat of sDPS green sturgeon related to the American River Common Features GRR. The HMMP should focus on filling important data gaps on green sturgeon life history and micro and macro habitat ecology in both the Sacramento River and the north Delta within the project impact area, in regard to how bank stabilization measures proposed in the American River Common Features GRR affect sturgeon ecology and survival, particularly in regard to juvenile rearing and survival.

   The goal of this conservation measure is to leverage the resources of the IEP to develop an HMMP that utilizes and applies the best available scientific expertise and information available.

3. The Corps shall either refine the SAM or develop an alternative green sturgeon survival and growth response model based on using and updating the existing Hydrologic Engineering Center Ecosystem Function Model (HEC-EFM) that reflects green sturgeon's preference for benthic habitat and that accounts for the physical loss of habitat from revetment footprints instead of the convention used by the SAM where the fish response is evaluated at the intersect of seasonal water surface elevations. The new modeling may include hydraulic modeling, but must be capable of evaluating green sturgeon survival in response to levee repair projects in the project impact area and their effects on all habitat conditions, not exclusively flow changes. Development of the model shall be initiated at the start of the preconstruction engineering and design (PED) phase of the American River Common Features GRS and shall be peer reviewed by sturgeon experts on the IEP, other academia with sturgeon expertise and be consulted on with NMFS.

   The goal of this measure is to develop a functional assessment methodology using the best available scientific expertise and information available to model the effects of future American River Common Features GRR actions and evaluate the performance of mitigation actions relative to the survival and growth of sDPS green sturgeon that are exposed to such actions.

4. The HMMP shall also, restore or compensate for the number of acres and ecological function of soft bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. This mitigation shall be coordinated with the Interagency Working Group (IWG) or a Bank Protection Working Group (BPWG) and must be carried out within the lower Sacramento River/North Delta in order to offset the adverse modification to designated critical habitat. The restored habitat must be capable of providing abundant benthic prey freshwater or estuarine areas; with adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics, is necessary for normal behavior, growth and viability of all life stages; and provide safe and unobstructed migratory pathways are necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats. The restoration/mitigation shall be initiated prior to commencement of construction within the designated critical habitat of sDPS green sturgeon for the American River Common Features GRR and the updated model should be used to validate performance. The restoration site and plan shall be developed in coordination with the IEP and be consulted on with NMFS.

   The goal is to ensure the spatial and temporal ecological impacts from project-related permanent loss of critical habitat for green sturgeon critical for juvenile green sturgeon are fully compensated.

5. The green sturgeon HMMP shall also be developed with measurable objectives for completely offsetting all adverse impacts to all life stages of sDPS green sturgeon (as modeled using refined approaches described in RPA action 3, above, and considering design refinements that occur in the PED phase of project implementation).

The goal of this measure is to develop "SMART" objectives for mitigation. "SMART" objectives are specific (target a specific area for improvement), measurable (quantify or suggest an indicator of progress), attainable (specify who will do the work and if possible how), realistic (state what results can realistically be achieved, given available resources) and timely (specify when the results can be achieved) habitat performance objectives for green sturgeon mitigation.

6. Mitigation actions shall be initiated prior to the construction activities affecting sDPS green sturgeon and their critical habitat. Specific mitigation plans may be developed during project design engineering to reduce the specific impacts of levee construction actions.

   The goal of this measure is to ensure that mitigation coincides with project implementation and to minimize, to the maximum extent possible, extended temporal effects.

7. The sDPS green sturgeon HMMP will include measurable performance standards at agreed upon intervals and will be monitored for a period of at least ten years following construction. If additional monitoring is necessary, the monitoring shall be included in the project O&M plan and carried out by the local sponsor. The HMMP will include adaptive management strategies for correcting any mitigation measures that do not meet performance standards.

   The goal of this measure it to provide a reasonable amount of time to measure performance standards after mitigation occurs to ensure that it meets the objectives of the HMMP.

1.5 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area for the Common Features GRR includes: (1) approximately 12 miles of the north and south banks of the American River immediately upstream from the confluence with the Sacramento River; (2) the east bank of the Natomas East Main Drainage Canal (NEMDC), Dry, Robla, and Arcade Creeks and the Magpie Creek Diversion Channel (collectively referred to as the East Side Tributaries); (3) the east bank of the Sacramento River downstream from the American River to Freeport, where the levee ties into Beach Lake Levee, the southern defense for Sacramento; and (4) the Sacramento Weir and Bypass, located along the north edge of the city of West Sacramento (Figure 1).

The action area includes perennial waters of the Sacramento River extending 200 feet perpendicular from the average summer-fall shoreline and 1,000 feet downstream from proposed in-water construction areas. This represents the potential area of turbidity and sedimentation effects based on the reported limits of visible turbidity plumes in the Sacramento River during similar construction activities (NMFS 2008).

ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions will affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This BO includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that will be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

1. Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
2. Describe the environmental baseline in the action area.
3. Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
4. Describe any cumulative effects in the action area.
5. Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
6. Reach jeopardy and adverse modification conclusions.
7. If necessary, define a reasonable and prudent alternative to the proposed action.

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

2.1.1 Use of Analytical Surrogates

The effects of the Common Features GRR are primarily analyzed using Standard Assessment Methodology (SAM). The Corps provided the background data, assumptions, analyses, and assessment of habitat compensation requirements for the federally protected fish species relevant to this consultation.

The SAM was designed to address a number of limitations associated with previous habitat assessment approaches and provide a tool to systematically evaluate the impacts and compensation requirements of bank protection projects based on the needs of listed fish species.

It is a computational modeling and tracking tool that evaluates bank protection alternatives by taking into account several key factors affecting threatened and endangered fish species. By identifying and then quantifying the response of focal species to changing habitat conditions over time, project managers, biologists and design engineers can make changes to project design to avoid, minimize, or compensate for impacts to habitat parameters that influence the growth and survival of target fish species by life stage and season. The model is used to assess species responses as a result of changes to habitat conditions, either by direct quantification of bank stabilization design parameters (*e.g.,* bank slope, substrate).

In 2003, the Corps established a program to carry out "a process to review, improve, and validate analytical tools and models for USACE Civil Works business programs". Reviews are conducted to ensure that planning models used by the Corps are technically and theoretically sound, computationally accurate, and in compliance with the Corps planning policy. As such, all existing and new planning models developed by the Corps are required to be certified through the appropriate Planning Center of Expertise and Headquarters in accordance with Corps rules and procedures.

The assumptions, model variables, and modeling approaches used in the SAM have been developed to be adapted and validated through knowledge gained from monitoring and experimentation within the SRBPP while retaining the original overall assessment method and framework. The first update to the SAM included the addition of sDPS green sturgeon as well as a number of modifications to modeled-species responses based upon updated literature reviews and recent monitoring efforts at completed bank protection sites (Stillwater Sciences 2009, USACE 2009).

In late 2010, the certification process for the SAM was initiated by the Corps, Sacramento District in coordination with the Ecosystem Planning Center of Expertise. The process entailed charging a panel of six experts to review the SAM, along with the SAM (version 3.0). The Review Panel was composed of a plan formulation expert, fisheries biologist, aquatic ecologist, geomorphologist/geologist, population biologist/modeling expert, and software programmer.
A major advantage of the SAM is that it integrates species life history and seasonal flow-related variability in habitat quality and availability to generate species responses to project actions over time. The SAM systematically evaluates the response of each life stage to habitat features affected by bank protection projects.

The SAM quantifies habitat values in terms of a weighted species response index (WRI) that is calculated by combining habitat quality (*i.e.*, fish response indices) with quantity (*i.e.*, bank length or wetted area) for each season, target year, and relevant species/life stage. The fish response indices are derived from hypothesized relationships between key habitat attributes (described below) and the species and life stage responses. Species response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (*i.e.*, with or without project), the SAM uses these relationships to determine the response of individual species and life stages to the measured or predicted values of each habitat attribute for each season and target year, and then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear feet or area of shoreline to which it applies to generate a weighted species response index expressed in feet or square feet. The species WRI provides a common metric that can be used to quantify habitat values over time, compare project conditions to existing conditions, and evaluate the effectiveness of on-site and off-site compensation actions.

The WRI represent an index of a species growth and survival based on a 30-day exposure to post project conditions over the life of the project. As such, negative SAM values can be used as a surrogate to quantify harm to a target fish species by life stage and season. Also, although SAM values represent and index of harm to a species, since the values are expressed as "weighted bankline feet" or "weighted area", these values can be used to help quantify compensatory conservation actions such as habitat restoration, and are used for that purpose in this BO.

During the process of this consultation, the Corps and NMFS identified several short comings with the SAM as a tool for reliably forecasting the growth and survival of green sturgeon. The primary short coming is that the SAM evaluates habitat conditions at the seasonal water surface intersect with the river bank. While this is considered an effective point for measuring salmon and steelhead habitat, green sturgeon have a greater affinity for benthic habitat than shoreline habitat. Further, during discussions between the Corps and NMFS, it was widely agreed upon that levee repair actions in the West Sacramento Study Area are likely to only affect the juvenile rearing life stage and probably have little to no adverse impacts on the adult life stages of green sturgeon because spawning habitat is not present and adults that are migrating upstream are probably more influenced by impacts that affect swimming speed and upstream passage than shoreline habitat manipulations. Because of this, NMFS has decided to use the SAM as a proxy for quantifying habitat disturbance and harm and use as an ecological surrogate for quantifying the amount and extent of take for juvenile rearing and migrating green sturgeon, but the precision is not as sharp as for salmon and steelhead. Therefore, a new model will be developed to determine compensatory mitigation actions and tracking performance.

2.1.2 Compensation Timing

As described in the proposed action, projects such as this often propose compensation for unavoidable short-term effects to species and impacts to habitat. These compensation timeframes are generally based on anticipated SAM response time. Under the Corps BA, compensation timing is defined and in practice adopts an approach that the SAM modeled impact at the proposed timing (Green sturgeon: 15 years: Chinook salmon, 5 years: Central Valley steelhead, 4 years) is sufficient to compensate for project effects. NMFS adopts a slightly different approach to the analysis of the BO in that the compensation time should be a target for avoiding exposure of more than one generation of a population with a multiple age class structure. Negative SAM-modeled values beyond those years, especially at winter and spring water surface elevations, may have significant effects to the species and impacts to critical habitat that would reduce the species survival and recovery in the wild or substantially reduce the conservation value of the species because the adverse effects (reduced growth and survival of individuals) would begin to reduce the number of reproducing individuals across multiple generations. In some cases, negative SAM values extend beyond these compensation periods, in which case offsite compensatory mitigation can reduce the long-term effects to a species survival and recovery by creating high quality habitat conditions in areas that provide high ecological value for the species. Because we have determined the SAM model is not a strong representation of green sturgeon growth and survival response, we are applying the implementation of the USACE Green Sturgeon Conservation Measures As key actions necessary to both avoid reducing the survival and recovery of the species in the wild and reducing the conservation value of critical habitat, instead of applying a specific compensation time period for green sturgeon. As such, this BO applies the following compensation timing as general targets for avoiding such long-term effects to salmon and steelhead:

1. Chinook salmon, 5 years;
2. Central Valley steelhead, 4 years

2.2 Rangewide Status of the Species and Critical Habitat

This BO examines the status of each species that will be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The BO also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

One factor affecting the rangewide status of the CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon, and aquatic habitat at large is climate change.

The following federally listed species and designated critical habitats occur in the action area and may be affected by the proposed action:

Sacramento River winter-run Chinook salmon ESU (*Oncorhynchu tshawytscha*) Listed as endangered (70 FR 37160, June 28, 2005)

Sacramento River winter-run Chinook salmon designated critical habitat (June 16, 1993, 58 FR 33212)

CV spring-run Chinook salmon ESU (*O. tshawytscha*)
Listed as threatened (70 FR 37160, June 28, 2005)

CV spring-run Chinook salmon designated critical habitat (70 FR 52488, September 2, 2005)

CCV steelhead DPS (*O. mykiss*)
Listed as threatened (71 FR 834, January 5, 2006)

CCV steelhead designated critical habitat
(70 FR 52488, September 2, 2005)

Southern DPS of North American green sturgeon (*Acipenser medirostris*)
Listed as threatened (71 FR 17757, April 7, 2006)

Southern DPS of North American green sturgeon designated critical habitat (74 FR 52300, October 9, 2009)

Critical habitat designations identify those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration or protection. Within the Common Features GRR this includes the river water, river bottom, and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation (defined as the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of one to two years on the annual flood series) used by listed salmonids and sturgeon.

NMFS has recently completed an updated status review of five Pacific salmon ESUs and one steelhead DPS, including Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead, and concluded that the species' status should remain as previously listed (76 FR 50447; August 15, 2011). The 2011 status reviews (NMFS 2011a, 2011b, 2011c) additionally stated that, although the listings should remain unchanged, the status of these populations have worsened over the past five years since the 2005/2006 reviews and recommended that status be reassessed in two to three years as opposed to waiting another five years.

2.2.1 Sacramento River Winter-run Chinook salmon

The Sacramento River winter-run Chinook salmon (winter-run *Oncorhynchus tshawytscha*) ESU, currently listed as endangered, was listed as a threatened species under emergency provisions of the ESA on August 4, 1989 (54 FR 32085) and formally listed as a threatened species in November 1990 (55 FR 46515). On January 4, 1994 (59 FR 440), NMFS re-classified winter-run as an endangered species. NMFS concluded that winter-run in the Sacramento River warranted listing as an endangered species due to several factors, including: (1) the continued decline and increased variability of run sizes since its first listing as a threatened species in 1989;

(2) the expectation of weak returns in future years as the result of two small year classes (1991 and 1993); and (3) continued threats to the "take" of winter-run (August 15, 2011, 76 FR 50447).

On June 28, 2005, NMFS concluded that the winter-run ESU was "in danger of extinction" due to risks to the ESU's diversity and spatial structure and, therefore, continues to warrant listing as an endangered species under the ESA (70 FR 37160). In August 2011, NMFS completed a 5-year status review of five Pacific salmon ESUs, including the winter-run ESU, and again determined that the species' status should remain as "endangered" (August 15, 2011, 76 FR 50447). The 2011 review concluded that although the listing remained unchanged since the 2005 review, the status of the population had declined over the past five years (2005–2010).

The winter-run ESU currently consists of only one population that is confined to the upper Sacramento River (spawning downstream of Shasta and Keswick dams) in California's CV. In addition, an artificial propagation program at the Livingston Stone National Fish Hatchery (LSNFH) produces winter-run that are considered to be part of this ESU (June 28, 2005, 70 FR 37160). Most components of the winter-run life history (*e.g.*, spawning, incubation, freshwater rearing) have been compromised by the habitat blockage in the upper Sacramento River. All historical spawning and rearing habitats have been blocked since the construction of Shasta Dam in 1943. Remaining spawning and rearing areas are completely dependent on cold water releases from Shasta Dam in order to sustain the remnant population.

Life History

1. <u>Adult Migration and Spawning</u>

Winter-run exhibit a unique life history pattern (Healey 1994) compared to other salmon populations in the CV (*i.e.*, spring-run, fall-run, and late-fall run), in that they spawn in the summer, and the juveniles are the first to enter the ocean the following winter and spring. Adults first enter San Francisco Bay from November through June (Hallock and Fisher 1985) and migrate up the Sacramento River, past the RBDD from mid-December through early August (NMFS 1997). The majority of the run passes RBDD from January through May, with the peak passage occurring in mid-March (Hallock and Fisher 1985). The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type (Table 5; Yoshiyama *et al.* 1998, Moyle 2002).

Winter-run tend to enter freshwater while still immature and travel far upriver and delay spawning for weeks or months upon arrival at their spawning grounds (Healey 1991). Spawning occurs primarily from mid-May to mid-August, with the peak activity occurring in June and July in the upper Sacramento River reach (50 miles) between Keswick Dam and RBDD (Vogel and Marine 1991). Winter-run deposit and fertilize eggs in gravel beds known as redds excavated by the female that then dies following spawning. Average fecundity was 5,192 eggs/female for the 2006–2013 returns to LSNFH, which is similar to other Chinook salmon runs [*e.g.*, 5,401 average for Pacific Northwest (Quinn 2005)]. Chinook salmon spawning requirements for depth and velocities are broad, and the upper preferred water temperature is between 55–57°F (13–14°C) degrees (Snider *et al.* 2001). The majority of winter-run adults return after three years.

Table 5. The temporal occurrence of adult (a) and juvenile (b) winter-run in the Sacramento River. Darker shades indicate months of greatest relative abundance.

Winter run relative abundance	High				Medium				Low			
a) Adults freshwater												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River basin[a,b]												
Upper Sacramento River spawning[c]												
b) Juvenile emigration												
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sacramento River at Red Bluff [d]												
Sacramento River at Knights Landing[e]												
Sacramento trawl at Sherwood Harbor[f]												
Midwater trawl at Chipps Island[g]												

Sources: [a] (Yoshiyama *et al*. 1998); (Moyle 2002); [b](Myers *et al.* 1998) ; [c] (Williams 2006) ; [d] (Martin *et al.* 2001); [e] Knights Landing Rotary Screw Trap Data, CDFW (1999-2011); [f,g] Delta Juvenile Fish Monitoring Program, USFWS (1995-2012)

2. <u>Eggs/Fry Emergence</u>

Winter-run incubating eggs are vulnerable to adverse effects from floods, flow fluctuations, siltation, desiccation, disease, predation during spawning, poor gravel percolation, and poor water quality. The optimal water temperature for egg incubation ranges from 46–56°F (7.8–13.3°C) and a significant reduction in egg viability occurs in mean daily water temperatures above 57.5°F (14.2°C; Seymour 1956, Boles 1988, USFWS 1998, EPA 2003, Richter and Kolmes 2005, Geist *et al.* 2006). Total embryo mortality can occur at temperatures above 62°F (16.7°C; NMFS 1997). Depending on ambient water temperature, embryos hatch within 40-60 days and alevin (yolk-sac fry) remain in the gravel beds for an additional 4–6 weeks. As their yolk-sacs become depleted, fry begin to emerge from the gravel and start exogenous feeding in their natal stream, typically in late July to early August and continuing through October (Fisher 1994).

3. <u>Juvenile/Outmigration</u>

Juvenile winter-run have been found to exhibit variability in their life history dependent on emergence timing and growth rates (Beckman *et al.* 2007). Following spawning, egg incubation, and fry emergence from the gravel, juveniles begin to emigrate in the fall. Some juvenile winter-run migrate to sea after only 4 to 7 months of river life, while others hold and rear upstream and spend 9 to 10 months in freshwater. Emigration of juvenile winter-run fry and pre-smolts past RBDD (RM 242) may begin as early as mid-July, but typically peaks at the end of September (Table 5), and can continue through March in dry years (Vogel and Marine 1991, NMFS 1997).

4. Estuarine/Delta Rearing

Juvenile winter-run emigration into the estuary/Delta occurs primarily from November through early May based on data collected from trawls in the Sacramento River at Sherwood Harbor (West Sacramento), RM 57 (USFWS 2001). The timing of emigration may vary somewhat due to changes in river flows, Shasta Dam operations, and water year type, but has been correlated with the first storm event when flows exceed 14,000 cfs at Knights Landing, RM 90, which trigger abrupt emigration towards the Delta (del Rosario *et al.* 2013). Residence time in the Delta for juvenile winter-run averages approximately 3 months based on median seasonal catch between Knights Landing and Chipps Island. In general, the earlier juvenile winter-run arrive in the Delta, the longer they stay and rear, as peak departure at Chipps Island regularly occurs in March (del Rosario *et al.* 2013). The Delta serves as an important rearing and transition zone for juvenile winter-run as they feed and physiologically adapt to marine waters (smoltification). The majority of juvenile winter-run in the Delta are 104 to 128 millimeters (mm) in size based on USFWS trawl data (1995-2012), and from 5 to 10 months of age, by the time they depart the Delta (Fisher 1994, Myers *et al.* 1998).

5. Ocean Rearing

Winter-run smolts enter the Pacific Ocean mainly in spring (March–April), and grow rapidly on a diet of small fishes, crustaceans, and squid. Salmon runs that migrate to sea at a larger size tend to have higher marine survival rates (Quinn 2005). The diet composition of Chinook salmon from California consist of anchovy, rockfish, herring, and other invertebrates (in order of preference, Healey 1991). Most Chinook from the Central Valley move northward into Oregon and Washington, where herring make up the majority of their diet. However winter-run, upon entering the ocean, tend to stay near the California coast and distribute from Point Arena southward to Monterey Bay. Winter-run have high metabolic rates, feed heavily, and grow fast, compared to other fishes in their range. They can double their length and increase their weight more than ten-fold in the first summer at sea (Quinn 2005). Mortality is typically highest in the first summer at sea, but can depend on ocean conditions. Winter-run abundance has been correlated with ocean conditions, such as periods of strong up-welling, cooler temperatures, and El Nino events (Lindley *et al.* 2009). Winter-run spend approximately 1-2 years rearing in the ocean before returning to the Sacramento River as 2-3 year old adults. Very few winter-run Chinook salmon reach age 4. Once they reach age 3, they are large enough to become vulnerable to commercial and sport fisheries.

Description of Viable Salmonid Population (VSP) Parameters

1. Abundance

Historically, winter-run population estimates were as high as 120,000 fish in the 1960s, but declined to less than 200 fish by the 1990s (NMFS 2011). In recent years, since carcass surveys began in 2001 (Figure 3), the highest adult escapement occurred in 2005 and 2006 with 15,839 and 17,296, respectively. However, from 2007 to 2012, the population has shown a precipitous decline, averaging 2,486 during this period, with a low of 827 adults in 2011 (Figure 3). This recent declining trend is likely due to a combination of factors such as poor ocean productivity (Lindley *et al.* 2009), drought conditions from 2007-2009, and low in-river survival (NMFS 2011a). In 2013, the population increased to 6,075 adults, well above the 2007–2012 average, but below the high for the last ten years.

Although impacts from hatchery fish (*i.e.*, reduced fitness, weaker genetics, smaller size, less ability to avoid predators) are often cited as having deleterious impacts on natural in-river populations (Matala *et al.* 2012), the winter-run conservation program at LSNFH is strictly controlled by the USFWS to reduce such impacts. The average annual hatchery production at LSNFH is approximately 176,348 per year (2001–2010 average) compared to the estimated natural production that passes RBDD, approximately 4.7 million (2002–2010 average, Poytress and Carrillo 2011). Therefore, hatchery production typically represents approximately 3-4 percent of the total in-river juvenile production in any given year.

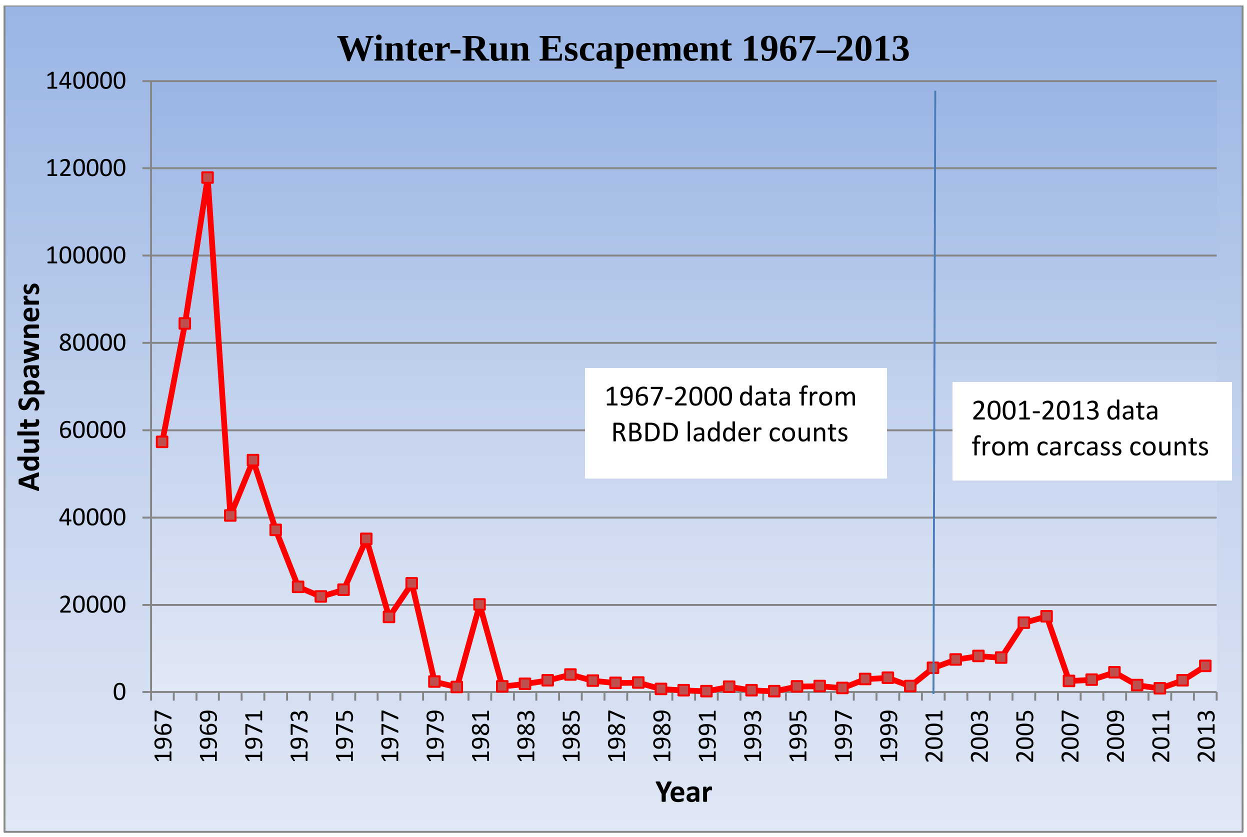

Figure 2. Winter-run Chinook salmon escapement numbers 1970-2013, includes hatchery broodstock and tributaries, but excludes sport catch. RBDD later counts used pre-2000, carcass surverys post 2001(3).

2. Productivity

ESU productivity was positive over the period 1998–2006, and adult escapement and juvenile production had been increasing annually until 2007, when productivity became negative (Figure 4) with declining escapement estimates. The long-term trend for the ESU, therefore, remains negative, as the productivity is subject to impacts from environmental and artificial conditions. The population growth rate based on cohort replacement rate (CRR) for the period 2007–2012 suggests a reduction in productivity (Figure 4), and indicates that the winter-run population is not replacing itself. In 2013, winter-run experienced a positive CRR, possibly due to favorable in-river conditions in 2011 (a wet year), which increased juvenile survival to the ocean.

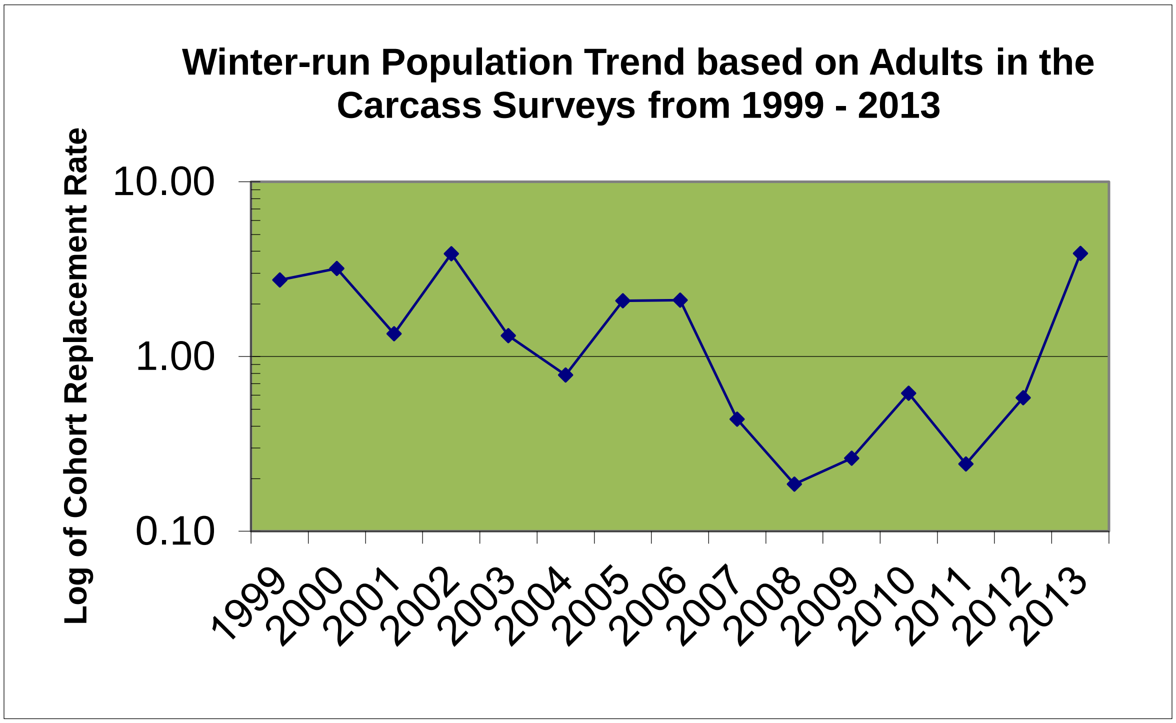

Figure 3. Winter-run population trend using cohort replacement rate derived from adult escapement, including hatchery fish, 1986–2013.

An age-structured density-independent model of spawning escapement by Botsford and Brittnacher (1998) assessing the viability of winter-run found the species was certain to fall below the quasi-extinction threshold of three consecutive spawning runs with fewer than 50 females (Good *et al.* 2005). Lindley and Mohr (2003) assessed the viability of the population using a Bayesian model based on spawning escapement that allowed for density dependence and a change in population growth rate in response to conservation measures found a biologically significant expected quasi-extinction probability of 28 percent. Although the growth rate for the winter-run population improved up until 2006, it exhibits the typical variability found in most endangered species populations. The fact that there is only one population, dependent upon cold-water releases from Shasta Dam, makes it vulnerable to periods of prolonged drought (NMFS 2011). Productivity, as measured by the number of juveniles entering the Delta, or juvenile production estimate (JPE), has declined in recent years from a high of 3.8 million in 2007 to 1.1 million in 2013 (Table 6). Due to uncertainties in the various factors, the JPE was updated in

2010 with the addition of confidence intervals (Cramer Fish Sciences model), and again in 2013 with a change in survival based on acoustic tag data (NMFS 2014). However, juvenile winter-run productivity is still much lower than other Chinook salmon runs in the Central Valley and in the Pacific Northwest (Michel 2010).

Table 6. Winter-run adult and juvenile population estimates based on RBDD counts (1986–2001) and carcass counts (2001–2013), with corresponding 3-year-cohort replacement rates

Return Year	**Adult Population Estimate[a]**	**Cohort Replacement Rate[b]**	**NMFS-calculated Juvenile Production**
1986	2596		
1987	2185		
1988	2878		
1989	696	0.27	
1990	430	0.20	
1991	211	0.07	
1992	1240	1.78	40,100
1993	387	0.90	273,100
1994	186	0.88	90,500
1995	1297	1.05	74,500
1996	1337	3.45	338,107
1997	880	4.73	165,069
1998	2992	2.31	138,316
1999	3288	2.46	454,792
2000	1352	1.54	289,724
2001	8224	2.75	370,221
2002	7441	2.26	1,864,802
2003	8218	6.08	2,136,747
2004	7869	0.96	1,896,649
2005	15839	2.13	881,719
2006	17296	2.10	3,556,995
2007	2542	0.32	3,890,534
2008	2830	0.18	1,100,067
2009	4537	0.26	1,152,043
2010	1,596	0.63	1,144,860
2011	827	0.29	332,012
2012	2,674	0.59	162,051
2013	6,075	3.88	1,196,387
median	2,542	0.95	412,507

[a] Population estimates include adults taken into the hatchery and were based on ladder counts at RBDD until 2001, after which the methodology changed to carcass surveys (CDFG 2012).

[b] Assumes all adults return after three years. NMFS calculated a CRR using the adult spawning population, divided by the spawning population three years prior. Two year old returns were not used.

[c] JPE estimates include survival estimates from the spawning gravel to the point where they enter the Delta (Sacramento I St Bridge), but does not include through-Delta survival.

3. Spatial Structure

The distribution of winter-run spawning and initial rearing historically was limited to the upper Sacramento River (upstream of Shasta Dam), McCloud River, Pitt River, and Battle Creek, where springs provided cold water throughout the summer, allowing for spawning, egg incubation, and rearing during the mid-summer period (Slater 1963 *op. cit.* Yoshiyama et al. 1998). The construction of Shasta Dam in 1943 blocked access to all of these waters except Battle Creek, which currently has its own impediments to upstream migration (*i.e.*, a number of small hydroelectric dams situated upstream of the Coleman Fish Hatchery weir). The Battle Creek Salmon and Steelhead Restoration Project (BCSSRP) is currently removing these impediments, which should restore spawning and rearing habitat for winter-run in the future. Approximately 299 miles of former tributary spawning habitat upstream of Shasta Dam is inaccessible to winter-run. Yoshiyama *et al.* (2001) estimated that in 1938, the upper Sacramento River had a "potential spawning capacity" of approximately 14,000 redds equal to 28,000 spawners. Since 2001, the majority of winter-run redds have occurred in the first 10 miles downstream of Keswick Dam. Most components of the winter-run life history (*e.g.*, spawning, incubation, freshwater rearing) have been compromised by the construction of Shasta Dam.

The greatest risk factor for winter-run lies within its spatial structure (NMFS 2011). The remnant and remaining population cannot access 95% of their historical spawning habitat, and must therefore be artificially maintained in the Sacramento River by: (1) spawning gravel augmentation, (2) hatchery supplementation, and, (3) regulating the finite cold-water pool behind Shasta Dam to reduce water temperatures. Winter-run require cold water temperatures in the summer that simulate their upper basin habitat, and they are more likely to be exposed to the impacts of drought in a lower basin environment. Battle Creek is currently the most feasible opportunity for the ESU to expand its spatial structure, but restoration is not scheduled to be completed until 2017 (BCSSRP). The draft CV Salmon and Steelhead Recovery Plan includes criteria for recovering the winter-run Chinook salmon ESU, including re-establishing a population into historical habitats upstream of Shasta Dam (NMFS 2009b). Additionally, NMFS (2009a) included a requirement for a pilot fish passage program upstream of Shasta Dam.

4. Diversity

The current winter-run population is the result of the introgression of several stocks (*e.g.*, spring-run and fall-run Chinook) that occurred when Shasta Dam blocked access to the upper watershed. A second genetic bottleneck occurred with the construction of Keswick Dam which blocked access and did not allow spatial separation of the different runs (Good *et al.* 2005). Lindley *et al.* (2007) recommended reclassifying the winter-run population extinction risk from low to moderate, if the proportion of hatchery origin fish from the LSNFH exceeded 15 percent due to the impacts of hatchery fish over multiple generations of spawners. Since 2005, the percentage of hatchery winter-run recovered in the Sacramento River has only been above 15 percent in two years, 2005 and 2012 (Figure 5).

Concern over genetic introgression within the winter-run population led to a conservation program at LSNFH that encompasses best management practices such as: (1) genetic confirmation of each adult prior to spawning, (2) a limited number of spawners based on the effective population size, and (3) use of only natural-origin spawners since 2009. These practices reduce the risk of hatchery impacts on the wild population. Hatchery-origin winter-run have made up more than 5 percent of the natural spawning run in recent years and in 2012, it exceeded 30 percent of the natural run (Figure 5). However, the average over the last 16 years (approximately 5 generations) has been 8 percent, still below the low-risk threshold (15%) used for hatchery influence (Lindley *et al.* 2007).

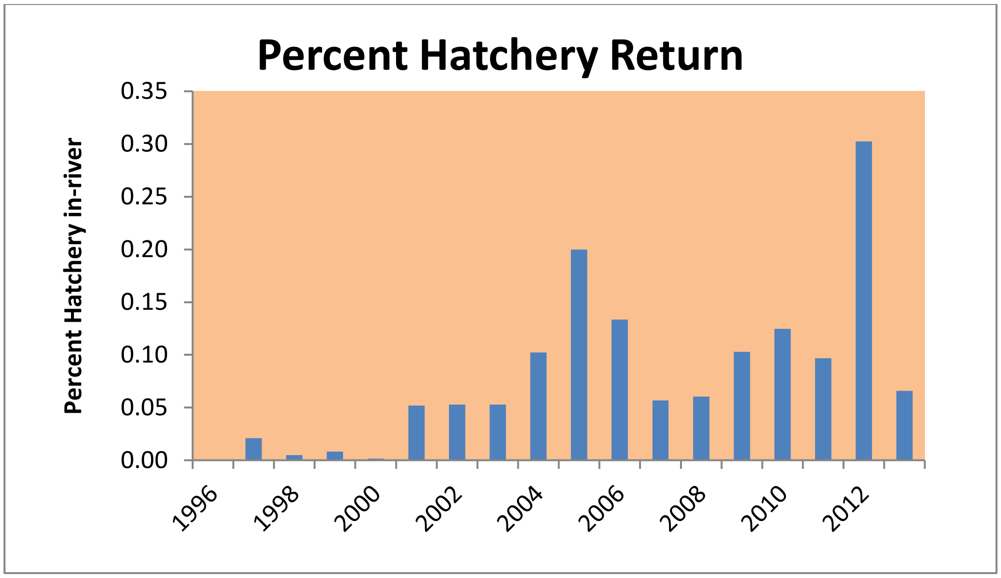

Figure 4. Percentage of hatchery-origin winter-run Chinook salmon naturally spawning in the Sacramento River (1996–2013). Source: CDFW carcass surveys, 2013.

Summary of Sacramento River Winter-run Chinook Salomon ESU Viability

There are several criteria (only one is required) that would qualify the winter-run ESU at moderate risk of extinction, and since there is still only one population that spawns downstream of Keswick Dam, that population would be at high risk of extinction in the long-term according the criteria in Lindley *et al.* (2007). Recent trends in those criteria are: (1) continued low abundance (Figure 3); (2) a negative growth rate over 6 years (2006–2012), which is two complete generations (Figure 4); (3) a significant rate of decline since 2006; and (4) increased risk of catastrophe from oil spills, wild fires, or extended drought (climate change). The most recent 5-year status review (NMFS 2011) on winter-run concluded that the ESU had increased to a high risk of extinction. In summary, the most recent biological information suggests that the extinction risk for the winter-run ESU has increased from moderate risk to high risk of extinction since 2005, and that several listing factors have contributed to the recent decline, including drought and poor ocean conditions (NMFS 2011).

Critical Habitat: Essential Features for Sacramento River Winter-run Chinook Salmon

NMFS designated critical habitat for winter-run Chinook salmon on June 16, 1993 (58 FR 33212). Critical habitat was delineated as the Sacramento River from Keswick Dam at river mile (RM) 302 to Chipps Island, RM 0, at the westward margin of the Sacramento-San Joaquin Delta (Delta), including Kimball Island, Winter Island, and Brown's Island; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. In the Sacramento River, critical habitat includes the river water, river bottom, and the adjacent riparian zone.

Critical habitat for winter-run is defined as specific areas (listed below) that contain the physical and biological features considered essential to the conservation of the species. This designation includes the river water, river bottom (including those areas and associated gravel used by winter-run as spawning substrate), and adjacent riparian zone used by fry and juveniles for rearing (June 16, 1993, 58 FR 33212). NMFS limits "adjacent riparian zones" to only those areas above a stream bank that provide cover and shade to the near shore aquatic areas. Although the bypasses (*e.g.,* Yolo, Sutter, and Colusa) are not currently designated critical habitat for winter-run, NMFS recognizes that they may be utilized when inundated with Sacramento River flood flows and are important rearing habitats for juvenile winter-run. Also, juvenile winter-run may use tributaries of the Sacramento River for non-natal rearing. Critical habitat also includes the estuarine water column and essential foraging habitat and food resources used by winter-run as part of their juvenile outmigration or adult spawning migration.

The following is the status of the physical and biological habitat features that are considered to be essential for the conservation of winter-run (June 16, 1993, 58 FR 33212):

1. <u>Access from the Pacific Ocean to Appropriate Spawning Areas</u>

Adult migration corridors should provide satisfactory water quality, water quantity, water temperature, water velocity, cover, shelter and safe passage conditions in order for adults to reach spawning areas. Adult winter-run generally migrate to spawning areas during the winter and spring. At that time of year, the migration route is accessible to the appropriate spawning grounds on the upper 60 miles of the Sacramento River, however much of this migratory habitat is degraded and they must pass through a fish ladder at the Anderson-Cottonwood Irrigation Dam (ACID). In addition, the many flood bypasses are known to strand adults in agricultural drains due to inadequate screening (Vincik and Johnson 2013). Since the primary migration corridors are essential for connecting early rearing habitat with the ocean, even the degraded reaches are considered to have a high intrinsic conservation value to the species.

2. <u>The Availability of Clean Gravel for Spawning Substrate</u>

Suitable spawning habitat for winter-run exists in the upper 60 miles of the Sacramento River between Keswick Dam and Red Bluff Diversion Dam (RBDD). However, the majority of spawning habitat currently being used occurs in the first 10 miles downstream of Keswick Dam.

The available spawning habit is completely outside the historical range utilized by winter-run upstream of Keswick Dam. Because Shasta and Keswick dams block gravel recruitment, the U.S. Bureau of Reclamation (Reclamation) annually injects spawning gravel into various areas of the upper Sacramento River. With the supplemented gravel injections, the upper Sacramento River reach continues to support a small naturally-spawning winter-run Chinook salmon population. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

3. Adequate River Flows for Successful Spawning, Incubation of Eggs, Fry Development and Emergence, and Downstream Transport of Juveniles

An April 5, 1960, Memorandum of Agreement between Reclamation and the CDFW originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. In addition, Reclamation complies with the 1990 flow releases required in State Water Resource Control Board (SWRCB) Water Rights Order (WRO) 90-05 for the protection of Chinook salmon. This order includes a minimum flow release of 3,250 cubic feet per second (cfs) from Keswick Dam downstream to RBDD from September through February during all water year types, except critically dry.

4. Water Temperatures at 5.8–14.1°C (42.5–57.5°F) for Successful Spawning, Egg Incubation, and Fry Development

Summer flow releases from Shasta Reservoir for agriculture and other consumptive uses drive operations of Shasta and Keswick dam water releases during the period of winter-run migration, spawning, egg incubation, fry development, and emergence. This pattern, the opposite of the pre-dam hydrograph, benefits winter-run by providing cold water for miles downstream during the hottest part of the year. The extent to which winter-run habitat needs are met depends on Reclamation's other operational commitments, including those to water contractors, Delta requirements pursuant to State Water Rights Decision 1641 (D-1641), and Shasta Reservoir end of September storage levels required in the NMFS 2009 biological opinion on the long-term operations of the CV Project and State Water Project (CVP/SWP, NMFS 2009a). WRO 90-05 and 91-1 require Reclamation to operate Shasta, Keswick, and Spring Creek Powerhouse to meet a daily average water temperature of 13.3°C (56°F) at RBDD. They also provide the exception that the water temperature compliance point (TCP) may be modified when the objective cannot be met at RBDD. Based on these requirements, Reclamation models monthly forecasts and determines how far downstream 13.3°C (56°F) can be maintained throughout the winter-run spawning, egg incubation, and fry development stages.

In every year since WRO 90-05 and 91-1were issued, operation plans have included modifying the TCP to make the best use of the cold water available based on water temperature modeling and current spawning distribution. Once a TCP has been identified and established in May, it generally does not change, and therefore, water temperatures are typically adequate through the summer for successful winter-run egg incubation and fry development for those redds constructed upstream of the TCP (except for in some critically dry and drought years). However, by continually moving the TCP upstream, the value of that habitat is degraded by reducing the spawning area in size and imprinting upon the next generation to return further upstream.

5. Habitat and Adequate Prey Free of Contaminants

Water quality conditions have improved since the 1980s due to stricter standards and Environmental Protection Agency (EPA) Superfund site cleanups (see Iron Mountain Mine remediation under Factors). No longer are there fish kills in the Sacramento River caused by the heavy metals (*e.g.*, lead, zinc and copper) found in the Spring Creek runoff. However, legacy contaminants such as mercury (and methyl mercury), polychlorinated biphenyls (PCB), heavy metals and persistent organochlorine pesticides continue to be found in watersheds throughout the CV. In 2010, the EPA, listed the Sacramento River as impaired under the Clean Water Act, section 303(d), due to high levels of pesticides, herbicides, and heavy metals (http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml). Although most of these contaminants are at low concentrations in the food chain, they continue to work their way into the base of the food web, particularly when sediments are disturbed and previously entombed compounds are released into the water column.

Adequate prey for juvenile salmon to survive and grow consists of abundant aquatic and terrestrial invertebrates that make up the majority of their diet before entering the ocean. Exposure to these contaminated food sources such as invertebrates may create delayed sublethal effects that reduce fitness and survival (Laetz *et al*. 2009). Contaminants are typically associated with areas of urban development, agriculture, or other anthropogenic activities (*e.g.*, mercury contamination as a result of gold mining or processing). Areas with low human impacts frequently have low contaminant burdens, and therefore lower levels of potentially harmful toxicants in the aquatic system. Freshwater rearing habitat has a high intrinsic conservation value even if the current conditions are significantly degraded from their natural state.

6. Riparian and Floodplain Habitat that Provides for Successful Juvenile Development and Survival

The channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento River system typically have low habitat complexity, low abundance of food organisms, and offer little protection from predators. Juvenile life stages of salmonids are dependent on the natural functioning of this habitat for successful survival and recruitment. Ideal habitat contains natural cover, such as riparian canopy structure, submerged and overhanging large woody material (LWM), aquatic vegetation, large rocks and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Riparian recruitment is prevented from becoming established due to the reversed hydrology (*i.e*., high summer time flows and low winter flows prevent tree seedlings from establishing). However, there are some complex, productive habitats within historical floodplains [*e.g.*, Sacramento River reaches with setback levees (*i.e.*, primarily located upstream of the City of Colusa)] and flood bypasses (*i.e.*, fish in Yolo and Sutter bypasses experience rapid growth and higher survival due to abundant food resources) seasonally available that remain in the system. Nevertheless, the current condition of degraded riparian habitat along the mainstem Sacramento River restricts juvenile growth and survival (Michel 2010, Michel *et al.* 2012).

7. Access Downstream so that Juveniles Can Migrate from the Spawning Grounds to San Francisco Bay and the Pacific Ocean

Freshwater emigration corridors should be free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. Migratory corridors are downstream of the Keswick Dam spawning areas and include the mainstem of the Sacramento River to the Delta, as well as non-natal rearing areas near the confluence of some tributary streams.

Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. Unscreened diversions that entrain juvenile salmonids are prevalent throughout the mainstem Sacramento River and in the Delta. Predators such as striped bass (*Morone saxatilis*) and Sacramento pikeminnow (*Ptychocheilus grandis*) tend to concentrate immediately downstream of diversions, resulting in increased mortality of juvenile Chinook salmon.

Water pumping at the CVP/SWP export facilities in the South Delta at times causes the flow in the river to move back upstream (reverse flow), further disrupting the emigration of juvenile winter-run by attracting and diverting them to the interior Delta, where they are exposed to increased rates of predation, other stressors in the Delta, and entrainment at pumping stations. NMFS' biological opinion on the long-term operations of the CVP/SWP (NMFS 2009a) sets limits to the strength of reverse flows in the Old and Middle Rivers, thereby keeping salmon away from areas of highest mortality. Regardless of the condition, the remaining estuarine areas are of high conservation value because they provide factors which function as rearing habitat and as an area of transition to the ocean environment.

2.2.2 Central Valley Spring-run Chinook salmon

In August 2011, NMFS completed an updated status review of five Pacific Salmon ESUs, including CV spring-run Chinook salmon, and concluded that the species' status should remain as previously listed (76 FR 50447). The 2011 Status Review (NMFS 2011b) additionally stated that although the listings will remain unchanged since the 2005 review, and the original 1999 listing (64 FR 50394), the status of these populations has worsened over the past five years and recommended that the status be reassessed in two to three years as opposed to waiting another five years.

CV spring-run Chinook salmon were listed as threatened on September 16, 1999, (64 FR 50394). This ESU consists of spring-run Chinook salmon occurring in the Sacramento River basin. The Feather River Fish Hatchery (FRFH) spring-run Chinook salmon population has been included as part of the CV spring-run Chinook salmon ESU in the most recent modification of the CV spring-run Chinook salmon listing status (70 FR 37160). Critical habitat was designated for CV spring-run Chinook salmon on September 2, 2005, (70 FR 52488), and includes the action area for the Proposed Action. It includes stream reaches of the Feather and Yuba rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the main stem of the Sacramento River from Keswick Dam through the Delta; and portions of the network of channels in the northern Delta.

Historically spring-run Chinook salmon were the second most abundant salmon run in the CV and one of the largest on the west coast (CDFG 1990, 1998). These fish occupied the upper and middle reaches (1,000 to 6,000 feet elevation) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The CV Technical Review Team (TRT) estimated that historically there were 18 or 19 independent populations of CV spring-run Chinook salmon, along with a number of dependent populations, all within four distinct geographic regions (diversity groups) (Lindley *et al.* 2004). Of these 18 populations, only 3 extant populations currently exist (Mill, Deer, and Butte creeks on the upper Sacramento River) and they represent only the northern Sierra Nevada diversity group. All populations in the basalt and porous lava diversity group and the southern Sierra Nevada diversity group have been extirpated. The northwestern California diversity group did not historically contain independent populations, and currently contains two or three populations that are likely dependent on the northern Sierra Nevada diversity group populations for their continued existence.

Construction of low elevation dams in the foothills of the Sierras on the Mokelumne, Stanislaus, Tuolumne, and Merced rivers, was thought to have extirpated CV spring-run Chinook salmon from these watersheds of the San Joaquin River, as well as on the American and Yuba rivers of the Sacramento River basin. However, observations in the last decade suggest that perhaps a naturally occurring population may still persist in the Stanislaus and Tuolumne rivers (Franks, personal communication, 2012), as well as in the Yuba River. Documented naturally-spawning populations of CV spring-run Chinook salmon are currently restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and the Yuba River (CDFG 1998).

Life History

Adult CV spring-run Chinook salmon leave the ocean to begin their upstream migration in late January and early February (CDFG 1998) and enter the Sacramento River beginning in March (Yoshiyama 1998). Spring-run Chinook salmon move into tributaries of the Sacramento River (*e.g.* Butte, Mill, Deer creeks) beginning as early as February in Butte Creek and typically mid-March in Mill and Deer creeks (Lindley *et al.* 2004). Adult migration peaks around mid-April in Butte Creek, and mid-to end of May in Mill and Deer creeks, and is complete by the end of July in all three tributaries (Lindley *et al.* 2004) (Table 7). Typically, spring-run Chinook salmon utilize mid- to high-elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering while conserving energy and allowing their gonadal tissue to mature (Yoshiyama *et al.* 1998).

Spring-run Chinook salmon spawning occurs between September and October (Moyle 2002). Between 56 and 87 percent of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are 3 years old (Calkins *et al.* 1940, Fisher 1994).

Spring-run Chinook salmon fry emerge from the gravel from November to March (Moyle 2002) and the emigration timing is highly variable, as they may migrate downstream as young-of-the-year or as juveniles or yearlings. The model size of fry migrants at approximately 40 millimeters (mm) between December and April in Mill, Butte, and Deer creeks reflects a prolonged emergence of fry from the gravel (Lindley *et al.* 2004). Studies in Butte Creek, (Ward *et al.* 2003, McReynolds *et al.* 2007) found the majority of CV spring-run Chinook salmon migrants to be fry, which occurred primarily during December, January, and February; and that these movements appeared to be influenced by increased flow. Small numbers of CV spring-run Chinook salmon were observed to remain in Butte Creek to rear and migrated as yearlings later in the spring. Juvenile emigration patterns in Mill and Deer creeks are very similar to patterns observed in Butte Creek, with the exception that Mill and Deer creek juveniles typically exhibit a later young-of-the-year migration and an earlier yearling migration (Lindley *et al.* 2004). CDFW (CDFG 1998) observed the emigration period for spring-run Chinook salmon extending from November to early May, with up to 69 percent of the young-of-the-year fish outmigrating through the lower Sacramento River and Delta during this period. Peak movement of juvenile CV spring-run Chinook salmon in the Sacramento River at Knights Landing occurs in December, and again in March and April. However, juveniles also are observed between November and the end of May (Snider and Titus 2000).

Once juveniles emerge from the gravel they initially seek areas of shallow water and low velocities while they finish absorbing the yolk sac and transition to exogenous feeding (Moyle 2002). Many also would disperse downstream during high-flow events. As is the case in other salmonids, there is a shift in microhabitat use by juveniles to deeper faster water as they grow larger. Microhabitat use can be influenced by the presence of predators which can force fish to select areas of heavy cover and suppress foraging in open areas (Moyle 2002).

Table 7. The temporal occurrence of adult (a) and juvenile (b) CV spring-run Chinook salmon in the Sacramento River. Darker shades indicate months of greatest relative abundance.

Table 7

(a) Adult migration																								
Location	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Sac.River basin[a,b]					Medium	Medium	Medium	Medium	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low				
Sac. River mainstem[c]		Low	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low								
Mill Creek[d]					Low	Low	Medium	High	High	High	High	Medium	Medium	Low	Low									
Deer Creek[d]					Low	Low	Medium	High	High	High	High	Medium	Medium											
Butte Creek[d]			Medium	Medium	Medium	Medium	Medium	High	High	High	High	Medium	Low											
(b) Adult Holding			Medium	Medium	Medium	Medium	Medium	High	High	High	High	High	High	High	High	High	High	Medium	Medium	Low				
(c) Adult Spawning															Low	Medium	High	High	Medium	Low				
(d) Juvenile migration																								
Location	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Sac. River Tribs[e]	Medium	Medium	Medium	Medium	Medium	Medium													Medium	Medium	High	High	High	High
Upper Butte Creek[f]	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low							Low	Low	Low	Low	High	High
Mill, Deer, Butte Creeks[d]	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low							Low	Low	Low	Low	Low	Low
Sac. River at RBDD[c]	High	High	Low	Low	Low	Low	Low	Low	Low												High	High	High	High
Sac. River at KL[g]	Medium	Medium	Medium	Medium	High	High	High	High	Medium	Medium											Medium	Medium	High	High

Relative Abundance: (black) = High; (dark grey) = Medium; (light grey) = Low

Note: Yearling spring-run Chinook salmon rear in their natal streams through the first summer following their birth. Downstream emigration generally occurs the following fall and winter. Most young of the year spring-run Chinook salmon emigrate during the first spring after they hatch.

Sources: [a]Yoshiyama *et al.* (1998); [b]Moyle (2002); [c]Myers *et al.* (1998); [d]Lindley *et al.* (2004); [e]CDFG (1998); [f]McReynolds *et al.* (2007); Ward *et al.* (2003); [g]Snider and Titus (2000)

Description of VSP Parameters

Like the winter-run Chinook salmon population, the CV spring-run Chinook salmon population fails to meet the “representation and redundancy rule” since there are only one demonstrably viable populations in one diversity group (northern Sierra Nevada) out of the three diversity groups that historically contained them. Over the long term, these remaining populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount

Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the spring-run Chinook salmon populations in these three watersheds due to their close proximity to each other.

1. Abundance

The CV drainage as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). The San Joaquin River historically supported large runs of spring-run Chinook salmon, suggested to be one of the largest runs of any Chinook salmon on the West Coast with estimates averaging 200,000 – 500,000 adults returning annually (CDFG 1990). Construction of Friant Dam began in 1939 and was completed in 1942, which blocked access to upstream habitat.

The FRFH spring-run Chinook salmon population has been included in the ESU based on its genetic linkage to the natural population and the potential development of a conservation strategy for the hatchery program. On the Feather River, significant numbers of spring-run Chinook salmon, as identified by run timing, return to the FRFH. Since 1954, spawning escapement has been estimated using combinations of in-river estimates and hatchery counts, with estimates ranging from 2,908 in 1964 to 2 fish in 1978 (DWR 2001). Spring-run estimates after 1981 have been based solely on salmon entering the hatchery during the month of September. The 5-year moving averages from 1997 to 2006 had been more than 4,000 fish, but from 2007 to 2011, the 5-year moving averages have declined each year to a low of 1,783 fish in 2011 (CDFG 2012). However, coded wire tag (CWT) information from these hatchery returns has indicated that fall-run and spring-run Chinook salmon have overlap (DWR 2001). In addition, genetic testing has indicated substantial introgression has occurred between fall-run and spring-run Chinook salmon populations within the Feather River system due to temporal overlap and hatchery practices (DWR 2001). Because Chinook salmon have not always been spatially separated in the FRFH, spring-run and fall-run Chinook salmon have been spawned together, thus compromising the genetic integrity of the spring-run Chinook salmon stock (Good *et al.* 2005; DWR draft Hatchery Genetic Management Plan 2010). For the reasons discussed above, the Feather River spring-run Chinook salmon population numbers are not included in the following discussion of ESU abundance.

In addition, monitoring of the Sacramento River mainstem during spring-run Chinook salmon spawning timing indicates some spawning occurs in the river. Here, the lack of physical separation of spring-run Chinook salmon from fall-run Chinook salmon is complicated by overlapping migration and spawning periods. Significant hybridization with fall-run Chinook salmon makes identification of spring-run Chinook salmon in the mainstem very difficult to determine, but counts of early spawning Chinook salmon redds are typically used as an indicator of abundance. Less than 15 redds per year were observed in the Sacramento River from 1989 to 1993, during September aerial redd counts (USFWS 2003). Redd surveys conducted in September between 2001 and 2011 have observed an average of 36 salmon redds from Keswick Dam downstream to the RBDD, ranging from three to 105 redds (CDFG, unpublished data, 2011). Therefore, even though physical habitat conditions can support spawning and incubation, spring-run Chinook salmon depend on spatial segregation and geographic isolation from fall-run Chinook salmon to maintain genetic diversity. With the onset of fall-run Chinook salmon spawning occurring in the same time and place as potential spring-run Chinook salmon spawning, it is likely to have caused extensive introgression between the populations (CDFG 1998). For these reasons, Sacramento River mainstem spring-run Chinook salmon are not included in the following discussion of ESU abundance trends.

Sacramento River tributary populations in Mill, Deer, and Butte creeks are likely the best trend indicators for the CV spring-run Chinook salmon ESU as a whole because these streams contain the primary independent populations within the ESU. Generally, these streams have shown a positive escapement trend since 1991, displaying broad fluctuations in adult abundance, ranging from 1,013 in 1993 to 23,788 in 1998. Tributary numbers during 2005 to 2011 showed a downturn; however, 2012 and 2013 showed an increase to 10,810 and 18,499 fish, respectively. Escapement numbers for 2013 increased in most tributary populations, which resulted in the second highest number of spring-run Chinook salmon returning to the tributaries since 1960. Escapement numbers are dominated by Butte Creek returns, which have averaged over 7,000 fish from 1995 to 2005. During this same period, adult returns on Mill and Deer creeks have averaged 780 fish, and 1,464 fish respectively. From 2001 to 2005, the CV spring-run Chinook salmon ESU has experienced a trend of increasing abundance in some natural populations, most dramatically in the Butte Creek population (Good *et al.* 2005). Although trends were generally positive during this time, annual abundance estimates display a high level of fluctuation, and the overall number of CV spring-run Chinook salmon remains well below estimates of historic abundance.

In 2002 and 2003, mean water temperatures in Butte Creek exceeded 21^{o}C for 10 or more days in July (Williams 2006). These persistent high water temperatures, coupled with high fish densities, precipitated an outbreak of Columnaris Disease (*Flexibacter columnaris*) and Ichthyophthiriasis (*Ichthyophthirius multifiis*) in the adult spring-run Chinook salmon over-summering in Butte Creek. In 2002, this contributed to the pre-spawning mortality of approximately 20 to 30 percent of the adults. In 2003, approximately 65 percent of the adults succumbed, resulting in a loss of an estimated 11,231 adult spring-run Chinook salmon in Butte Creek due to the disease. Since 2005, abundance numbers in most of the tributaries have declined. From 2006 to 2009, adult returns indicate that population abundance is declining from the peaks seen in the 5 years prior for the entire Sacramento River basin.

For Mill Creek the 2009, return of 220 spring-run Chinook salmon was the lowest return since 1997. Assuming the 2012, spring-run Chinook salmon return was primarily of three year old fish, then those 768 Chinook salmon represent a significant increase over the 2009, parent year. The 2013 estimate was 644, which was an increase from 2010 estimate of 482. The Mill Creek population of spring-run Chinook salmon is currently at a moderate risk of extinction, due to the significant decline in abundance from prior to 2008 through 2011. However, with the increase in abundance in 2012 and 2013, this trend may be improving. The Deer Creek abundance of spring-run Chinook salmon experienced a significant decline starting in 2008, with an increase in 2012 and 2013.

The abundance of spring-run Chinook salmon in Clear Creek was lower in 2010, 2011, and from 2005 through 2011, abundance numbers in most of the tributaries declined. Adult returns from 2006 to 2009, indicate that population abundance for the entire Sacramento River basin was declining from the peaks seen in the five years prior to 2006. Declines in abundance from 2005 to 2011, placed the Mill Creek and Deer Creek populations in the high extinction risk category due to the rates of decline, and in the case of Deer Creek, also the level of escapement (NMFS 2011). Butte Creek had sufficient abundance to retain its low extinction risk classification, but the rate of population decline in years 2006 through 2011 was nearly sufficient to classify it as a high extinction risk based on this criteria. Nonetheless, the watersheds identified as having the highest likelihood of success for achieving viability/low risk of extinction include, Butte, Deer and Mill creeks (NMFS 2011). Some other tributaries to the Sacramento River, such as Clear Creek and Battle Creek have seen population gains in the years from 2001 to 2009, but the overall abundance numbers have remained low. Year 2012 appeared to be a good return year for most of the tributaries with some, such as Battle Creek, having the highest return on record (799). Additionally, 2013 adult escapement numbers combined for Butte, Mill and Deer creeks increased (over 17,000), which resulted in the second highest number of spring-run Chinook salmon returning to the tributaries since 1998. 2014 adult escapement was lower than 2013 to be lower, with an adult escapement of just over 5,000 fish, which indicates a highly fluctuating and unstable ESU.

1. Productivity

The 5-year geometric mean for the extant Butte, Deer, and Mill creek spring-run Chinook salmon populations ranged from 491 to 4,513 fish, indicating increasing productivity over the short-term and was projected to likely continue into the future (Good *et al.* 2005). However, as mentioned in the previous paragraph, the next five years of adult escapement to these tributaries has seen a cumulative decline in fish numbers and the CRR has declined in concert with the population declines. The productivity of the Feather River and Yuba River populations and contribution to the CV spring-run ESU currently is unknown.

2. Spatial Structure

With only one of four diversity groups currently containing viable populations, the spatial structure of CV spring-run Chinook salmon is severely reduced. Butte Creek spring-run Chinook salmon cohorts have recently utilized all currently available habitat in the creek; and it is unknown if individuals have opportunistically migrated to other systems. The persistent populations in Clear Creek and Battle Creek, with habitat restoration completed and underway are anticipated to add to the spatial structure of the CV spring-run Chinook salmon ESU if they can reach viable status in the basalt and porous lava and northwestern California diversity group areas. The spatial structure of the spring-run Chinook salmon ESU would still be lacking with the extirpation of all San Joaquin River basin spring-run Chinook salmon populations. Plans are underway to re-establish a spring-run Chinook salmon experimental population downstream of Friant Dam in the San Joaquin River, as part of the San Joaquin River Settlement Agreement. This would be done with Feather River Hatchery stock. Interim flows for this began in 2009. Its long-term contribution to the CV spring-run Chinook salmon ESU is uncertain. It is clear that further efforts would need to involve more than restoration of currently accessible watersheds to make the ESU viable. The draft CV Recovery Plan calls for reestablishing populations into historical habitats currently blocked by large dams, such as a population upstream of Shasta Dam. It also calls to facilitate passage of fish upstream and downstream of Englebright Dam on the Yuba River (NMFS 2009b).

3. Diversity

The CV spring-run Chinook salmon ESU is comprised of two genetic complexes. Analysis of natural and hatchery spring-run Chinook salmon stocks in the CV indicates that the northern Sierra Nevada diversity group spring-run Chinook salmon populations in Mill, Deer, and Butte creeks retains genetic integrity as opposed to the genetic integrity of the Feather River population, which has been somewhat compromised. The Feather River spring-run Chinook salmon have introgressed with the fall-run Chinook salmon, and it appears that the Yuba River population may have been impacted by FRFH fish straying into the Yuba River. Additionally, the diversity of the spring-run Chinook salmon ESU has been further reduced with the loss of the majority, if not all, of the San Joaquin River basin spring-run Chinook salmon populations. Efforts underway, like the San Joaquin Restoration Project, are needed to improve the diversity of the CV spring-run Chinook salmon ESU.

Summary of CV Spring-run Chinook salmon DPS Viability

Lindley et al. (2007) indicated that the spring-run Chinook salmon populations in the CV had a low risk of extinction in Butte and Deer creeks, according to their population viability analysis (PVA) model and other population viability criteria (*i.e.*, population size, population decline, catastrophic events, and hatchery influence, which correlate with VSP parameters abundance, productivity, spatial structure, and diversity). The Mill Creek population of spring-run Chinook salmon was at moderate extinction risk according to the PVA model, but appeared to satisfy the other viability criteria for low-risk status. However, the CV spring-run Chinook salmon population failed to meet the "representation and redundancy rule" since there are only demonstrably viable populations in one diversity group (northern Sierra Nevada) out of the three diversity groups that historically contained them. Over the long term, these remaining populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the spring-run Chinook salmon populations in these three watersheds due to their close proximity to each other. One large event could eliminate all three populations.

In the 2011 California CV status review for spring-run Chinook salmon, NMFS identified the status of CV spring-run Chinook salmon ESU as having probably deteriorated since the 2005 status review and Lindley et al.'s (2007) assessment, with two of the three extant independent populations (Deer and Mill creeks) of spring-run Chinook salmon slipping from low or moderate extinction risk to high extinction risk. Since the abundance of some populations is improving, though this is based on only two years (2012 and 2013), the extinction risk of Sacramento tributary populations generally has improved from high to moderate.

Critical Habitat and Primary Constituent Elements for CV Spring-Run Chinook Salmon

Critical habitat was designated for CV spring-run Chinook salmon on September 2, 2005, (70 FR 52488). Critical habitat for CV spring-run Chinook salmon includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation (defined as the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of one to two years on the annual flood series) (Bain and Stevenson 1999; 70 FR 52488). Critical habitat for CV spring-run Chinook salmon is defined as specific areas that contain the primary constituent elements (PCEs) essential to the conservation of the species. Following are the inland habitat types used as PCEs for CV spring-run Chinook salmon.

1. Spawning Habitat

Freshwater spawning sites are those with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. Most spawning habitat in the CV for Chinook salmon is located in areas directly downstream of dams containing suitable environmental conditions for spawning and incubation. Spawning habitat for CV spring-run Chinook salmon occurs on the mainstem Sacramento River between RBDD and Keswick Dam and in tributaries such as Mill, Deer, and Butte creeks; as well as the Feather and Yuba rivers, Big Chico, Battle, Antelope, and Clear creeks. However, little spawning activity has been recorded in recent years on the Sacramento River mainstem for spring-run Chinook salmon. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

2. Freshwater Rearing Habitat

Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile salmonid development; and natural cover such as shade, submerged and overhanging large woody material, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees [*i.e.*, primarily located upstream of the City of Colusa]) and flood bypasses (*i.e.*, Yolo and Sutter bypasses). However, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from piscivorous fish and birds.

Freshwater rearing habitat also has a high intrinsic conservation value even if the current conditions are significantly degraded from their natural state. Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

3. Freshwater Migration Corridors

Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks, and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream passage of adults, and the downstream emigration of juveniles. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For adults, upstream passage through the Delta and much of the Sacramento River is not a problem, yet a number of challenges exist on many tributary streams. For juveniles, unscreened or inadequately screened water diversions throughout their migration corridors and a scarcity of complex in-river cover have degraded this PCE. However, since the primary migration corridors are used by numerous populations, and are essential for connecting early rearing habitat with the ocean, even the degraded reaches are considered to have a high intrinsic conservation value to the species.

4. Estuarine Areas

Estuarine areas free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water are included as a PCE. Natural cover such as submerged and overhanging large woody material, aquatic vegetation, and side channels, are suitable for juvenile and adult foraging.

The remaining estuarine habitat for these species is severely degraded by altered hydrologic regimes, poor water quality, reductions in habitat complexity, and competition for food and space with exotic species. Regardless of the condition, the remaining estuarine areas are of high conservation value because they provide factors which function to provide predator avoidance, as rearing habitat and as an area of transition to the ocean environment.

2.2.3 California Central Valley steelhead

CCV steelhead were listed as threatened on March 19, 1998, (63 FR 13347). Following a new status review (Good *et al.* 2005) and after application of the agency's hatchery listing policy, the NMFS reaffirmed its status as threatened and also listed several hatchery stocks as part of the DPS in 2006 (71 FR 834). In June 2004, after a complete status review of 27 west coast salmonid ESUs, the NMFS proposed that CCV steelhead remain listed as threatened (69 FR 33102). On January 5, 2006, NMFS reaffirmed the threatened status of the CCV steelhead and applied the

DPS policy to the listed steelhead ESUs because the resident and anadromous life forms of *O. mykiss* remain “markedly separated” as a consequence of physical, ecological and behavioral factors, and therefore warranted delineation as a separate DPS (71 FR 834). On August 15, 2011, the NMFS completed another 5-year status review of CCV steelhead and recommended that the CCV steelhead DPS remain classified as a threatened species (NMFS 2011a).

Critical habitat was designated for CCV steelhead on September 2, 2005, (70 FR 52488). Critical habitat includes the stream channels to the ordinary high water line within designated stream reaches such as those of the American, Feather, and Yuba rivers, and Deer, Mill, Battle, Antelope, and Clear creeks in the Sacramento River basin; the Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced rivers in the San Joaquin River basin; and the Sacramento and San Joaquin rivers and Delta. Currently the CCV steelhead DPS and its designated critical habitat extends up the San Joaquin River upstream to the confluence with the Merced River.

Life History

1. Migratory Forms Present in CV

Steelhead in the CV historically consisted of both summer-run and winter-run migratory forms, based on their state of sexual maturity at the time of river entry and the duration of their time in freshwater before spawning. Between 1944 and 1947, annual counts of summer-run steelhead passing through the Old Folsom Dam fish ladder during May, June, and July ranged from 400 to 1,246 fish (Gerstung 1971). After 1950, when the fish ladder at Old Folsom Dam was destroyed by flood flows, summer-run steelhead were no longer able to access their historic spawning areas, and either perished in the warm water downstream of Old Folsom Dam or hybridized with winter-run steelhead. Only winter-run (ocean maturing) steelhead currently are found in California CV rivers and streams (Moyle 2002; McEwan and Jackson 1996). Summer-run steelhead have been extirpated due to a lack of access to suitable holding and staging habitat, such as coldwater pools in the headwaters of CV streams, presently located upstream of impassible dams (Lindley *et al.* 2006).

2. Age Structure

Juvenile steelhead (parr) rear in freshwater for one to three years before outmigrating to the ocean as smolts (Moyle 2002). The time that parr spend in freshwater is related to their growth rate, with larger, faster-growing members of a cohort smolting at an earlier age (Peven *et al.* 1994; Seelbach 1993). Hallock *et al.* (1961) aged 100 adult steelhead caught in the Sacramento River upstream of the Feather River confluence in 1954, and found that 70 had smolted at age-2, 29 at age-1, and one at age-3. Seventeen of the adults were repeat spawners, with three fish on their third spawning migration, and one on its fifth. Age at first maturity varies among populations. In the CV, most steelhead return to their natal streams as adults at a total age of two to four years (Hallock 1961, McEwan and Jackson 1996).

3. Egg to Parr Stages

Steelhead eggs hatch in three to four weeks at 10°C to 15°C (Moyle 2002). The length of time it takes for eggs to hatch depends mostly on water temperature. After hatching, alevins remain in the gravel for an additional two to five weeks while absorbing their yolk sacs, and emerge in spring or early summer (Barnhart 1986). Fry emerge from the gravel usually about four to six weeks after hatching, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Upon emergence, fry inhale air at the stream surface to fill their air bladders, absorb the remains of their yolks in the course of a few days, and start to feed actively, often in schools (Barnhart 1986; NMFS 1996).

The newly emerged juveniles move to shallow, protected areas associated within the stream margin (McEwan and Jackson 1996). As steelhead parr increase in size and their swimming abilities improve, they increasingly exhibit a preference for higher velocity and deeper mid-channel areas (Hartman 1965; Everest and Chapman 1972; Fontaine 1988).

4. Preferred Juvenile Habitat

Productive juvenile rearing habitat is characterized by complexity, primarily in the form of cover, which can be deep pools, woody debris, aquatic vegetation, or bolders. Cover is an important habitat component for juvenile steelhead both as velocity refugia and as a means of avoiding predation (Meehan and Bjornn 1991). Optimal water temperatures for growth range from 15°C to 20°C (McCullough *et al.* 2001, Spina 2006).

5. Smolt Migration

Juvenile steelhead will often migrate downstream as parr in the summer or fall of their first year of life (USFWS 2002), but this is not a true smolt migration (Loch *et al.* 1988). Smolt migrations occur in the late winter through spring, when juveniles have undergone a physiological transformation to survive in the ocean, and become slender in shape, bright silvery in coloration, with no visible parr marks. Emigrating steelhead smolts use the lower reaches of the Sacramento River and the Delta primarily as a migration corridor to the ocean. There is little evidence that they rear in the Delta or on floodplains, though there are few behavioral studies of this life-stage in the CV.

6. Ocean Behavior

Unlike Pacific salmon, steelhead do not appear to form schools in the ocean (Behnke 1992). Steelhead in the southern part of their range appear to migrate close to the continental shelf, while more northern populations may migrate throughout the northern Pacific Ocean (Barnhart 1986).

7. Adult Run-Timing and Spawning Habitat

CCV steelhead generally leave the ocean from August through April (Busby *et al.* 1996), enter freshwater from August to November with a peak in September (Hallock 1961), and spawn from

December to April, with a peak in January through March, in rivers and streams where cold, well oxygenated water is available (Table 8; Williams 2006; Hallock *et al.* 1961; McEwan and Jackson 1996). Timing of upstream migration is correlated with higher flow events, such as freshets, and the associated change in water temperatures (Workman *et al.* 2002). Adults typically spend a few months in freshwater before spawning (Williams 2006). Female steelhead construct redds in suitable gravel and cobble substrate, primarily in pool tailouts and heads of riffles.

8. Fecundity

The number of eggs laid per female is highly correlated with adult size, though the strain of the fish can also play a role. Adult steelhead size depends on the duration of and growth rate during their ocean residency (Meehan and Bjornn 1991). CCV steelhead generally return to freshwater after one to two years at sea (Hallock *et al.* 1961), and adults typically range in size from two to twelve pounds (Reynolds *et al.* 1993). Steelhead about 55 cm long may have fewer than 2,000 eggs, whereas steelhead 85 cm long can have 5,000 to 10,000 eggs, depending on the stock (Meehan and Bjornn 1991). The average for Coleman National Fish Hatchery (CNFH) since 1999 is about 3,900 eggs per female (USFWS 2011).

9. Iteroparity

Unlike Pacific salmon, steelhead are iteroparous, meaning they are capable of spawning multiple times before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; and repeat spawners tend to be biased towards females (Busby *et al.* 1996). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners were relatively numerous (17.2 percent) in Waddell Creek. Null *et al.* (2013) found between 36 percent and 48 percent of kelts released from CNFH in 2005 and 2006 survived to spawn the following spring, which is in sharp contrast to what Hallock (1989) reported for CNFH in the 1971 season, where only 1.1 percent of adults were fish that had been tagged the previous year. Most populations have never been studied to determine the percentage of repeat spawners. Hatchery steelhead are typically less likely than wild fish to survive to spawn a second time (Leider *et al.* 1986).

10. Kelts

Post-spawning steelhead (kelts) may migrate downstream to the ocean immediately after spawning, or they may spend several weeks holding in pools before outmigrating (Shapovalov and Taft 1954). Recent studies have shown that kelts may remain in freshwater for an entire year after spawning (Teo *et al.* 2011), but that most return to the ocean (Null *et al.* 2013).

11. Population Dynamics

Historic CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s the steelhead run size had declined to about 40,000 adults (McEwan 2001). Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River upstream of the Feather River. Steelhead counts at the RBDD declined from an average of 11,187 for the period from 1967 to 1977, to an average of approximately 2,000 through the early 1990's, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan and Jackson 1996, McEwan 2001). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations.

About 80 percent of the historical spawning and rearing habitat once used by anadromous *O. mykiss* in the CV is now upstream of impassable dams (Lindley *et al.* 2006). The extent of habitat loss for steelhead most likely was much higher than that for salmon because steelhead were undoubtedly more extensively distributed. Due to their superior jumping ability, the timing of their upstream migration which coincided with the winter rainy season, and their less restrictive preferences for spawning gravels, steelhead could have utilized at least hundreds of miles of smaller tributaries not accessible to the earlier-spawning salmon (Yoshiyama *et al.* 1996). Steelhead were found as far south as the Kings River (and possibly Kern river systems in wet years) (McEwan 2001). Native American groups such as the Chunut people have had accounts of steelhead in the Tulare Basin (Latta 1977).

Nobriga and Cadrett (2003) compared CWT and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998 through 2001 to estimate that about 100,000 to 300,000 steelhead smolts are produced naturally each year in the CV. Good *et al.* (2005) made the following conclusion based on the Chipps Island data:

> *"If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire CV. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s."*

Existing naturally produced steelhead stocks in the CV are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill creeks and the Yuba River. Populations may exist in Big Chico and Butte creeks and a few wild steelhead are produced in the American and Feather rivers (McEwan and Jackson 1996). Clear Creek steelhead spawner abundance has not been estimated.

Until recently, CCV steelhead were thought to be extirpated from the San Joaquin River system. Monitoring has detected small numbers of steelhead in the Stanislaus, Mokelumne, and Calaveras rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995. A counting weir has been in place in the Stanislaus River since 2002 and in the Tuolumne River since 2009 to detect adult salmon, and have also detected *O. mykiss* passage. In 2012, 15 adult *O. mykiss* were detected passing the Tuolumne River weir and 82 adult *O. mykiss* were detected at the Stanislaus River weir (FishBio 2012a,b). In addition, rotary screw trap sampling has occurred since 1995 in the Tuolumne River, but only one juvenile *O. mykiss* was caught during the 2012 season (FishBio 2012b).

Rotary screw traps are well known to be very inefficient at catching steelhead smolts, so the actual numbers of smolts could be much higher. Rotary screw trapping on the Merced River has occurred since 1999. A fish counting weir was installed on this river in 2012. Since installation, one adult *O. mykiss* has been reported passing the weir. Juvenile *O. mykiss* were not reported captured in the rotary screw traps on the Merced River until 2012, when a total of 381 were caught (FishBio 2013). The unusually high number of *O. mykiss* captured may be attributed to a flashy storm event that rapidly increased flows over a 24 hour period. Zimmerman *et al.* (2009) has documented CCV steelhead in the Stanislaus, Tuolumne, and Merced rivers based on otolith microchemistry.

CDFW conducts annual Kodiak trawl sampling on the San Joaquin River near Mossdale. Based on these catches, as well as rotary screw trap efforts in all three tributaries, Marston (2004) stated that it is “clear from this data that *O. mykiss* do occur in all the tributaries as migrants and that the vast majority of them occur on the Stanislaus River.” Mossdale Kodiak trawl catches continue to occur and are still being conducted by CDFW. The low adult returns to these tributaries and the low numbers of juvenile emigrants captured suggest that existing populations of CCV steelhead on the Tuolumne, Merced, and lower San Joaquin rivers are severely depressed. The loss of these populations would severely impact CCV steelhead spatial structure and further challenge the viability of the CCV steelhead DPS.

In the Mokelumne River, East Bay Municipal Utilities District has included steelhead in their redd surveys on the Lower Mokelumne River since the 1999-2000 spawning season (NMFS 2011a). Based on data from these surveys, the overall trend suggests that redd numbers have slightly increased over the years (2000-2010). However, according to Satterthwaite *et al.* (2010), it is likely that most of the *O. mykiss* spawning in the Mokelumne River are non-anadromous (or resident) fish rather than steelhead. The Mokelumne River steelhead population is supplemented by Mokelumne River Hatchery production. In the past, this hatchery received fish imported from the Feather River and Nimbus hatcheries (Merz 2002). However, this practice was discontinued 11 years ago for Nimbus stock, and 3 years ago for Feather River stock. Recent results show that the Mokelumne River Hatchery steelhead are closely related to Feather River fish, suggesting that there has been little carry-over of genes from the Nimbus stock.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show a decline, an overall low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for CV salmonids. Using data through 2005, Lindley *et al.* (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The most recent status review of the CCV steelhead DPS (NMFS 2011a) found that the status of the population appears to have worsened since the 2005 status review (Good *et al.* 2005), when it was considered to be in danger of extinction. Analysis of data from the Chipps Island monitoring program indicates that natural steelhead production has continued to decline and that hatchery origin fish represent an increasing fraction of the juvenile production in the CV. Since 1998, all hatchery produced steelhead in the CV have been adipose fin clipped (ad-clipped). Since that time, the trawl data indicates that the proportion of ad-clip steelhead juveniles captured in the Chipps Island monitoring trawls has increased relative to wild juveniles, indicating a decline in natural production of juvenile steelhead. In recent years, the proportion of hatchery produced juvenile steelhead in the catch has exceeded 90 percent and in 2010 was 95 percent of the catch. Because hatchery releases have been fairly consistent through the years, this data suggests that the natural production of steelhead has been declining in the CV.

Salvage of juvenile steelhead at the CVP and SWP fish collection facilities has also shown a shift towards reduced natural production. In the past decade, there has been a decline in the percentage of salvaged juvenile steelhead that are naturally produced from 55 percent in 1998 down to 22 percent in 2010 (NMFS 2011a).

In contrast to the data from Chipps Island and the CVP and SWP fish collection facilities, some populations of wild CCV steelhead appear to be improving (Clear Creek) while others (Battle Creek) appear to be better able to tolerate the recent poor ocean conditions and dry hydrology in the CV compared to hatchery produced fish (NMFS 2011a). Since 2003, fish returning to the CNFH have been identified as wild (adipose fin intact) or hatchery produced (Ad-clipped). Returns of wild fish to the hatchery have remained fairly steady at 200-300 fish per year, but represent a small fraction of the overall hatchery returns. Numbers of hatchery origin fish returning to the hatchery have fluctuated much more widely; ranging from 624 to 2,968 fish per year. The returns of wild fish remained steady, even during the recent poor ocean conditions and the 3-year drought in the CV, while hatchery produced fish showed a decline in the numbers returning to the hatchery (NMFS 2011a). Furthermore, the continuing widespread distribution of wild steelhead in the CV provides the spatial distribution necessary for the DPS to survive and avoid localized catastrophes. However, these populations are frequently very small, and lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2011a).

Table 8. The temporal occurrence of (a) adult and (b) juvenile CCV steelhead at locations in the CV. Darker shades indicate months of greatest relative abundance

(a) Adult migration and holding

Location	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
[1,3]Sac. River	L	L	L	L	L	L						L	L	L	L	M	M	H	H	M	L	L	L	L
[2,3]Sac R at Red Bluff	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	H	M	L	L	L	L
[4]Mill, Deer Creeks	M	M	H	M	M	L	L	L	L	L	L	L							M	H	H	L	L	L
[6]Sac R. at Fremont Weir	L	L	L	L											M	M	H	H	M	M	L	L	L	L
[6]Sac R. at Fremont Weir	L	L	L	L											M	M	H	H	M	M	L	L	L	L
[7]San Joaquin River	H	H	M	M	L	L							L	L	L	L	M	M	M	M	M	M	H	H

(b) Juvenile migration

Location	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
[1,2]Sacramento River	L	L	L	L	M	M	M	M	M	M	M	M	L	L	L	L	L	L	M	M	M	M	L	L
[2,8]Sac. R at KL	L	L	L	L	H	H	L	L	L															L
[9]Sac. River @ KL	M	M	M	M	H	H	H	H	M	M											L	L	L	L
[10]Chipps Island (wild)	L	L	L	L	H	H	H	H	M	M	M	M	L	L					L	L	L	L	L	L
[8]Mossdale					L	L	H	H	H	H	L	L	L											
[11]Woodbridge Dam	M	M	M	M	M	M	M	M	M	M	M	M	M	M										
[12]Stan R. at Caswell	L	L	M	M	H	H	M	M	M	M	M	L												
[13]Sac R. at Hood	L	L	H	H	H	H	H	H	H	H	H										L	L	L	L

Relative Abundance: H = High; M = Medium; L = Low

Sources: [1]Hallock 1961; [2]McEwan 2001;[3]USFWS unpublished data; [4]CDFG 1995; [5]Hallock *et al.* 1957; [6]Bailey 1954; [7]CDFG Steelhead Report Card Data 2007;[8]CDFG unpublished data; [9]Snider and Titus 2000; [10]Nobriga and Cadrett 2003; [11]Jones and Stokes Associates, Inc., 2002; [12]S.P. Cramer and Associates Inc. 2000 and 2001; [13]Schaffter 1980, 1997.

Description of VSP Parameters

1. Abundance

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good *et al.* 2005; NMFS 2011a); the long-term trend remains negative. Comprehensive steelhead population monitoring has not taken place in the CV, despite 100 percent marking of hatchery steelhead since 1998. Efforts are underway to improve this deficiency, and a long term adult escapement monitoring plan is being considered (Eilers *et al.* 2010). Hatchery production and returns are dominant over natural fish and include significant numbers of non-DPS-origin Eel/Mad River steelhead stock. Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past several years.

2. Productivity

An estimated 100,000 to 300,000 naturally produced juvenile steelhead are estimated to leave the CV annually, based on rough calculations from sporadic catches in trawl gear (Good *et al.* 2005). The Mossdale trawls on the San Joaquin River conducted annually by CDFW and USFWS capture steelhead smolts, although usually in very small numbers. These steelhead recoveries which represent migrants from the Stanislaus, Tuolumne, and Merced rivers suggest that existing populations of CCV steelhead on these tributaries are severely depressed. In addition, the Chipps Island midwater trawl dataset from the USFWS provides information on the trend (Williams *et al.* 2011).

3. Spatial Structure

Steelhead appear to be well-distributed throughout the CV (Good *et al.* 2005; NMFS 2011a). In the San Joaquin River Basin, steelhead have been confirmed in all of the tributaries: Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced rivers. Zimmerman *et al.* (2009) used otolith microchemistry to show that *O. mykiss* of anadromous parentage occur in all three major San Joaquin River tributaries, but at low levels, and that these tributaries have a higher percentage of resident *O. mykiss* compared to the Sacramento River and its tributaries. The efforts to provide passage of salmonids over impassable dams may increase the spatial diversity of CCV steelhead populations if the passage programs are implemented for steelhead. In addition, the San Joaquin River Restoration Program (SJRRP) calls for a combination of channel and structural modifications along the San Joaquin River downstream of Friant Dam, releases of water from Friant Dam to the confluence of the Merced River, and the reintroduction of spring-run and fall-run Chinook salmon. If the SJRRP is successful, habitat improved for spring-run Chinook salmon could also benefit CCV steelhead (NMFS 2011a).

4. Diversity

CCV steelhead abundance and growth rate continue to decline, largely the result of a significant reduction in the diversity of habitats available to CCV steelhead (Lindley *et al.* 2006). Recent reductions in population size are also supported by genetic analysis (Nielsen *et al.* 2003). Garza and Pearse (2008) analyzed the genetic relationships among CCV steelhead populations and found that unlike the situation in coastal California watersheds, fish downstream of barriers in the CV were more closely related to downstream of barrier fish from other watersheds than to *O. mykiss* upstream of barriers in the same watershed. This pattern suggests the ancestral genetic structure is still relatively intact upstream of barriers, but may have been altered below barriers by stock transfers. The genetic diversity of CCV steelhead is also compromised by hatchery origin fish, which likely comprise the majority of the spawning run, placing the natural population at a high risk of extinction (Lindley *et al.* 2007). There are four hatcheries (CNFH, FRFH, Nimbus Fish Hatchery, and Mokelumne River Fish Hatchery) in the CV which combined release approximately 600,000 yearling steelhead smolts each year. These programs are intended to compensate for the loss of steelhead habitat caused by dam construction, but hatchery origin fish now appear to constitute a major proportion of the total abundance in the DPS. Two of these hatchery stocks (Nimbus and Mokelumne River hatcheries) originated from outside the DPS (from the Eel and Mad rivers) and are not presently considered part of the DPS.

Summary of CCV Steelhead DPS Viability

All indications are that natural CCV steelhead have continued to decrease in abundance over the past 25 years (Good et al. 2005; NMFS 2011a). The long-term trend remains negative. Hatchery production and returns are dominant over natural fish. Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past several years.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show a decline, an overall low abundance, and fluctuating return rates. Lindley et al. (2007) developed viability criteria for CV salmonids. Using data through 2005, Lindley et al. (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild steelhead in the CV provides the spatial distribution necessary for the DPS to survive and avoid localized catastrophes. However, these populations are frequently very small, and lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2011a). The most recent status review of the CCV steelhead DPS (NMFS 2011a) found that the status of the population appears to have worsened since the 2005 status review (Good et al. 2005), when it was considered to be in danger of extinction.

Critical Habitat and Primary Constituent Elements for CCV Steelhead

Critical habitat was designated for CCV steelhead on September 2, 2005 (70 FR 52488). Critical habitat for CCV steelhead includes stream reaches such as those of the Sacramento, Feather, and Yuba Rivers, and Deer, Mill, Battle, and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries, and the waterways of the Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation (defined as the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series) (Bain and Stevenson 1999; 70 FR

52488). Critical habitat for CCV steelhead is defined as specific areas that contain the PCE and physical habitat elements essential to the conservation of the species. Following are the inland habitat types used as PCEs for CCV steelhead. PCEs for CCV steelhead include:

1. Freshwater Spawning Habitat

Freshwater spawning sites are those with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. Most of the available spawning habitat for steelhead in the CV is located in areas directly downstream of dams due to inaccessibility to historical spawning areas upstream and the fact that dams are typically built at high gradient locations. These reaches are often impacted by the upstream impoundments, particularly over the summer months, when high temperatures can have adverse effects upon salmonids spawning and rearing downstream of the dams. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

2. Freshwater Rearing Habitat

Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and survival; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging LWM, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees [*i.e.*, primarily located upstream of the City of Colusa]) and flood bypasses (*i.e.*, Yolo and Sutter bypasses). However, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Freshwater rearing habitat also has a high conservation value even if the current conditions are significantly degraded from their natural state. Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

3. Freshwater Migration Corridors

Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks, and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream and downstream passage of adults, and the emigration of smolts. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For this reason, freshwater migration corridors are considered to have a high conservation value even if the migration corridors are significantly degraded compared to their natural state.

4. Estuarine Areas

Estuarine areas free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water are included as a PCE. Natural cover such as submerged and overhanging LWM, aquatic vegetation, and side channels, are suitable for juvenile and adult foraging. Estuarine areas are considered to have a high conservation value as they provide factors which function to provide predator avoidance and as a transitional zone to the ocean environment.

2.2.4 Southern DPS of North American Green Sturgeon

The following section entails the status of the species for the Southern distinct population segment of SDPS green sturgeon (sDPS green sturgeon). This section establishes the life history and viability for sDPS green sturgeon, and discusses their critical habitat. The critical habitat analysis is approached by examining the PCEs of that critical habitat, and this analysis considers separately freshwater and estuarine environments. Throughout this analysis of life history, viability, and critical habitat, the focus is upon the CV of California. Therefore, not all aspects of sDPS green sturgeon are presented; for example, the PCEs for the critical habitat in the marine environment are not included.

1. Listed as threatened on June 6, 2006 (71 FR 17757)
2. Critical habitat designated October 9, 2009 (74 FR 52300)

Life History

Our understanding of the biology of the sDPS of green sturgeon is evolving. In areas where information is lacking, inferences are sometimes made from what is known about the Northern distinct population segment (nDPS) green sturgeon and, to a lesser extent, from other sturgeon species, especially the sympatric white sturgeon (*Acipenser transmontanus*). Green sturgeon are long lived, iteroperous, anadromous fish. They may live up to 60-70 years; green sturgeon captured in Oregon have been age-estimated using a fin-spine analysis up to 52 years (Farr and Kern 2005). The green sturgeon sDPS includes those that spawn south of the Eel River. Until recently, it was believed that the green sturgeon sDPS was composed of a single spawning population on the Sacramento River. However, recent research conducted by DWR has revealed spawning activity in the Feather River (Seesholtz, A. M., M. J. Manuel, and J. P. Van Eenennaam). 2015. First documented spawning and associated habitat conditions for green sturgeon in the Feather River, California. Environmental Biology of Fishes 98:905-912. Additionally, there is some evidence of spawning in the Yuba River downstream of Daguerre Point Dam (Cramer Fish Sciences 2013).

Laboratory studies have provided some important information about about larval sturgeon diet and habitat use. Green sturgeon larvae hatch from fertilized eggs after approximately 169 hours at a water temperature of 15º C (59º F) (Van Eenennaam *et al.* 2001, Deng *et al.* 2002). Studies conducted at the University of California, Davis by Van Eenennaam *et al.* (2005) using nDPS juveniles indicated that an optimum range of water temperature for egg development ranged between 14º C (57.2ºF) and 17º C (62.6ºF). Temperatures over 23 ºC (73.4ºF) resulted in 100 percent mortality of fertilized eggs before hatching. Eggs incubated at water temperatures between 17.5º C (63.5ºF) and 22º C (71.6ºF) resulted in elevated mortalities and an increased occurrence of morphological abnormalities in those eggs that did hatch. At incubation temperatures below 14º C (57.2ºF), hatching mortality also increased significantly, and morphological abnormalities increased slightly, but not statistically so (Van Eenennaam *et al.* 2005).

Young green sturgeon appear to rear for the first one to two months in the Sacramento River between Keswick Dam and Hamilton City (CDFG 2002). Juvenile green sturgeon first appear in USFWS sampling efforts at RBDD in June and July at lengths ranging from 24 to 31 mm fork length, indicating they are approximately two weeks old (CDFG 2002, USFWS 2002). Growth is rapid as juveniles reach up to 300 mm the first year and over 600 mm in the first 2 to 3 years (Nakamoto *et al.* 1995). Juvenile green sturgeon have been salvaged at the Federal and State pumping facilities (which are located in the southern region of the Delta), and sampled in trawling studies by the CDFW during all months of the year (CDFG 2002). The majority of these fish that were captured in the Delta were between 200 and 500 mm indicating they were from 2 to 3 years of age, based on Klamath River age distribution work by Nakamoto *et al.* (1995). The lack of a significant proportion of juveniles smaller than approximately 200 mm in Delta captures indicates juvenile sDPS green sturgeon likely hold in the mainstem Sacramento River for up to 10 months, as suggested by Kynard *et al.* (2005). Both nDPS and sDPS green sturgeon juveniles tested under laboratory conditions, with either full or reduced rations, had optimal bioenergetic performance (*i.e.,* growth, food conversion, swimming ability) between 15ºC (59º F) and 19º C (66.2º F), thus providing a temperature related habitat target for conservation of this rare species (Mayfield and Cech 2004). This temperature range overlaps the egg incubation temperature range for peak hatching success previously discussed.

Radtke (1966) inspected the stomach contents of juvenile green sturgeon in the Delta and found food items to include a mysid shrimp (*Neomysis awatschensis),* amphipods (*Corophium* spp.*)*, and other unidentified shrimp. No additional information is available regarding the diet of sDPS green sturgeon in the wild, but they are presumed to be generalist, opportunistic benthic feeders.

There is a fair amount of variability (1.5 – 4 years) in the estimates of the time spent by juvenile green sturgeon in freshwater before making their first migration to sea. Nakamoto *et al.* (1995) found that nDPS green sturgeon on the Klamath River migrated to sea, on average by age three and no later than by age four. Moyle (2002) suggests juveniles migrate out to sea before the end of their second year, and perhaps as yearlings. Laboratory experiments indicate that both nDPS and sDPS green sturgeon juveniles may occupy fresh to brackish water at any age, but they are physiologically able to completely transition to saltwater at around 1.5 years in age (Allen and Cech 2007). In studying nDPS green sturgeon on the Klamath River, Allen *et al.* (2009) devised a technique to estimate the timing of transition from fresh water to brackish water to seawater by taking a bone sample from the leading edge of the pectoral fin and anlyzing the ratios of stontium and barium to calcium. The results of this study indicate that green sturgeon move from freshwater to brackish water (such as the estuary) at ages 0.5–1.5 years and then move into seawater at ages 2.5-3.5 years. Table 9 shows the migration timing of various life stages throughout the CV, Delta, San Francisco Bay, and into the Pacific Ocean.

In the summer months, multiple rivers and estuaries throughout the sDPS range are visited by dense aggregations of green sturgeon (Moser and Lindley 2007, Lindley *et al.* 2011). Capture of green sturgeon as well as tag detections in tagging studies have shown that green sturgeon are present in San Pablo Bay and San Francisco Bay at all months of the year (Kelly *et al.* 2007, Heublein *et al.* 2009, Lindley *et al.* 2011). An increasing amount of information is becoming available regarding green sturgeon habitat use in estuaries and coastal ocean, and why they aggregate episodically (Lindley *et al.* 2008, Lindley *et al.* 2011). Genetic studies on green sturgeon stocks indicate that almost all of the green sturgeon in the San Francisco Bay ecosystem belong to the sDPS (Israel and Klimley 2008).

Green sturgeon do not mature until they are at least 15–17 years of age (Beamesderfer *et al.* 2007). Therefore, it would not be expected that a green sturgeon returning to freshwater would be younger than this. However, once mature, green sturgeon appear to make spawning runs once every few years. Erickson and Hightower (2007) found that nDPS green sturgeon returned to the Rogue River 2–4 years after leaving; it is presumed that sDPS green sturgeon display similar behavior and return to the Sacramento River or Feather River system to spawn every 2–5 years. Adult sDPS green sturgeon begin their upstream spawning migrations into freshwater as early as late February with spawning occuring between March and July (CDFG 2002, Heublein 2006, Heublein *et al.* 2009, Vogel 2008). Peak spawning is believed to occur between April and June in deep, turbulent, mainstem channels over large cobble and rocky substrates featuring crevices and interstices (Van Eenennaam *et al.* 2001). Poytress *et al.* (2012) conducted spawning site and larval sampling in the upper Sacramento River from 2008–2012 and has identified a number of confirmed spawning locations (Figure 6). Green sturgeon fecundity is approximately 50,000 to 80,000 eggs per adult female (Van Eenennaam *et al.* 2001). They have the largest egg size of any sturgeon. The outside of the eggs are mildly adhesive, and are more dense than than those of white sturgeon (Kynard *et al.* 2005, Van Eenennaam *et al.* 2009).

Post spawning, green sturgeon may exhibit a variety of behaviors. Ultimately they will return to the ocean, but how long they take to do this and what they do along the way are open questions. Illustrating the spectrum of behavioral choices, Benson *et al.* (2007) conducted a study in which 49 nDPS green sturgeon were tagged with radio and/or sonic telemetry tags and tracked manually or with receiver arrays from 2002 to 2004. Tagged individuals exhibited four movement patterns: upstream spawning migration, spring outmigration to the ocean, or summer holding, and outmigration after summer holding.

Table 9. The temporal occurrence of (a) adult, (b) larval (c) juvenile and (d) subadult coastal migrant sDPS of green sturgeon. Locations emphasize the CV of California. Darker shades indicate months of greatest relative abundance.

(a) Adult-sexually mature (≥145 – 205 cm TL for females and ≥ 120 – 185 cm TL old for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upper Sac. River[a,b,c.i]												
SF Bay Estuary[d,h,i]												

(b) Larval and juvenile (≤10 months old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RBDD, Sac River[e]												
GCID, Sac River[e]												

(c) Older Juvenile (> 10 months old and ≤3 years old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
South Delta*[f]												
Sac-SJ Delta[f]												
Sac-SJ Delta[e]												
Suisun Bay[e]												

(d) Sub-Adult/non-sexually mature (approx. 75 cm to 145 cm for females and 75 to 120 cm for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pacific Coast[c,g]												

Relative Abundance: = High = Medium = Low

* Fish Facility salvage operations

Sources: [a]USFWS (2002); [b]Moyle *et al.* (1992); [c]Adams *et al.* (2002) and NMFS (2005); [d]Kelly *et al.* (2007); [e]CDFG (2002); [f]IEP Relational Database, fall midwater trawl green sturgeon captures from 1969 to 2003; [g]Nakamoto *et al.* (1995); [h]Heublein (2006); [i]CDFG Draft Sturgeon Report Card (2007)

Threats and Stressors

Green sturgeon are long lived, and thus face environmental and anthropocentric stressors that may affect the probability that they reach reproductive maturity. Males are observed to reproduce as early as 14 years old, while females grow older prior to maturing as early as 16 years old (Van Eenennaam et al. 2005). Both males and females occupy all types of aquatic environments- freshwater, estuarine, and marine. Numerous environmental factors potentially limit green sturgeon survival during the earliest stages of their life cycle while in freshwater. This period is called the "critical age" in fishes due to its relevance in survival and recruitment of individuals into the adult population (Hardy and Litvak 2004). Recruitment failure of the earliest life history stages may be a significant bottleneck for other North American acipenserids such as Pallid sturgeon and the white sturgeon in Upper Columbia and Kootenai rivers, the populations of which have numerous reproductive adults, but few recently surviving wild juveniles (Duke et al. 1999, Hildebrand et al. 1999, Korman and Walters 2001) .

There are many potential limiting factors during this early life period. They are the following: 1) warm water temperatures, 2) insufficient flows, 3) decreased dissolved oxygen, 4) lack of rearing habitat, and 5) increased predation. Water is released from Shasta Dam to maintain daily temperatures below 18º C downstream to a temperature compliance point, which in 2007 was maintained at Jellys Ferry and Balls Ferry to facilitate the incubation of eggs of spawning winter-run Chinook. This maintenance of cool water temperatures benefits green sturgeon spawning upstream of Red Bluff Diversion Dam. Temperature records from acoustic telemetry receivers along the mainstem have not been analyzed, but may provide data for assessing whether temperatures are limiting survival of embryos, larvae or juveniles downstream of RBDD. Once larvae grow into juveniles, their survival may be limited by lack of habitat, insufficient food, and possibly contaminants. Juveniles are fairly tolerant of variable temperature and dissolved oxygen, and are likely mobile enough to select favorable habitats (see Ecology sections). It is possible that juveniles can also be entrained in water diversions for farmland irrigation, although their benthic behavior likely limits this impact, and this is not well understood.

The members of the older age classes principally face anthropocentric threats to their survival in estuarine and marine environments. Once within the estuary, juveniles might accumulate pollutants such as methyl-mercury and pyrethroids, whose uptake is enhanced by the benthic feeding orientation of green sturgeon. Pyrethroids also may limit the availability of prey for young green sturgeon due to their effect of very low dosages on zooplankton and bottom-dwelling organisms. The size of the populations of subadults and adults have been potentially limited by human fisheries and barriers to spawning areas which may prevent them from racing the most optimal spawning habitats. Harvest can cause abrupt declines in green sturgeon adult abundance. Even an amount as small as 10% additional mortality over the green sturgeon's life-span can reduce population abundance by 50% and adult abundance by 90% (Beamesderfer et al. 2007). An additional simulated increase in mortality of 20% over natural mortality resulted in no green sturgeon surviving to adulthood. These forms of mortality could include human and nonhuman sources of direct mortality, and are not well quantified for the Southern DPS. Of greater concern, might be even much smaller additional mortality rates' influence on green sturgeon's reproductive potential. Additional rates of only 2-3% annual mortality over green sturgeon's life cycle reduced egg production to levels making sturgeon stocks extremely susceptible to overfishing (Beamesderfer et al. 2007).

Modification of the riverscape has resulted in loss of spawning habitat, rearing habitat, and increased barriers to migration. Larvae, juveniles, and adults life history stages are all benthic in orientation and all require deep habitats for dispersal, holding, and spawning. Successful fertilization and survival of embryos seems to require spawning habitats reflecting specific water quality and quantity parameters, which have been negatively impacted by construction of dams and channelization of the river. Riparian habitats provide allochthonous contributions to the river food web that indirectly support juvenile prey items. It is possible that modifications in temperature regime controlled by the Shasta Dam temperature control device may benefit green sturgeon spawning above Red Bluff Diversion Dam, but more research is necessary to understand the impacts of temperature on the distribution and success of green sturgeon spawning.

Channelization of the estuary has likely negative impacted the amount of subtidal and intertidal habitat available for green sturgeon foraging. These habitats have been lost along San Pablo and Suisun bays, where subadult and adult green sturgeon are commonly found. These estuarine habitats are likely important for growth during the juvenile, coastal migrant, and adults life stages. Invasive plant species in the estuary have likely impacted the quantity of shallow habitat available to coastal migrant and adult green sturgeon, and alterations of the food web due to invasive species have also likely shifted green sturgeon estuarine diet.

Future Research

One conclusion of the NMFS BRT assessing the status of green sturgeon was that “it is essential that immediate efforts be undertaken to implement population monitoring for the DPS using methods that directly assess population status” (NMFS 2005). Although laboratory studies have yielded much information on the physiological needs of the species, field studies have yet to be completed applying this information to identifying adult spawning, larval survival, juvenile rearing, and juvenile smoltification. Information is necessary about the life history diversity, abundance, population growth rate, foraging behavior and temporal presence of Sacramento River green sturgeon.

Managers should develop research and monitoring to estimate the riverine larval and juvenile populations for a period of time reflecting the potential variation in physical and biological processes influencing recruitment. These results will give managers an idea for the effect of management on critical habitats, influence of adult demography on recruitment dynamics, and the actual production of green sturgeon in younger cohorts. Estimates derived from these types of studies may be a good indication for spawning and abundance, which are not negatively influenced by the impact of entrainment, operations, and harvest. If estimates of young riverine fish are known, then adaptive research evaluating the impacts of anthropocentric stressors on older life history stages will allow managers to assess the actual effects of these anthropocentric stressors. Currently, abundance derived from harvest or operational entrainment data does not allow managers to determine if these impacts are causing declines in abundance or just reflect the natural production of spawning adults.

The distribution of spawning adults as well as a characterization of their spawning habitat within the Sacramento River should be completed. This will provide insight into the density of spawning adults and influence spawning aggregation have to the juvenile population, the rates of egg and larval mortality, and the potential loss of this spawning habitat by flow and temperature modification in the system. In 2008, UCD, BOR, and FWS initiated tracking green sturgeon as they move within the upper mainstem and collected eggs at spawning sites. Additional funding is necessary to adequately monitor spawning movements and increased egg and larval collection sites along the Sacramento riverscape to evaluate green sturgeon habitat relationships.

Little is known about green sturgeon food selection and foraging behavior making the predictability of where preferred food is available low. As green sturgeon move into lower riverine reaches, the estuary and marine environments, food resources are not well understood (Israel and Klimley 2008). If native food sources have declined due to invasive species occupying their habitat or pollutants reducing available food, finding sufficient food may be problematic for juvenile green sturgeon. There is a need to investigate further the effects of selenium and other contaminants on green sturgeon and to find ways to reduce sources. Recent evidence indicates adult white sturgeon may be accumulating selenium in concentrations detrimental to reproduction, presumably by consuming the introduced overbite clam (Linville 2006).

Support should be provided for priority research guided by the Interagency Ecological Program Sturgeon Work Team. This conceptual model should indicate that much is already known about the basic biology of green sturgeon from laboratory studies and can serve as the basis for developing hypotheses for testing in field studies. The next research step should be to discern the importance of this biology on population viability within the watershed. A systematically applied research program attempting to study the critical periods and habitats of green sturgeon in riverine and estuarine environments will provide managers with information on the actual utilization, status, and abundance of different life history stages of green sturgeon in the Sacramento River. Once these field observations are completed, our larger and more comprehensive understanding for the basic ecology of the species will permit the development of a population viability model, which could prioritize the above-mentioned risks to the population and guide management decisions (Israel and Klimley 2008).

Description of Viability Parameters for sDPS Green Sturgeon

As an approach to determining the conservation status of salmonids, NMFS has developed a framework for identifying attributes of a VSP. The intent of this framework is to provide parties with the ability to assess the effects of management and conservation actions and ensure their actions promote the listed species' survival and recovery. This framework is known as the VSP concept (McElhany *et al.* 2000). The VSP concept measures population performance in term of four key parameters: abundance, population growth rate, spatial structure, and diversity. Although the VSP concept was developed for Pacific salmonids, the underlying parameters are general principles of conservation biology and can therefore be applied more broadly; here we adopt the VSP concept for sDPS green sturgeon.

1. Abundance

Abundance is one of the most basic principles of conservation biology, and from this measurement other parameters can be related. In applying the VSP concept, abundance is examined at the population level, and therefore population size is perhaps a more appropriate term. Population estimates of the green sturgeon sDPS are in development. A decrease in sDPS green sturgeon abundance has been inferred from the amount of take observed at the south Delta pumping facilities; the Skinner Delta Fish Protection Facility (SDFPF) and the Tracy Fish Collection Facility (TFCF) (Figure 7). There are, however, uncertainties with the data in figure 7. Adams et al. (2007) describe that while the numbers of green sturgeon still were higher in the pre 1986 period, it appears that the expansion procedure exaggerated that difference. These entrainment estimates suffer from problems of species identification (green sturgeon were not identified until 1981 at the federal facility), and the estimates are expanded catches from brief sampling periods.

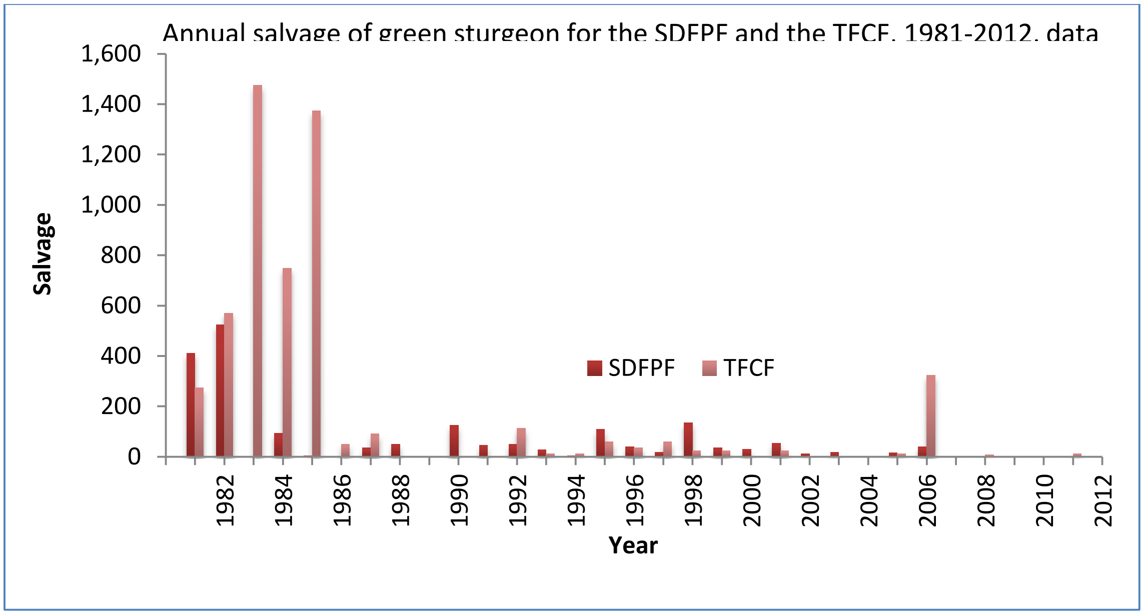

Figure 7. Annual salvage of green sturgeon for the SDFPF and the TFCF from 1981 to 2012. Data source: ftp://ftp.delta.dfg.ca.gov/salvage

Adult spawning population estimates in the upper Sacramento River (above RBDD*)*, using sibling based genetics, indicates 10-28 spawners contributed to juvenile production per year between 2002-2006 (Israel and May 2010). This is a minimum estimate of the effective adult spawning population because sampling was limited, may have preferentially selected for larvae spawning immediately above RBDD, and did not include animals spawning downstream of the RBDD. Fish monitoring efforts at RBDD and Glen Colusa Irrigation District (GCID) on the upper Sacramento River have captured anywhere between 0 and 2,068 juvenile green sturgeon per year, between 1986 and 2000 (Adams *et al.* 2002).

In determining the conservation status of sDPS green sturgeon, a few notes with regards to population size are crucial. Population(s) should be large enough to survive environmental variations, catastrophes, and anthropogenic perturbations. Also, the population(s) should be sufficiently large to maintain long term genetic diversity (McElhany *et al.* 2000). Our understanding of the status of sDPS green sturgeon towards these concerns is developing.

Because of their long life span, green sturgeon abundance is particularly sensitive to increased mortality. Even relatively small increases in annual mortality can substantially reduce adult abundance due to cumulative effects accruing over a number of years. Because of their delayed age of maturation, cumulative impacts may severely reduce the population's reproduction potential.

Beamesderfer *et al*. (2007) used the life table model to evaluate the sensitivity of the population to additional mortality rates when applied to different life stages. The analyses showed that low rates of additional mortality (2% to 5%), when applied across multiple life stages, can result in abrupt declines in green sturgeon population numbers and reproductive potential.

2. <u>Productivity</u>

For long-lived species such as sturgeon, abundance, age structure, and sex ratios are particularly powerful indicators of long-term productivity patterns. Viable sturgeon populations are characterized by a broad distribution of size classes and ages. In order for sDPS green sturgeon to rebound from being threatened to a viable status, its population growth rate will need to be positive until some equilibrium population size is reached, at which point the growth rate should stabilize.

Productivity and recruitment information for sDPS green sturgeon is an area that requires additional research; existing data is too limited to be presented as robust estimates. Incidental catches of larval green sturgeon in the mainstem Sacramento River and of juvenile green sturgeon at the south Delta pumping facilities suggest that green sturgeon are successful at spawning, but that annual year class strength may be highly variable (Beamesderfer *et al.* 2007, Lindley *et al.* 2007). In general, sturgeon year class strength appears to be episodic with overall abundance dependent upon a few successful spawning events (NMFS 2010). It is unclear if the population is able to consistently replace itself. This is significant because the VSP concept requires that a population meeting or exceeding the abundance criteria for viability should, on average, be able to replace itself (McElhany *et al*. 2000). More research is needed to establish green sturgeon sDPS productivity.

3. <u>Spatial Structure</u>

Green sturgeon, as a species, are known to range from Baja California to the Bering Sea along the North American continental shelf. During the late summer and early fall, subadults and nonspawning adult green sturgeon frequently can be found aggregating in estuaries along the Pacific coast (Emmett 1991, Moser and Lindley 2007). Based on genetic analyses and spawning site fidelity (Adams *et al.* 2002, Israel *et al.* 2004), green sturgeon are comprised of at least two DPSs.

1. A nDPS consisting of populations originating from coastal watersheds northward of and including the Eel River (*i.e.* Klamath, Rogue, and Umpqua rivers), and
2. A sDPS consisting of populations originating from coastal watersheds south of the Eel River.

Throughout much of their range, sDPS and nDPS green sturgeon are known to co-occur, especially in northern estuaries and over-wintering grounds. However, those green sturgeon that are found within the inland waters of the Central Valley, California are almost entirely sDPS green sturgeon (Israel and Klimley 2008).

Adams *et al.* (2007) summarizes information that suggests green sturgeon may have been distributed upstream of the locations of present-day dams on the Sacramento and Feather rivers. In the California CV, sDPS green sturgeon are known to range from the Delta to the Sacramento River up to Keswick Dam, the Feather River up to the fish barrier structure downstream of Oroville Dam, and the Yuba River up to Daguerre Point Dam. Additional habitat may have historically existed in the San Joaquin River basin. Anecdotal evidence from anglers suggest sDPS green sturgeon presence in the San Joaquin River. Since implementation of the Sturgeon Report Card in 2007, anglers have reported catching 177 white sturgeon and 7 green sturgeon on the San Joaquin River upstream from Stockton (Dubois, J., M. D. Harris, and J. Mauldin. 2014. 2013 Sturgeon Fishing Report Card: Preliminary Data Report. CDFW Bay Delta Region, Stockton, CA, May 8, 2014).

In applying the VSP concept to sDPS green sturgeon, it is important to look at the within-population spatial diversity. Ongoing research is being conducted to determine if the green sturgeon sDPS is composed of a single population, or perhaps several populations. It is known that sDPS green sturgeon spawn in the mainstem Sacramento River, the Feather River, and the Yuba River; but it is not yet known if these spawning areas represent individual populations, sub-populations, or if they are all part of one single population. However, it is encouraging to note that at least this level of spatial diversity exists; when sDPS green sturgeon were originally listed as threatened under the ESA, the only known spawning locations at the time were those on the mainstem Sacramento River.

4. Diversity

The VSP concept identifies a variety of traits that exhibit diversity within and among populations, and this variation has important effects on population viability (McElhany *et al.* 2000). For sDPS green sturgeon, such traits include, but are not limited to fecundity, age at maturity, physiology, and genetic characteristics. On a species-wide scale, studies have examined the genetic differentiation between sDPS and nDPS green sturgeon (Israel *et al.* 2004).

Although the population structure of sDPS green sturgeon is still being refined, it may be the case that only a single population exists. This may have the effect of providing for lower diversity than if two or more populations existed. Lindley *et al.* (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population.

Summary of sDPS Green Sturgeon Viability

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010a). Viability is defined as an independent population having a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year timeframe (McElhany et al. 2000). The best available scientific information does not indicate that the extinction risk facing sDPS green sturgeon is negligible over a long term (~100 year) time horizon; therefore the sDPS is not believed to be viable. To support this statement, the population viability analysis (PVA) that was done for sDPS green sturgeon in relation to stranding events (Thomas et al. 2013) may provide some insight. While this PVA model made many assumptions that need to be verified as new information becomes available, it was alarming to note that over a 50-year time period the DPS declined under all scenarios where stranding events were recurrent over the lifespan of a green sturgeon.

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley et al. (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2010a).

There is a strong need for additional information about sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their habitat needs.

Southern DPS of North American Green Sturgeon Critical Habitat

Critical habitat was designated for the sDPS green sturgeon on October 9, 2009 (74 FR 52300). A full and exact description of all sDPS green sturgeon critical habitat, including excluded areas, can be found at 50 CFR 226.219. Critical habitat includes the stream channels and waterways in the Delta to the ordinary high water line. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are also included as critical habitat for sDPS green sturgeon.

Critical habitat for sDPS green sturgeon includes principal biological or physical constituent elements within the defined area that are essential to the conservation of the species. PCEs for sDPS green sturgeon have been designated for freshwater riverine systems, estuarine habitats, and nearshore coastal areas. In keeping with the focus on the California CV, we will limit our discussion to freshwater riverine systems and estuarine habitats.

Freshwater Riverine Systems

1. Food Resources

Abundant food items for larval, juvenile, subadult, and adult life stages for sDPS green sturgeon should be present in sufficient amounts to sustain growth, development, and support basic metabolism. Although specific information on food resources for green sturgeon within freshwater riverine systems is lacking, they are presumed to be generalists and opportunists that feed on similar prey as other sturgeons (Israel and Klimley 2008). Seasonally abundant drifting and benthic invertebrates have been shown to be the major food items of shovelnose and pallid sturgeon in the Missouri River (Wanner *et al.* 2007), lake sturgeon in the St. Lawrence River (Nilo *et al.* 2006), and white sturgeon in the lower Columbia River (Muir *et al.* 2000). As sturgeons grow, they begin to feed on oligochaetes, amphipods, smaller fish, and fish eggs as represented in the diets of lake sturgeon (Nilo *et al.* 2006), pallid sturgeon (Gerrity *et al.* 2006), and white sturgeon (Muir *et al.* 2000).

2. Substrate Type or Size

Critical habitat in the freshwater riverine system should include substrate suitable for egg deposition and development, larval development, subadults, and adult life stages. For example, spawning is believed to occur over substrates ranging from clean sand to bedrock, with preferences for cobble (Emmett *et al.* 1991, Moyle *et al.* 1995). Eggs are likely to adhere to substrates, or settle into crevices between substrates (Van Eenennaam *et al.* 2001, Deng *et al.* 2002). Larvae exhibited a preference for benthic structure during laboratory studies (Van Eenennaam *et al.* 2001, Deng *et al.* 2002, Kynard *et al.* 2005), and may seek refuge within crevices, but use flat-surfaced substrates for foraging (Nguyen and Crocker 2006).

3. Water Flow

An adequate flow regime is necessary for normal behavior, growth, and survival of all life stages in the upper Sacramento River. Such a flow regime should include stable and sufficient water flow rates in spawning and rearing reaches to maintain water temperatures within the optimal range for egg, larval, and juvenile survival and development (11°C - 19°C) (Mayfield and Cech 2004, Van Eenennaam *et al.* 2005, Allen *et al.* 2006). Sufficient flow is also needed to reduce the incidence of fungal infestations of the eggs, and to flush silt and debris from cobble, gravel, and other substrate surfaces to prevent crevices from being filled in and to maintain surfaces for feeding. Successful migration of adult green sturgeon to and from spawning grounds is also dependent on sufficient water flow. Spawning in the Sacramento River is believed to be triggered by increases in water flow to about 14,000 cfs [average daily water flow during spawning months: 6,900 – 10,800 cfs; Brown (2007)]. In Oregon's Rogue River, nDPS green sturgeon have been shown to emigrate to sea during the autumn and winter when water temperatures dropped below 10° C and flows increased (Erickson *et al.* 2002). On the Klamath

River, the fall outmigration of nDPS green sturgeon has been shown to coincide with a significant increase in discharge resulting from the onset of the rainy season (Benson *et al* 2007). On the Sacramento River, flow regimes are largely dependent on releases from Shasta Dam, thus the operation of this dam could have profound effects upon sDPS green sturgeon habitat.

4. Water Quality

Adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics are necessary for normal behavior, growth, and viability of all life stages. Suitable water temperatures would include: stable water temperatures within spawning reaches; temperatures within 11°C - 17°C (optimal range = 14°C - 16°C) in spawning reaches for egg incubation (March-August) (Van Eenennaam *et al.* 2005); temperatures below 20°C for larval development (Werner *et al.* 2007); and temperatures below 24°C for juveniles (Mayfield and Cech 2004, Allen *et al.* 2006). Suitable salinity levels range from fresh water (< 3 ppt) for larvae and early juveniles to brackish water (10 ppt) for juveniles prior to their transition to salt water. Prolonged exposure to higher salinities may result in decreased growth and activity levels and even mortality (Allen and Cech 2007). Adequate levels of dissolved oxygen (DO) are needed to support oxygen consumption by early life stages (ranging from 61.78 to 76.06 mg O_2 hr^{-1} kg^{-1} for juveniles, Allen and Cech (2007). Suitable water quality would also include water with acceptably low levels of contaminants (*i.e*., pesticides, organochlorines, selenium, elevated levels of heavy metals, *etc*.) that may disrupt normal development of embryonic, larval, and juvenile stages of green sturgeon. Poor water quality can have adverse effects on growth, reproductive development, and reproductive success. Studies on effect of water contaminants upon green sturgeon are needed; studies performed upon white sturgeon have clearly demonstrated the negative impacts contaminants can have upon white sturgeon biology (Foster *et al.* 2001a, 2001b, Feist *et al.* 2005, Fairey *et al.* 1997, Kruse and Scarnecchia 2002). Legacy contaminants such as mercury still persist in the watershed and pulses of pesticides have been identified in winter storm discharges throughout the Sacramento River basin, and the CV and Delta.

5. Migratory Corridor

Safe and unobstructed migratory pathways are necessary for adult green sturgeon to migrate to and from spawning habitats, and for larval and juvenile green sturgeon to migrate downstream from spawning and rearing habitats within freshwater rivers to rearing habitats within the estuaries. Unobstructed passage throughout the Sacramento River up to Keswick Dam (RM 302) is important, because optimal spawning habitats for green sturgeon are believed to be located upstream of the RBDD (RM 242).

6. Depth

Deep pools of ≥ 5 m depth are critical for adult green sturgeon spawning and for summer holding within the Sacramento River. Summer aggregations of green sturgeon are observed in these pools in the upper Sacramento River upstream of GCID. The significance and purpose of these aggregations are unknown at the present time, but may be a behavioral characteristic of green sturgeon. Adult green sturgeon in the Klamath and Rogue rivers also occupy deep holding pools for extended periods of time, presumably for feeding, energy conservation, and/or refuge from high water temperatures (Erickson *et al.* 2002, Benson *et al.* 2007). As described above approximately 54 pools with adequate depth have been identified in the Sacramento River upstream of the GCID location.

7. Sediment Quality

Sediment should be of the appropriate quality and characteristics necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of contaminants [*e.g.*, elevated levels of heavy metals (*e.g.*, mercury, copper, zinc, cadmium, and chromium), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides] that can result in negative effects on any life stage of green sturgeon or their prey. Based on studies of white sturgeon, bioaccumulation of contaminants from feeding on benthic species may negatively affect the growth, reproductive development, and reproductive success of green sturgeon. The Sacramento River and its tributaries have a long history of contaminant exposure from abandoned mines, separation of gold ore from mine tailings using mercury, and agricultural practices with pesticides and fertilizers which result in deposition of these materials in the sediment horizons in the river channel. The San Joaquin River is a source for many of these same contaminants, although pollution and runoff from agriculture are the predominant driving force. Disturbance of these sediment horizons by natural or anthropogenic actions can liberate he sequestered contaminants into the river. This is a continuing concern throughout the watershed.

For Estuarine Habitats

1. Food Resources

Abundant food items within estuarine habitats and substrates for juvenile, subadult, and adult life stages are required for the proper functioning of this PCE for green sturgeon. Green sturgeon feed primarily on worms, mollusks, and crustaceans (Moyle 2002). Radtke (1966) studied the diet of juvenile sDPS green sturgeon and found their stomach contents to include a mysid shrimp, amphipods, and other unidentified shrimp. These prey species are critical for the rearing, foraging, growth, and development of juvenile, subadult, and adult green sturgeon within the bays and estuaries. Currently, the estuary provides these food resources, although annual fluctuations in the population levels of these food resources may diminish the contribution of one group to the diet of green sturgeon relative to another food source.

Invasive species are a concern because they may replace the natural food items consumed by green sturgeon. The Asian overbite clam (*Corbula amurensis*) is one example of a prolific invasive clam species in the Delta. It has been observed to pass through white sturgeon undigested (Kogut 2008).

2. Water Flow

Within bays and estuaries adjacent to the Sacramento River (*i.e.*, the Delta and the Suisun, San Pablo, and San Francisco bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds is required. Sufficient flows are needed to attract adult green sturgeon to the Sacramento River from the bay and to initiate the upstream spawning migration into the upper river. The specific quantity of flow required is a topic of ongoing research.

3. Water Quality

Adequate water quality, including temperature, salinity, oxygen content, and other chemical characteristics, is necessary for normal behavior, growth and viability of all life stages. Suitable water temperatures for juvenile green sturgeon should be below 24°C (75ºF). At temperatures above 24°C, juvenile green sturgeon exhibit decreased swimming performance (Mayfield and Cech 2004) and increased cellular stress (Allen *et al.* 2006). Suitable salinities in the estuary range from brackish water (10 ppt) to salt water (33 ppt). Juveniles transitioning from brackish to salt water can tolerate prolonged exposure to salt water salinities, but may exhibit decreased growth and activity levels (Allen and Cech 2007), whereas subadults and adults tolerate a wide range of salinities (Kelly *et al.* 2007). Subadult and adult green sturgeon occupy a wide range of DO levels, but may need a minimum DO level of at least 6.54 mg O_2/l (Kelly *et al.* 2007, Moser and Lindley 2007).

Suitable water quality also includes water free of contaminants (*e.g.*, pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal development of juvenile life stages, or the growth, survival, or reproduction of subadult or adult stages. In general, water quality in the Delta and estuary meets these criteria, but local areas of the Delta and downstream bays have been identified as having deficiencies. Discharges of agricultural drain water have also been implicated in local elevations of pesticides and other related agricultural compounds within the Delta and the tributaries and sloughs feeding into the Delta. Discharges from petroleum refineries in Suisun and San Pablo bay have been identified as sources of selenium to the local aquatic ecosystem (Linville *et al.* 2002).

4. Migratory Corridor

Safe and unobstructed migratory pathways are necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats. Within the waterways comprising the Delta, and bays downstream of the Sacramento River, safe and unobstructed passage is needed for juvenile green sturgeon during the rearing phase of their life cycle. Passage within the bays and the Delta is also critical for adults and subadults for feeding and summer holding, as well as to access the Sacramento River for their upstream spawning migrations and to make their outmigration back into the ocean. Within bays and estuaries outside of the Delta and the areas comprised by Suisun, San Pablo, and San Francisco bays, safe and unobstructed passage is necessary for adult and subadult green sturgeon to access feeding areas, holding areas, and thermal refugia, and to ensure passage back out into the ocean. Currently, safe and unobstructed passage has been diminished by human actions in the Delta and bays. The CVP and SWP, responsible for large volumes of water diversions, alter flow patterns in the Delta due to export pumping and create entrainment issues in the Delta at the pumping and Fish Facilities. Power generation facilities in Suisun Bay create risks of entrainment and thermal barriers through their operations of cooling water diversions and discharges. Installation of seasonal barriers in the South Delta and operations of the radial gates in the Delta Cross Channel (DCC) facilities alter migration corridors available to green sturgeon. Actions such as the hydraulic dredging of ship channels and operations of large ocean going vessels create additional sources of risk to green sturgeon within the estuary. Commercial shipping traffic can result in the loss of fish, particularly adult fish, through ship and propeller strikes.

5. Water Depth

A diversity of depths is necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages. Subadult and adult green sturgeon occupy deep (≥ 5 m) holding pools within bays, estuaries, and freshwater rivers. These deep holding pools may be important for feeding and energy conservation, or may serve as thermal refugia (Benson *et al.* 2007). Tagged adults and subadults within the San Francisco Bay estuary primarily occupied waters with depths of less than 10 meters, either swimming near the surface or foraging along the bottom (Kelly *et al.* 2007). In a study of juvenile green sturgeon in the Delta, relatively large numbers of juveniles were captured primarily in shallow waters from 3 – 8 feet deep, indicating juveniles may require shallower depths for rearing and foraging (Radtke 1966).

Currently, there is a diversity of water depths found throughout the San Francisco Bay estuary and Delta waterways. Most of the deeper waters, however, are composed of artificially maintained shipping channels, which do not migrate or fluctuate in response to the hydrology in the estuary in a natural manner. Shallow waters occur throughout the Delta and San Francisco Bay. Extensive "flats" occur in the lower reaches of the Sacramento and San Joaquin river systems as they leave the Delta region and are even more extensive in Suisun and San Pablo bays. In most of the region, variations in water depth in these shallow water areas occur due to natural processes, with only localized navigation channels being dredged (*e.g.*, the Napa River and Petaluma River channels in San Pablo Bay).

6. Sediment Quality

Sediment quality (*i.e.*, chemical characteristics) is necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of contaminants (*e.g.*, elevated levels of selenium, PAHs, and organochlorine pesticides) that can cause negative effects on all life stages of green sturgeon (see description of *sediment quality* for riverine habitats above).

Summary of the Conservation Value of Green Sturgeon Critical Habitat

The current condition of critical habitat for the green sturgeon sDPS is degraded over its historical conditions. It does not provide the full extent of conservation values necessary for the survival and recovery of the species, especially in the upstream riverine habitat. In particular, passage and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the green sturgeon sDPS evolved. The habitat values proposed for green sturgeon critical habitat have suffered similar types of degradation as described for winter-run Chinook salmon critical habitat. In addition, the alterations to the lower Sacramento River and delta may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to the protracted rearing time in the delta and estuary. Loss of individuals during this phase of the life history of green sturgeon represents losses to multiple year classes, which can ultimately impact the potential population structure for decades.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The environmental baseline describes the status of listed species and critical habitat in the action area, to which we add the effects of the Common Features GRR, to consider the effects of the proposed Federal actions within the context of other factors that impact the listed species. The effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the status of listed species and, for non-Federal activities in the action area, those actions that are likely to affect listed species in the future, to determine if implementation of the Common Features GRR is likely to cause an appreciable reduction in the likelihood of both survival and recovery or result in destruction or adverse modification of critical habitat.

Reaches throughout the Common Features GRR planning area historically provided both shallow and deeper water habitat. Channel confining levees and upstream reservoirs that maintain year-round outflow have eliminated much of the adjacent shallow water floodplain habitat. Many native fish species are adapted to rear in flooded, shallow water areas that provide abundant cover and prey. As a consequence of habitat alterations, and the introduction of non-native species and pollutants, some native fish species are now extinct while most others are reduced in numbers (Moyle 2002).

The Sacramento River watershed receives winter/early spring precipitation in the form of rain and snow (at higher elevations). Prior to the construction and operation of any reservoirs, winter rainfall events caused extensive flooding and spring snowmelt resulted in high flows during spring and early summer. Summer and fall flows were historically low. Currently, much of the total runoff is captured and stored in reservoirs for gradual release during the summer and fall months. High river flows occur during the winter and spring, but these are usually lower than during pre-European settlement times; summer and fall low flows are sustained by releases from upstream reservoirs.

The flood risk management system protecting the City of Sacramento has been identified as insufficient by the Corps. According to the Corps, there is a high probability that flows in the American and Sacramento Rivers will stress the network of levees protecting Sacramento to the point that levees could fail. Failure of these levees could inundate highly urbanized areas up to 20 feet deep.

Sixteen land cover types were identified in the Common Features GRR project area. Nine of the land cover types are considered natural communities: all four riparian habitats, emergent marsh, valley oak woodland, walnut woodland, nonnative annual grassland, pond, and perennial drainage. The other cover types are associated with human activities: all three agricultural field types, walnut orchard, agricultural ditch, and developed/landscaped.

Despite the impaired status of the Sacramento and American Rivers in the proposed project action area, the value of the lower Sacramento River as a migratory corridor for CV spring-run Chinook salmon, CCV steelhead, Sacramento River winter-run Chinook salmon, and sDPS green sturgeon is high primarily because it contains habitat elements that support the rearing and growth of juveniles and the successful upstream migration of adults. The same high value can be attributed to the American River for both CV spring-run and sDPS green sturgeon. The Common Features GRR will occur downstream of the confluence of major watersheds, including the American, Yuba, and Feather river and watersheds further upstream such as Butte Creek and Battle Creek. Thus, the action area is also within the migratory corridor for the fish that utilize all the aforementioned watersheds.

Anticipated climate change may affect spatial and temporal precipitation patterns along with the intensity and duration of precipitation within the Sacramento and American River watersheds. The effect of climate change is anticipated to be more winter and less spring and summer run-off within the watershed. In addition, expected run-off is anticipated to be warmer, possibly affecting the ability to meet downstream water temperature objectives to protect salmon, steelhead, and green sturgeon. This combined with more precipitation as rain will affect future operations of all reservoirs within the California CV. A change in the run-off pattern within the Sacramento and American River watersheds will likely affect reservoir storage and downstream river flows due to more frequent spillway releases.

This same flood management system impacts the natural meander and ecosystem of the Sacramento and American Rivers. The Common Features Project study area includes the mainstem The Common Features GRR action area includes the mainstem Sacramento River from Freeport (RM 46) in the Delta upstream to the American River confluence (RM 60). The region also includes the lower American River from the confluence with the Sacramento River upstream to RM 11, NEMDC, Arcade Creek, Dry/Robla Creeks and Magpie Creek.

Downstream from the American River confluence, the Sacramento River is moderately sinuous, with the channel confined on both sides by man-made levees enhanced by decades of man-made additions. The channel in this reach is of uniform width, is not able to migrate, and is typically narrower and deeper relative to the upstream reach due to scour caused by the concentration of shear forces acting against the channel bed (Brice 1977). Channel migration is similarly limited along the lower American River because of man-made levees and regulated flows from Folsom and Nimbus Dams.

The natural banks and adjacent floodplains of both rivers are composed of silt- to gravel-sized particles with poor to high permeability. Historically, the flow regimes caused the deposition of a gradient of coarser to finer material, and longitudinal fining directed downstream (sand to bay muds). The deposition of these alluvial soils historically accumulated to form extensive natural levees and splays along the rivers, 5 to 20 feet above the floodplain for as far as 10 miles from the channel (Thompson 1961). The present day channels consist of fine-grained cohesive banks that erode due to natural processes as well as high flow events (Corps 2012).

Seasonal high flows enter the adjacent Yolo Bypass from this reach of the Sacramento River via the Sacramento Bypass (RM 63). Tidal influence emanating from Suisun Bay extends up the Sacramento River for 80 miles to Verona, with greater tidal variations occurring downstream during low river stages in summer and fall.

NEMDC is an approximately 13.3-mile, human-made, partially leveed drainage channel that provides drainage from Sankey Road and connects streams of the American Basin (Dry, Robla, and Arcade Creeks) to the American River. South of the confluence with Arcade Creek, the east and west levees of NEMDC are dominated by wild oats grasslands, while the channel is characterized by Fremont cottonwood forest, with smaller amounts of valley oak woodland, smart-weed cocklebur patches, and perennial rye grass fields.

The approximately 16.2-mile-long channel of Arcade Creek extends east-to-west from Orangevale to the American River, via NEMDC. The north and south levees are dominated by wild oats grasslands. Valley oak woodland is the main riparian vegetation type along Arcade Creek, but Fremont cottonwood forest occurs in small patches along the easternmost reach of Arcade Creek near NEMDC. Hardstem bulrush marsh is found within Arcade Creek near Norwood Avenue while water primrose wetlands are predominant within the channel of Arcade Creek from approximately the confluence with NEMDC to Norwood Avenue. East of Norwood Avenue, the creek channel becomes narrower, and dominated by a shaded canopy of valley oak woodland.

The environmental baseline in the Common Features GRR action area also includes the sites completed under the WRDA 1996 and WRDA 1999 authorizations for the project. The WRDA 1996 construction included installing slurry walls in the American River levees to address seepage and slope stability concerns. The WRDA 1999 construction included shape and slope improvements to specific reaches of the American River levee system, and some segments of the Sacramento River levees.

The Common Features Project study area consists of primarily riparian forest, valley oak woodland, riparian scrub-shrub habitat, and typically non-native annual grassland. Early riparian habitat may be called scrub-shrub. Scrub-shrub generally refers to areas where the woody riparian canopy is composed of trees or shrubs approximately 20 feet high. Species that are typically found in these habitats include young cottonwood (*Populus trichocarpa*), willow (*Salix spp.*), elderberry (*Sambucus spp.*), buttonbush (*Cephalanthus occidentalis*), Himalaya blackberry (*Rubus armeniacus*), wild grape (*Vitis vinifera*), and poison oak (*Toxicodendron spp.*).

Riparian forest typically has a dominant overstory of cottonwood, California sycamore (*Platanus racemosa*), or valley oak (*Quercus lobata*). Species found in the scrub-shrub will make up the sub canopy and could also include white alder and box elder. Layers of climbing vegetation make up part of the subcanopy, with wild grape being a major component, but wild cucumber and clematis are also found in riparian communities.

The herbaceous ruderal habitat is found on most levees along the Sacramento River. It occurs on the levees and also within gaps in the riparian habitats. Plant species include wild oats (*Avena spp.*), soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus hordeaceus*), red brome (*Bromus madritensis*), wild barley (*Bromus hordeaceus)*, and foxtail fescue (*Festuca megalura*). Common forbs include broadleaf filaree (*Erodium spp.*), red stem filaree (*Erodium spp.*), turkey mullein (*Eremocarpus setigerus*), clovers (*Trifolium spp.*), and many others. The majority of these plants are not native to the project area.

Riparian recruitment and establishment models (Mahoney and Rood 1998; Bradley and Smith 1986) and empirical field studies (Scott et al. 1997, 1999) emphasize that hydrologic and fluvial processes play a central role in controlling the elevational and lateral extent of riparian plant species. These processes are especially important for pioneer species that establish in elevations close to the active channel, such as cottonwood and willows (*Salix* spp.). Failure of cottonwood recruitment and establishment is attributed to flow alterations by upstream dams (Roberts et al. 2001) and to isolation of the historic floodplain from the river channel. In addition, many of these formerly wide riparian corridors are now narrow and interrupted by levees and weirs. Finally, draining of wetlands, conversion of floodplains to agricultural fields, and intentional and unplanned introduction of exotic plant species have altered the composition and associated habitat functions of many of the riparian communities that are able to survive under current conditions.

2.3.1 Status of the Species in the Action Area

The action area, which encompasses portions of the lower Sacramento River and lower American River, and associated floodplains and riparian areas at and adjacent to the proposed construction sites functions as a migratory corridor for CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. The action area is also used for rearing and adult feeding.

1. <u>Presence of CCV Steelhead in the Action Area</u>

The CCV steelhead DPS final listing determination was published on January 5, 2006 (71 FR 834) and included all naturally spawned populations of steelhead (and their progeny) downstream of natural and manmade barriers in the Sacramento and San Joaquin rivers and their tributaries. FRFH steelhead are also included in this designation. All adult CCV steelhead originating in the Sacramento River watershed will have to migrate through the action area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, all CCV steelhead smolts originating in the Sacramento River watershed will also have to pass through the action area during their emigration to the ocean. The waterways in the action area also are expected to provide some rearing benefit to emigrating steelhead smolts. The CCV steelhead DPS occurs in both the Sacramento River and the San Joaquin River watersheds. However the spawning population of fish is much greater in the Sacramento River watershed and accounts for nearly all of the DPS' population.

CCV steelhead smolts will first start to appear in the action area in November. This is based on the records from the CVP and SWP fish salvage facilities, as well as the fish monitoring program in the northern and central Delta. Their presence increases through December and January, peaks in February and March, and declines in April. By June, the emigration has essentially ended, with only a small number of fish being salvaged through the summer at the CVP and SWP. Adult steelhead are expected to move through the action area throughout the year with the peak of upriver immigration expected to occur August through November. There is potential exposure to adult steelhead moving back downstream in a post-spawn condition (kelts) through the action area during the February to May period. It is expected that more kelts will be observed earlier in the period (February) due to the timing of spawning in the Sacramento River basin.

Based on the temporal presence of adult and juvenile steelhead in the lower Sacramento and American Rivers, the timing of the proposed project, and the location of the action area, it is likely that adult steelhead will be using the action area as a migration corridor during construction. Additionally, it is likely that juvenile steelhead may be emigrating through the action area during construction. Depending on the water year type and the timing of high flows in the Sacramento River basin, adult and/or juvenile CCV steelhead may be present in the Yolo Bypass and the Sacramento Bypass.

2. Presence of CV spring-run Chinook salmon in the Action Area

A similar application of the CVP and SWP salvage records and the northern and Central Delta fish monitoring data to the presence of CV spring-run Chinook salmon indicates that juvenile spring-run Chinook salmon first begin to appear in the action area in December and January, but that a significant presence does not occur until March and peaks in April. By May, the salvage of juvenile CV spring-run Chinook salmon declines sharply and essentially ends by the end of June. The data from the northern and central Delta fish monitoring programs indicate that a small proportion of the annual juvenile spring-run emigration occurs in January and is considered to be mainly composed of older yearling spring-run juveniles based on their size at date. Adult spring-run Chinook salmon are expected to start entering the action area in approximately January. Low levels of adult migration are expected through early March. The peak of adult spring-run Chinook salmon movement through the action area is expected to occur between April and June with adults continuing to enter the system through the summer. Currently, all known populations of CV spring-run Chinook salmon inhabit the Sacramento River watershed.

Based on the temporal presence of CV spring-run Chinook salmon in the lower Sacramento and American River, the timing of the proposed project, and the location of the action area, it is likely that adult and juvenile CV spring-run Chinook salmon will be using the action area. Depending on the water year type and the timing of high flows in the Sacramento River basin, adult and/or juvenile CV spring-run Chinook salmon may be present in the Yolo Bypass and the Sacramento Bypass. It is possible that any CV spring-run Chinook salmon (particularly adults) that arein the lower Sacramento River may enter into the American River.

3. Presence of Sacramento River winter-run Chinook salmon in the Action Area

The temporal occurrence of Sacramento River winter-run Chinook salmon smolts and juveniles within the action area are best described by a combination of the salvage records of the CVP and SWP fish collection facilities and the fish monitoring programs conducted in the northern and central Delta. Based on salvage records at the CVP and SWP fish collection facilities, juvenile Sacramento River winter-run Chinook salmon are expected in the actions area starting in December. Their presence peaks in March and then rapidly declines from April through June. The majority of winter-run juveniles will enter the action area during February through June. Presence of adult Chinook salmon is interpolated from historical data. Adult winter-run Chinook salmon are expected to enter the action area starting in January, with the majority of adults passing through the action area between February and April.

Based on the temporal presence of Sacramento River winter-run Chinook salmon in the lower Sacramento River, the timing of the proposed project, and the location of the action area, it is likely that adult and juvenile Sacramento River winter-run Chinook salmon will be using the action area. Depending on the water year type and the timing of high flows in the Sacramento River basin, adult and/or juvenile Sacramento River winter-run Chinook salmon may be present in the Yolo Bypass and the Sacramento Bypass. It is possible that any Sacramento River winter-run Chinook salmon (particularly adults) that are in lower Sacramento River may enter into the American River.

4. Presence of sDPS green sturgeon in the Action Area

The Sacramento River and a portion of the American River serve as an important migratory corridor for larval and juvenile sturgeon during their downstream migration to the San Francisco Bay Delta and Estuary. The San Francisco Bay Delta and Estuary provides year-round rearing habitat for juveniles, as well as foraging habitat for non-spawning adults and subadults in the summer months (NMFS 2008).

Detailed information regarding historic and current abundance, distribution and seasonal occurrence of SDPS green sturgeon in the action area is limited due to a general dearth of green sturgeon monitoring. The action area is located on the main migratory route for adults moving upstream to spawn, post spawn adults migrating back to the ocean, juvenile outmigrants, and rearing subadults. Juvenile green sturgeon from the sDPS are routinely collected at the SWP and CVP salvage facilities throughout the year. Based on the salvage records, green sturgeon may be present during any month of the year, and have been particularly prevalent during July and August. Adult green sturgeon begin to enter the Delta in late February and early March during the initiation of their upstream spawning run. The peak of adult entrance into the Delta appears to occur in late February through early April with fish arriving upstream in April and May. Adults continue to enter the Delta until early summer (June-July) as they move upriver to spawn. It is also possible that some adult green sturgeon will be moving back downstream in April and May through the action area, either as early post spawners or as unsuccessful spawners. Some adult green sturgeon have been observed to rapidly move back downstream following spawning, while others linger in the upper river until the following fall. It is possible that any of the adult or sub-adult sturgeon that inhabit the lower Sacramento River may swim into the American River. Similar to the salmonid species, depending on the water year type, it is possible that sturgeon will enter the Sacramento and Yolo bypass.

2.3.2 Status of Critical Habitat within the Action Area

The action area occurs within the USGC Hydrologic Unit Code (HUC) Lake Greenhaven-Sacramento River subbasin designated HUC 180201630701. Designated critical habitat for Sacramento River winter-run Chinook salmon (June 16, 1993, 58 FR 33212), CV spring-run Chinook salmon (September 2, 2005, 70 FR 52488), CCV steelhead (September 2, 2005, 70 FR 52488) and the sDPS of green sturgeon (October 9, 2009, 74 FR 52300) occur in this hydrologic unit. The HUC includes portions of the Sacramento and American Rivers. The critical habitat analytical review team (CHART) concluded that it contained one or more PCEs for both the CCV steelhead DPS and CV spring-run Chinook salmon ESU (NMFS 2005). The PCEs for steelhead and spring-run Chinook salmon habitat within the action area include freshwater rearing habitat and freshwater migration corridors. The features of the PCEs included essential to the conservation of the CCV steelhead DPS and CV spring-run Chinook salmon include the following: sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions necessary for salmonid development and mobility, sufficient water quality, food and nutrients sources, natural cover and shelter, migration routes free from obstructions, no excessive predation, holding areas for juveniles and adults, and shallow water areas and wetlands. Habitat within the action area is primarily utilized for freshwater rearing and migration by CCV steelhead and CV spring-run Chinook salmon juveniles and smolts and for adult freshwater migration. CCV steelhead also utilize the American River for spawning habitat.

Critical habitat for winter-run Chinook salmon includes the Sacramento River reach within the action area. Critical habitat elements include the river water, river bottom, and adjacent riparian zone used by fry and juveniles for rearing. Downstream migration of juveniles and upstream migration of adults should not be impeded or blocked. Adequate forage base is required to provide food for emigrating juvenile winter-run.

In regards to the designated critical habitat for the sDPS of green sturgeon, the action area includes PCEs concerned with: adequate food resources for all life stages; water flows sufficient to allow adults, subadults, and juveniles to orient to flows for migration and normal behavioral responses; water quality sufficient to allow normal physiological and behavioral responses; unobstructed migratory corridors for all life stages; a broad spectrum of water depths to satisfy the needs of the different life stages present in the estuary; and sediment with sufficiently low contaminant burdens to allow for normal physiological and behavioral responses to the environment.

The general condition and function of the aquatic habitat has already been described in the *Status of the Species and Critical Habitat* section of this BO. The substantial degradation over time of several of the essential critical elements has diminished the function and condition of the freshwater rearing and migration habitats in the action area. It has only rudimentary functions compared to its historical status. The channels of the lower Sacramento and American Rivers have been riprapped with coarse stone slope protection on artificial levee banks and these channels have been straightened to enhance water conveyance through the system. The extensive riprapping and levee construction has precluded natural river channel migrations. The natural floodplains have essentially been eliminated, and the once extensive wetlands and riparian zones have been "reclaimed" and subsequently drained and cleared for farming.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation value remains high for Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. CCV steelhead adults migrate into the lower American River to spawn, which is within the Lake Greenhaven-Sacramento River HUC, and the resulting fry rear and hold over within the American river until they are ready to migrate out to the ocean. All juvenile winter-run and spring-run Chinook salmon, sDPS green sturgeon, as well as those CCV steelhead smolts originating in the Sacramento River basin must pass into and through the Lake Greenhaven-Sacramento River HUC to reach the lower Delta and the ocean. A large fraction of these fish will likely pass downstream through the action area within the Sacramento River channel. Likewise, adults migrating upstream to spawn must pass through Lake Greenhaven-Sacramento River HUC to reach their upstream spawning areas on the tributary watersheds or main stem Sacramento River. A large proportion of the population is expected to move through the action area within the main channel of the Sacramento River. Therefore, it is of critical importance to the long-term viability of the Sacramento River winter-run Chinook salmon and CV spring-run Chinook salmon ESUs, the sDPS of green sturgeon, and the Sacramento River basin portion of the CCV steelhead DPS to maintain a functional migratory corridor and freshwater rearing habitat through the action area and the Lake Greenhaven-Sacramento River HUC in general.

2.3.4 Factors Affecting the Species and Habitat in the Action Area

The action area encompasses a small portion of the area utilized by the Sacramento River winter-run and CV spring-run Chinook salmon ESUs, and the CCV steelhead DPS as well as the sDPS green sturgeon. Many of the factors affecting these species throughout their range are discussed in the *Rangewide Status of the Species and Critical Habitat* section of this BO, and are considered the same in the action area. This section will focus on the specific factors in the action area that are most relevant to the proposed project.

The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs affecting listed salmonids in the action area. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round. Current flood control practices require peak flood discharges to be held back and released over a period of weeks to avoid overwhelming the flood control structures downstream of the reservoirs (*i.e.* levees and bypasses). Consequently, managed flows in the main stem of the river often truncate the peak of the flood hydrograph and extended the reservoir releases over a protracted period. These actions reduce or eliminate the scouring flows necessary to mobilize gravel and clean sediment from the spawning reaches of the river channel.

High water temperatures also limit habitat availability for listed salmonids in the lower Sacramento River. High summer water temperatures in the lower Sacramento River can exceed 72ºF (22.2ºC), and create a thermal barrier to the migration of adult and juvenile salmonids (Kjelson *et al*. 1982). In addition, water diversions at the dams (*i.e.* Friant, Goodwin, La Grange, Folsom, Nimbus, and other dams) for agricultural and municipal purposes have reduced in-river flows below the dams. These reduced flows frequently result in increased temperatures during the critical summer months which potentially limit the survival of juvenile salmonids in these tailwater sections (Reynolds *et al*. 1993). The elevated water temperatures compel many salmon juveniles to migrate out of the valley floor systems before summer heat makes the tailwaters unsuitable for salmonids. Those fish that remain either succumb to the elevated water temperatures or are crowded into river reaches with suitable environmental conditions.

Levee construction and bank protection have affected salmonid habitat availability and the processes that develop and maintain preferred habitat by reducing floodplain connectivity, changing riverbank substrate size, and decreasing riparian habitat and shaded riverine aquatic (SRA) cover. Individual bank protection sites typically range from a few hundred to a few thousand linear feet in length. Such bank protection generally results in two levels of impacts to the environment: (1) site-level impacts which affect the basic physical habitat structure at individual bank protection sites; and (2) reach-level impacts which are the accumulative impacts to ecosystem functions and processes that accrue from multiple bank protection sites within a given river reach. Revetted embankments result in loss of sinuosity and braiding and reduce the amount of aquatic habitat. Impacts at the reach level result primarily from halting erosion and controlling riparian vegetation. Reach-level impacts which cause significant impacts to fish are reductions in new habitats of various kinds, changes to sediment and organic material storage and transport, reductions of lower food-chain production, and reduction in large woody debris (LWD).

The use of rock armoring limits recruitment of LWD (*i.e.*, from non-riprapped areas), and greatly reduces, if not eliminates, the retention of LWD once it enters the river channel. Riprapping creates a relatively clean, smooth surface which diminishes the ability of LWD to become securely snagged and anchored by sediment. LWD tends to become only temporarily snagged along riprap, and generally moves downstream with subsequent high flows. Habitat value and ecological functioning aspects are thus greatly reduced, because wood needs to remain in place to generate maximum values to fish and wildlife. Recruitment of LWD is limited to any eventual, long-term tree mortality and whatever abrasion and breakage may occur during high flows. Juvenile salmonids are likely being impacted by reductions, fragmentation, and general lack of connectedness of remaining near shore refuge areas.

Point and non-point sources of pollution resulting from agricultural discharge and urban and industrial development occur upstream of, and within the action area. The effects of these impacts are discussed in detail in the *Rangewide Status of the Species and Critical Habitat* section. Environmental stressors as a result of low water quality can lower reproductive success and may account for low productivity rates in fish (*e.g.* green sturgeon, Klimley 2002). Organic contaminants from agricultural drain water, urban and agricultural runoff from storm events, and high trace element (*i.e.* heavy metals) concentrations may deleteriously affect early life-stage survival of fish in the Sacramento River (USFWS 1995). Principle sources of organic contamination in the Sacramento River are rice field discharges from Butte Slough, Reclamation District 108, Colusa Basin Drain, Sacramento Slough, and Jack Slough (USFWS 1995). Other impacts to adult migration present in the action area, such as migration barriers, water conveyance factors, water quality, NIS, *etc.*, are discussed in the *Rangewide Status of the Species and Critical Habitat* section.

As previously stated in the *Rangewide Status of the Species and Critical Habitat* section, the transformation of the Sacramento River from a meandering waterway lined with a dense riparian corridor, to a highly leveed system under varying degrees of control over riverine erosional processes resulted in homogenization of the river, including effects to the rivers sinuosity. These impacts likely included the removal of valuable pools and holding habitat for SDPS green sturgeon. In addition, the change in the ecosystem as a result of the removal of riparian vegetation and LWD likely reduce access to floodplain and offchannel rearing habitat, reduced the quantity and quality of benthic habitat and reduced the abundance prey items rearing, foraging and holding habitat. A major factor in the decline of sDPS green sturgeon, and the primary reason for listing this species, was the alteration of its adult spawning and larval rearing habitat in California's Sacramento River Basin (71 FR 17757, April 7, 2006).

2.4 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (in this case there are no interrelated or interdependent actions), that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

To evaluate the effects of the Common Features GRR, NMFS examined the potential proposed actions in the designated action areas. We analyzed construction-related impacts and the expected short- and long-term fish response to habitat modifications using the SAM. We also reviewed and considered the Corps proposed conservation measures. This assessment relied heavily on the information from the Corps BA developed for the Common Features GRR, and available monitoring data from other CV fish studies.

In general, the footprint for the Common Features Project consists of the flood risk management system protecting the city of Sacramento and surrounding areas. This will include structure upgrades, levee deconstruction, and adjacent staging areas. The continued existence of any new or improved flood management structures, associated critical habitat disturbance, vegetation removal, and operational aspects may adversely affect several life stages of CV spring-run Chinook salmon, CCV steelhead, Sacramento River winter-run Chinook salmon, and the sDPS of SDPS green sturgeon in the action area.

The assessment will consider the nature, duration, and extent of the potential actions relative to the migration timing, behavior, and habitat requirements of federally listed CV spring-run Chinook salmon, CCV steelhead, Sacramento River winter-run Chinook salmon, and sDPS of SDPS green sturgeon. Specifically, this assessment will consider the potential impacts resulting from the construction and subsequent O&M activites. Effects of the Common Features Project on aquatic resources include both short- and long-term impacts. Short-term effects, which are related primarily to construction activities (*i.e.*, increased suspended sediment and turbidity), may last several hours to several weeks. Long-term impacts may last months or years and generally involve physical alteration of the river bank and riparian vegetation adjacent to the water's edge.

The Common Features Project construction activities may increase noise, turbidity, suspended sediment, and sediment deposition that may disrupt feeding or temporarily displace fish from preferred habitat or impair normal behavior. Construction activities will also introduce rip rap material into the water column that may injure, harm, or kill listed fish. Some of these effects may occur downstream of the construction activities because noise and sediment may be propagated downstream. Substantial increases in suspended sediment could temporarily bury substrates and submerged aquatic vegetation that supports invertebrates for feeding juvenile fish.

The bank armoring and some of the levee repairs will also contribute to the continued confinement of the riverine system that in turn negatively impacts listed fish species and their designated critical habitat. Even with an ETL variance in place, adopting the ETL as part of the proposed project may have long-term impacts to critical habitat and listed species. Additionally, despite the assumption of a variance, there are uncertainties as to the subsequent O&M activities and their impacts.

Since specific project designs were not available at the time of this analysis, impacts are characterized using "worst case scenario" assumptions. With-project conditions were assumed to be analogous a typical SRBPP repair site (bank armoring paired with onsite restoration features including a planted riparian bench and installed IWM). A Vegetation Variance Request (VVR) was assumed to be in place. Project actions along the Sacramento Bypass and weir reaches, including slurry wall construction, slope stabilization, and levee raises, weir repair, and levee construction were assumed to result in removal of all woody and herbaceous vegetation and armoring of both summer-fall and winter-spring shorelines.

The Common Features project reach will be implemented in increments. The timing of each project sub-reach (Table 4) is based on the proposed schedule provided in the BA (USACE 2015). Some of the project increments will be of varying length, thereby impacting the subsequent analysis.

2.4.1 Construction Related Effects

NMFS expects that adult and juvenile CCV steelhead, adult winter-run Chinook salmon, adult spring-run Chinook salmon, and adult and juvenile green sturgeon may be present in the action area (although in low numbers because the construction window avoids periods of peak abundance) during construction activities. Only those fish that are holding adjacent to or migrating past the project sites will be directly exposed or affected by construction activities. Those fish that are exposed to the effects of construction activities will encounter short-term (*i.e.*, minutes to hours) construction-related noise, physical disturbance, and water quality changes that may cause injury or harm by increasing the susceptibility of some individuals to predation by temporarily disrupting normal behaviors, and affecting sheltering abilities. If an adult salmonid were to enter the action area, they will likely exhibit avoidance behavior in response to construction and associated activities.

Larger fish will likely respond to construction activities by quickly swimming away from the construction sites, and will escape injury. Toxic substances used at construction sites, including gasoline, lubricants, and other petroleum-based products could enter the waterway as a result of spills or leakage from machinery and injure listed salmonids, and green sturgeon. Petroleum products also tend to form oily films on the water surface that can reduce DO available to aquatic organisms. NMFS expects that adherence to BMPs that dictate the use, containment, and cleanup of contaminants will minimize the risk of introducing such products to the waterway.

Green sturgeon move to estuaries and the lower reaches of rivers between late winter and early summer, and ascend rivers to spawn in the spring and early summer. Adult green sturgeon may leave the rivers soon after spawning or hold in the river through the fall or winter (Heublein et al. 2009). Movement and foraging during downstream migration occurs at night for both larvae (approximately 10 days post-hatch) and juveniles (73 FR 52084; Cech *et al*. 2000, as cited in Reclamation 2008). Juvenile emigration reportedly occurs from May through September. Juveniles will experience the greatest exposure to construction activities.

Direct effects are defined as "the direct or immediate effects of the Proposed Action on the species or its habitat" (USFWS and NMFS, March 1998). Direct effects associated with in-river construction work will involve equipment and activities that will produce pressure waves, and create underwater noise and vibration, thereby temporarily altering in-river conditions.

Any increases in turbidity will most likely disrupt feeding and migratory behavior activities of juvenile salmonids (which CCV juvenile Steelhead have a high likely hood of being present).though their abundance is expected to be low). Turbidity and sedimentation events are not expected to affect visual feeding success of green sturgeon, as they are not believed to utilize visual cues (Sillman *et al.* 2005). Green sturgeon, which can occupy waters containing variable levels of suspended sediment and thus turbidity, are not expected to be impacted by the slight increase in the turbidity levels anticipated from the pile driving action as explained above. The construction activities are unlikely to impact any deepwater areas where the species spawn and hold.

NMFS expects that actual physical damage or harassment to listed fish species will be low during the months of construction. Adults will not sustain any physical damage due to construction because their size, preference for deep water, and their crepuscular migratory behavior will enable them to avoid most temporary, nearshore disturbance that occurs during typical daylight construction hours.

2.4.2 Standard Assessment Methodology Analysis

Common Features Project impacts were analyzed using SAM. The Corps provided the background data, assumptions, analyses, and assessment of habitat compensation requirements for the federally protected fish species relevant to this consultation. The Corps also included analysis for fall-run and late-fall run Chinook salmon.

The Sacramento River SAM analysis reach includes the entire left bank (east side) of the Sacramento River from the American River confluence to approximately 4,020 linear feet (lf) below the Freeport Bridge. The American River SAM analysis (ARN A-B and ARS A-C) reaches include portions of the right and left bank of the American River from Goethe Park to the confluence of the Sacramento. It also includes portions of NEMDC, Arcade Creek, Magpie Creek, and Dry/Robla Creek.

As described in the *Analytical* Approach section of the BO, during the process of this consultation, the Corps and NMFS identified several short comings with the SAM as a tool for reliably forecasting the growth and survival of green sturgeon. The primary short coming is that the SAM evaluates habitat conditions at the seasonal water surface intersect with the river bank. While this is considered an effective point for measuring salmon and steelhead habitat, green sturgeon have a greater affinity for benthic habitat than shoreline habitat. Further, during discussions between the Corps and NMFS, it was widely agreed upon that levee repair actions in the West Sacramento Study Area are likely to only affect the juvenile rearing life stage and probably have little to no adverse impacts on the adult life stages of green sturgeon because spawning habitat is not present and adults that are migrating upstream are probably more influenced by impacts that affect swimming speed and upstream passage than shoreline habitat manipulations. Because of this, NMFS has decided to use the SAM as a temporary proxy for quantifying habitat disturbance and harm that will ultimately be replaced by a more precise model as proposed by the Corps in the *Proposed Action* section of this BO.

The following data sources were used to characterize SAM habitat conditions (as defined by bank slope, floodplain availability, substrate size, instream structure, aquatic vegetation, and overhanging shade) within the Common Features Project area under baseline conditions:

1. The Corps' Sacramento River revetment database.
2. Aerial images of the Common Features Project reach (Google™ Earth).

The SAM employs six habitat variables to characterize near-shore and floodplain habitats of listed fish species:

1. Bank slope;
2. Floodplain availability;
3. Bank substrate size;
4. Instream structure;
5. Aquatic vegetation; and
6. Overhanging shade.

The following describes how input values for each of these attributes were derived for existing conditions in the SAM assessment.

1. **Bank Slope:** Existing bank slopes (rise-over-run ratio) were extrapolated from cross sections along the Sacramento River and existing SAM analyses performed on regionally analogous sites. Bank slope along all sub-reaches was assumed to be 2.5 for existing conditions.

2. **Floodplain Availability:** The SAM attribute of floodplain inundation ratio, which represents floodplain availability, was assumed to have a value of 1, reflecting the absence of significant floodplain habitat above the winter-spring shoreline under existing conditions.

3. **Bank Substrate Size:** The median substrate size along the summer-fall and winter-spring shorelines of the project reach was determined by referencing the Revetment Database (USACE 2004) and current and historical aerial images.

4. **Instream Structure:** The shoreline coverage of IWM along the average summer-fall and winter-spring shorelines of the Common Features project reach were determined by referencing the revetment database (USACE 2004). The revetment database uses four classes of instream structure, based on ranges of percent shoreline having IWM.

5. **Overhanging Shade:** The extent of overhanging shade along the summer-fall and winter-spring shorelines was determined through analysis of current and historic aerial images. Summer-fall conditions were analyzed using imagery from late summer and early fall months, typically representative of low water conditions. Winter-spring conditions were analyzes using imagery from late winter and early spring months, typically representative of high water conditions.

The following describes how input values for each of the SAM habitat attributes were derived for with-project conditions:

1. **Bank Slope:** With-project bank slopes (rise-over-run ratio) were based on the description of project actions for each sub-reach. Bank slopes for the SAC sub-reach were assumed to be analogous to SRBPP repair sites.

2. **Floodplain Availability:** Levee repair and bank stabilization actions typically do not increase floodplain availability (with exception of constructing setback levees). The Common Features project reaches being analyzed under this SAM do not include construction of any setback levees; therefore, the SAM attribute of floodplain inundation ratio, which represents floodplain availability, was assumed to lack significant floodplain habitat above the winter-spring shoreline under existing conditions.

3. **Bank Substrate Size:** The median substrate size along the summer-fall and winter-spring shorelines of the project reach were based on the description of project actions

for each reach. Bank substrate size along the Sacramento River reach was assumed to be analogous to SRBPP repair sites. Project actions at all other sub-reaches were expected to result in placement of 10 inch rock revetment along both summer-fall and winter-spring shorelines.

4. **Instream Structure:** The shoreline coverage of IWM along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. IWM coverage along the SAC sub-reach was assumed to be analogous to SRBPP repair sites (installation of 40 percent shoreline coverage at summer-fall shoreline). Project actions at all other sub-reaches were not expected to result in a change in available IWM along both summer-fall and winter-spring shorelines; IWM values for these sub-reaches will mirror existing condition values.

5. **Aquatic Vegetation:** The shoreline coverage of aquatic vegetation along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Aquatic vegetation along the Sacramento River was assumed to be analogous to SRBPP repair sites. The vegetation growth model below that was applied to the Sacramento River was taken from a previous SAM analysis conducted for Sacramento RM 62.5R (USACE 2008).

6. **Overhanging Shade:** The shoreline coverage of overhanging shade along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Overhanging shade along the Sacramento River was assumed to be analogous to SRBPP repair sites. It was assumed that a variance will be in place allowing for retention of woody vegetation along the lower 2/3 of the levee slope (applies to Sacramento River only). As the result of constructing a planted bench, it was assumed that the with-project seasonal shoreline will be shifted away from the existing shade providing canopy. Under this assumption, existing summer-fall values for overhanging shade were taken as the starting point for with-project winter-spring conditions. The with-project winter-spring values were further reduced by 75 percent (winter) and 25 percent (spring) to account for defoliation. As a final step, these winter-spring values were reduced by 20 percent to account for trees removed for construction equipment access. With-project overhanging shade values were expected to start at 0 percent as the result of a constructed bench shifting the shoreline away from the existing canopy. The shade growth model used was taken from a previous SAM analysis conducted for Sacramento RM 62.5R (USACE 2008).

Project actions at all other sub-reaches were expected to result in a complete removal of woody vegetation without revegetation efforts. For these sub-reaches, a value of 0 percent shoreline coverage of overhanging shade was applied throughout the life of the project along both summer-fall and winter-spring shorelines.

For more information on the SAM analysis and inputs, refer to the Appendix A.

2.4.3 SAM Results

The SAM results presented below and in Table 10, 11, and 12 are based on a "worst case scenario" analysis, as developed by the Corps. Table 10 and 11 show negative WRI values, but there are several areas where the action will result in improved conditions for salmon and steelhead. These are discussed below, and are summarized in Appendix A table 26, 27, and 28. The with-project conditions for the focus fish species and life stages were evaluated over a 50-year assessment timeline with baseline habitat values for each species and life stage described by pre-project conditions. Biological responses of each focus fish species life stage and average seasonal water surface elevation were predicted within each habitat unit and for each time step, based on habitat variable values and fish residency determined from region-specific timing tables (USACE 2012b). This analysis automatically includes or excludes particular life stages of the focus fish by assessing the river mile locations of each bank repair site, with the encoded timing tables. In general, as calculated, positive differences between the existing and with-project responses are considered to result in improved growth and survival for the focus fish species (*i.e.*, the bank repair action produced superior conditions than pre-project conditions). Negative values indicate the bank repair actions produced inferior conditions when compared with pre-project conditions and reduced growth and survival over a 30 day exposure period. In almost all cases, regardless of the integrated conservation and compensation measures (*i.e.*, installation of IWM, planting riparian habitat, and construction of engineered floodplain) there is a short-term temporal negative habitat impact associated with many of the bank repair activities, mainly because new levee configurations move the river bank away from existing, protected riparian vegetation and because it takes several years for newly planted riparian vegetation to growth out over the river channel and create overhanging shade and other benefits to aquatic habitat such as a source of macroinvertebrate production.

American River

NMFS reviewed the SAM results provided by the Corps. Details of the SAM results can be found Appendix A of this document. This includes tables and graphs of the SAM results from year 0 (beginning of construction) to year 50. Tables 10, 11, and 12 summarize all negative Common Features Project SAM WRI values for Chinook salmon, steelhead, and green sturgeon. It is important to note that when interpreting SAM results, year 0 refers to the year of construction.

Summary of CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead and sDPS green sturgeon effects by water surface elevation per location:

Common Features American River North Reaches A and B:

At fall water surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effects are greatest in the first 3 to 5 years for each species at -366 WRI, -712, and -5577, respectively.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effect is greatest at -2303 WRI.

The SAM displays reduced survival of adult migrating CCV steelhead is expected for up to 48 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effect is greatest at -1554 WRI and exceeds baseline following year 48 to a maximum increase benefit of 8 WRI.

At winter surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring-run Chinook salmon is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size reaching a maximum of 1,102 WRI. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO.

Reduced growth and survival of fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effects are greatest at -36 WRI for steelhead in the first year and the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected. After year one, survival and growth values improve to 1507 for CCV steelhead. The adverse effects to sDPS green sturgeon are greatest at -5020 and are expected to extend past 50 years.

Reduced growth and survival of migrating (smolts) CV spring-run Chinook salmon is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects are greatest at -3,002 WRI. At year 2, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 1,699 WRI.

The SAM displays reduced survival of adult migrating CCV steelhead for up to 5 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effect is greatest at -1554 WRI. At year 5, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 460 WRI.

Reduced survival of adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The adverse effect is greatest at -1,558 and -3,621 WRI, respectively. At year 5 for CCV steelhead, the SAM modeled habitat conditions exceed baseline conditions and improves growth and survival conditions are expected, reaching 460 WRI.

At spring water surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring-run Chinook salmon occurs after any construction activities by the first year and reaching a maximum of 1354 WRI. Increased growth and survival of fry and juvenile are expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO.

Reduced growth and survival of fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts to riparian habitat IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects are greatest at -2681 and -5020, respectively. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1418 WRI. The adverse effects to sDPS green sturgeon are greatest at -5020 WRI and are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon and CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects are greatest at -3129 and -2096 WRI, respectively. At year 4, for CV spring-run Chinook salmon, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 1,699 WRI. At year 2, for CCV steelhead, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 1173 WRI.

The SAM displays reduced survival of adult migrating CCV steelhead after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effect is greatest at -1635 WRI. At year 6, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 407 WRI.

Reduced survival of adult resident CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO.

The adverse effects are greatest at -1635 WRI for CCV steelhead in the first six years and the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected. After six years, survival and growth values improve to 407 for CCV steelhead.

At summer surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects are greatest for each species at -421 WRI, -833, and -7118, respectively.

Reduced growth and survival of juvenile migrating (smolts) of CV spring-run Chinook salmon and CCV steelhead are expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these adverse effects are quantified in the SAM in table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects are greatest at -3,129 and -3013 WRI, respectively.

Reduced survival of adult resident CV steelhead is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The adverse effects on the species are greatest at -3061 WRI, and -942, respectively.

American River South Bank sites A, B, and C

At fall surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected after any construction activities due to impacts riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The adverse effects are greatest for each species at -229 WRI, -489, and -2154, respectively. At year 26 for CV spring run Chinook salmon and year 36 for CCV steelhead, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 112 WRI and 88, respectively. The adverse effects to sDPS green sturgeon are greatest at -2154 and are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring run Chinook salmon is expected after any construction due to impacts riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The adverse effect is greatest at -620 WRI. After year 21, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected reaching a maximum of 526 WRI.

The SAM displays increased survival of adult migrating CV steelhead after construction activities due to impacts), IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The increased benefit maximizes at 3696 of WRI.

Increased survival of adult resident CCV steelhead is expected after construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The maximum increase benefit is for the species is 3696 and WRI and 1548, respectively.

At winter water surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring run Chinook salmon occurs after any construction activities by the first year and reaching a maximum of 1578 WRI. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO.

Reduced growth and survival of fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts to riparian habitat IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The adverse effects are greatest at – 489 WRI and – 876, respectively. At year 36, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 88 WRI. At year one, the SAM modeled habitat conditions for sDPS green sturgeon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 2941 WRI.

Increased growth and survival of juvenile migrating (smolts) CV spring run Chinook salmon is expected to occur after construction activities due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The maximum increase benefit for this species is 5377 WRI.

The SAM displays increased survival of adult migrating CCV steelhead after construction activities due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The increased benefit maximizes at 4015.

Increased survival of adult resident CV steelhead is expected to occur after construction activities, the maximum increase benefit for this species is 4015 WRI.

At spring water surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring run Chinook salmon and CCV steelhead occurs starting at year 0 and increased to the maximum above baseline scores of 2,100 and 2,601 WRI, respectively. Reduced growth and survival of fry and juvenile rearing sDPS green sturgeon is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The greatest adverse effect is at -876 WRI. At year 1, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 2,941 WRI.

Increased growth and survival of juvenile migrating (smolts) CV spring run Chinook salmon and CV steelhead is expected due to impacts on riparian habitat, IWM, and bank substrate size. The greatest effects for each species is 5123 WRI and 4061 WRI respectively. The amount and extent of this potential effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO.

The SAM displays increased survival of adult migrating CCV steelhead after the first year of construction due to impacts on riparian habitat, IWM, and bank substrate size the amount and extent of this potential effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The maximum benefit is 4164 WRI.

Increased survival of resident CCV steelhead occurs starting at year 0 and increased to above baseline 4164 WRI due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO.

Increased survival of adult resident CV steelhead is expected to occur after construction activities, the maximum increase benefit for this species is 4015 WRI.

At summer water surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The adverse effects are greatest at – 239, -512, and – 2496 WRI, respectively. At year 26, the SAM modeled habitat conditions for CV spring run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 111 WRI. At approximately year 6, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 64 WRI. The adverse effects to sDPS green sturgeon are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring run Chinook salmon and CCV steelhead are expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The adverse effects are greatest at -967 and -722 WRI, respectively. At year 22, the SAM modeled habitat conditions for CV spring run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 510 WRI. At year 25, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 583 WRI.

Increased survival of adult resident CCV steelhead is expected after construction activities due to impacts on riparian habitat, IWM, and bank substrate size, with maximum benefits of 3616 and 1537 WRI, respectively. The amount and extent of this effect is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO.

Project actions along portions of the American River reach will likely not include bank armoring in their final design, which will significantly reduce estimated impacts to fish species. Additional compensatory mitigation design features or improved erosion repair designs may result in reduced impact compared to the legacy designs used for the basis of this analysis. Site specific designs will be implemented on a site by site basis in consultation with resource agencies and project partners to minimize impacts as well as maximize opportunities for implementing onsite compensatory mitigation features.

The Corps has proposed to offset the effects with onsite and offsite compensation. During project implementation, site specific SAM analyses will be run on final designs to better evaluate these effects. These offsets are likely to improve growth and survival of Chinook salmon and steelhead at higher value habitats in the Delta and along their primary migration corridor of the Sacramento and American Rivers, and spawning and rearing areas along the American River.

Sacramento River Sites D,E,F, and G

At fall water surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. Reduced growth and survival of fry and juvenile rearing sDPS green sturgeon is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest adverse effects for the salmonids are -558 WRI, -1156, and -558 WRI respectively. The SAM modeled habitat conditions exceed baseline conditions and improve growth and survival is expected in year 35, 44, and 35, respectively with maximum values reaching 116, 99, and 116 WRI, respectively. The adverse effects to sDPS green sturgeon are greatest at -4674 WRI and are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these adverse effects are quantified in the SAM analysis table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest at -3845 WRI, -3985, and -3845, respectively.

The SAM displays reduced survival of adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and the extent of these potential effects is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest adverse effects for the salmonids are -1394 WRI, -2053, and 1394, respectively. The SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected at years 35, 29, and 35 respectively. After these years, survival and growth values improve to 362, WRI, 832, and 362 WRI, respectively.

Reduced survival of adult resident CCV steelhead after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effect is greatest at -2053 WRI and exceeds baseline following year 29, where adult resident survival increases to a maximum value of 832 WRI.

At winter surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring run Chinook salmon and Sacramento River winter-run Chinook salmon occurs after any construction activities by the first year and reaching a maximum of 2390 WRI for both species. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO.

Reduced growth and survival of fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest at -77 and -4397, respectively. At year 1, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 3234 WRI. The adverse effects to sDPS green sturgeon are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CCV spring run Chinook salmon, CCV steelhead, and CV winter run is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -3451 WRI, -3044, and -3451, respectively. At year two, the SAM modeled habitat conditions for CV spring run Chinook salmon and Sacramento River winter-run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4794 WRI for both species. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 3355 WRI.

The SAM displays reduced survival of adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon are expected to occur after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -892 WRI, -1747, and -892 WRI, respectively. At year 4, the SAM modeled habitat conditions for CV spring run Chinook salmon and CV winter run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 643 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1455 WRI.

Reduced survival of adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -1801 WRI, and -3068, respectively. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

At spring water surface elevations:

Increased growth and survival of fry and juvenile rearing CV spring run and winter-run Chinook salmon occurs after any construction activities by the first year and reaching a maximum of 3445 WRI. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO.

Reduced growth and survival of fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest at -36 WRI and -4397, respectively. At year 1, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4317 WRI. The adverse effects to sDPS green sturgeon are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CCV spring run Chinook salmon, CCV steelhead, and CV winter run is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -3484 WRI, -3082, and -3484, respectively. At year 2, the SAM modeled habitat conditions for CV spring run Chinook salmon and Sacramento River winter-run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4862 WRI for both species. At year three, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 3474 WRI.

The SAM displays reduced survival of adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon are expected to occur after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this potential effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -946 WRI, -1801, and -

946 WRI, respectively. At year 4, the SAM modeled habitat conditions for CV spring run Chinook salmon and CV winter run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 931 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

Reduced survival of adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -1801 WRI, and -3068, respectively. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

At summer water surface elevations:

Reduced growth and survival of fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. Reduced growth and survival of fry and juvenile rearing sDPS green sturgeon is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the salmonids are -578 WRI, -1206, and -578 WRI respectively. The SAM modeled habitat conditions exceed baseline conditions and improve growth and survival is expected in years 36, 45, and 36, respectively, with maximum increased WRI values of 113, 92, and 113. The adverse effects to sDPS green sturgeon are greatest at -5009 WRI and are expected to extend past 50 years.

Reduced growth and survival of juvenile migrating (smolts) CCV spring run Chinook is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse of these adverse effects are quantified in the SAM analysis table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest at -4258 WRI.

The SAM displays reduced survival of adult migrating CV spring run Chinook salmon, CV steelhead, and Sacramento River winter-run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and the extent of these potential effects is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest adverse effects for these species are -2136 WRI, -3793, and -2136 WRI, respectively. The SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected at years 37, 32, and 37 respectively. After these years, survival and growth values improve to 319 WRI, 748, and 319 WRI, respectively.

Reduced survival of adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this effect is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The adverse effects are greatest for the species at -3793 WRI, and -1298, respectively. At year

32, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 748 WRI.

Effects at the Sacramento Weir and Bypass

Bypass flooding may affect juvenile fish in two different manners: (1) stranding (and killing) of juvenile fish in the widened bypass is possible on the declining limb of flood flows when weir operations cease after a flood event, and (2) increasing floodplain inundation area and increasing juvenile growth and survival. Sommer *et. al.* (2001), have demonstrated that the Yolo Bypass, the primary floodplain of the lower Sacramento River, provides better rearing and migration habitat for juvenile chinook salmon (*Oncorhynchus tshawytscha*) than adjacent river channels. We expect that due to the proximity of the Sacramento Bypass to the Yolo Bypass, the fact that the Sacramento Bypass flows into the Yolo Bypass and similar floodplain conditions in both bypasses, that similar growth and survival conditions would be expected. Both effects are expected to occur approximately once every ten years when the river reaches an elevation of 27.5 feet at the I Street gage with a forecast to continue rising. The duration of bypass inundation is highly variable depending of the magnitude and duration of flood events. After a flood event, weir gates are typically closed as rapidly as practicable once the stage at the weir drops below 25 feet. This provides "flushing" flows to re-suspend sediment deposited in the Sacramento River between the Sacramento Weir and the American River during the low flow periods when the weir is open during the peak of the flood event Baseline stranding and growth levels are not known and it is difficult to predict specific stranding rates with a widened bypass, however, the Corps proposes to grade new and existing bypass features to drain in a manner that reduce juvenile stranding.

Interruption of upstream passage of adult salmonids and sturgeon along the Sacramento weir and stranding within the bypass may occur due to the declining hydrograph as a result of the widening of the bypass. This is also expected to occur once every ten years following the spilling of river water and as the flood flows recede. Stranding in the Sacramento Bypass and blocked upstream passage may not occur however, with the implemented conservation measures as outlined in the project description and may in fact improve passage conditions currently found at the Sacramento weir and bypass and reduce current stranding rates.

Migrating green sturgeon in the lower portion of the Sacramento River become stranded during high flow events in flood control weirs and bypasses. In April 2011, 24 threatened green sturgeon were stranded in two flood diversions along the Sacramento River. Modeling and research suggests that recurrent stranding of a similar magnitude without rescue could affect the long-term viability of Green Sturgeon (Thomas et. al., 2013). With the widening of the Sacramento Weir for increased flow capacity during high flow events, there is a potential to maintain or increase stranding of adults behind the weir individuals if no passage criteria are included within the weir design. However, as stated in the conservation measures as outlines in the Proposed Action section of this BO, the Corps also will work with local cost share sponsors to ensure GRR-related future flood risk reduction actions related to widening the Sacramento Weir shall fully mitigate upstream and downstream fish passage effects at the weir and within the spillway basin. The goal is to ensure that adult CV spring-run and Sacramento River inter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are able to migrate upstream while the weir is spilling into the bypass and that juvenile stranding in the spillway basin is minimized to the maximum extent possible. These measures are expected to reduce juvenile and adult stranding in the bypass and provide long-term benefits through improved growth and survival of juveniles and improved survival of adults.

Implementation of the Corps proposed Green Sturgeon Conservation Measures

The implementation of the Corp's Green Sturgeon Conservation Measures will serve several purposes to address scientific uncertainty about the species in the study area and to provide compensatory mitigation for the adverse effects related to shoreline and benthic habitat impacts. The HMMP with ensure that adverse impacts of future West Sacramento projects are sufficiently compensated in order to allow for the growth, survival and recovery of the species in the study area. Coordination of the HMMP with the IEP will leverage green sturgeon scientific expertise to ensure selected mitigation actions fully address the micro- and macro-ecological and survival needs of the species in the study area. Refinement of the SAM or development of alternative green sturgeon survival and response model using the Corps' Hydrologic Ecosystem Function Model, in consultation with NMFS and the IEP, will result in new modeling capacity that more accurately evaluates adverse project actions and the beneficial effects of mitigation actions relative to the growth and survival of green sturgeon in the study area. Restoring and compensating for the number of acres and ecological function of impacted benthic habitat and the initiation of this compensatory mitigation in the study area prior to the commencement of levee construction will reduce the impact of levee construction actions. The development of SMART compensatory mitigation objectives will ensure that all of the ecological impacts of levee construction actions are fully addressed.

2.4.4 Project Effects on Critical Habitat

For CV spring-run Chinook salmon and steelhead, the project generally will have short term impacts on the freshwater rearing and freshwater rearing PCEs of critical habitat. For winter-run Chinook salmon, and for winter-run Chinook salmon impacted essential features of critical habitat that will be affect include the river water, river bottom, and adjacent riparian zone used by fry and juveniles for rearing. The SAM model, which models fish response, also serves as a good proxy for measuring impact to these species critical habitat because it the model evaluates changes to important attributes of PCEs and essential features including overhanging shade, substrate size, instream woody material, bank slope and instream aquatic vegetation. The changes to these features are recognized in Table 10, 11 and 12 below. In general, impacts to critical habitat will generally last between 1 and 10 years, and in almost all cases they improve each year and eventually exceed baseline conditions over the life of the project. For these reasons, we do not expect the proposed action to reduce the conservation value of the critical habitat.

Because the proposed action occurs along the lower Sacramento River at the convergence of the north Delta, the action area includes both freshwater and estuarine habitat types. For green sturgeon, this means there are freshwater and estuarine including:

Freshwater

a) Food resources. Abundant prey items for larval, juvenile, subadult, and adult life stages.
b) Substrate type or size (*i.e*., structural features of substrates). Substrates suitable for egg deposition and development (*e.g.*, bedrock sills and shelves, cobble and gravel, or hard clean sand, with interstices or irregular surfaces to "collect" eggs and provide protection from predators, and free of excessive silt and debris that could smother eggs during incubation), larval development (*e.g.*, substrates with interstices or voids providing refuge from predators and from high flow conditions), and feeding of juveniles, subadults, and adults (*e.g.*, sand/mud substrates).

Estuarine

a) Food resources. Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.

NMFS estimates that approximately 20 acres of soft substrate habitat below the ordinary high water mark will be permanently lost to rock revetment. This number was calculated by using the provided linear feet in reaches C, D, E, F, and G in Table 4 and multiplying it by 15 feet which is the length of the distance revetment is placed from the bank into the river. This is a conceptual estimate that will be further refined during the preliminary engineering design (PED) phase before construction begins. This loss of habitat is expected to adversely affect benthic substrate and impair food resources for all life stages; and the quantity of sediment to allow for normal physiological and behavioral responses to the environment. Similar to salmon and steelhead, the SAM serves as a reasonable proxy for measuring impacts to critical habitat. For most life stages and season water surface elevations, the SAM show immediate adverse effects that continue to decline for the life of the project. However, the Corps' Green Sturgeon Conservation Measures will reduce the impact on critical habitat by providing compensatory mitigation within the action area. Specifically, the HMMP shall also restore or compensate for the number of acres and ecological function of soft bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. This compensation will be carried out within the lower Sacramento River/North Delta in order to offset the adverse modification to designated critical habitat. The restored habitat will be capable of providing abundant benthic prey, freshwater or estuarine areas with adequate water quality, temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth and viability of all life stages. It will also provide safe and unobstructed migratory pathways necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats.

Table 10. American River North Portion (ARN_AB) of the Common Feathers GRR Project Maximum SAM Modelled WRI Deficits and Duration of Deficits by Species, Life-Stage, and Season.

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	2	1,699
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	4	1,699
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-877	39	59
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	-759	5	245
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	4	1,699
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	3	1,418
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Steelhead				
Fall	Adult Migration	-1,554	48	8
	Fry and Juvenile Rearing	-712	50	0
	Juvenile Migration	***	***	***
	Adult Residence	-1,554	48	8
Winter	Adult Migration	-1,558	5	460
	Fry and Juvenile Rearing	-36	1	1,507

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Juvenile Migration	***	***	***
	Adult Residence	-1,558	5	460
Spring	Adult Migration	-1,635	6	407
	Fry and Juvenile Rearing	-1	1	1,731
	Juvenile Migration	-2,096	2	1,173
	Adult Residence	-1,635	6	407
Summer	Fry and Juvenile Rearing	-833	50	0
	Juvenile Migration	-3,013	50	0
	Adult Residence	-3,061	50	0
Green Sturgeon				
Fall	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-5,677	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
Winter	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
Spring	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
Summer	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-7,118	0	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.
*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 11. American River South Portion (ARS_ABC) of the Common Features GRR Project Maximum SAM modelled WRI Deficits and Duration of Deficits by Species, Life-Stage, and Season.

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	2,001
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Fall-Run Chinook Salmon				
Fall	Adult Migration	0	0	1,860
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	0	0	1,937
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	965
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Steelhead				
Fall	Adult Migration	0	0	3,696
	Fry and Juvenile Rearing	-489	36	88
	Juvenile Migration	***	***	***
	Adult Residence	0	0	3,696
Winter	Adult Migration	0	0	4,015
	Fry and Juvenile Rearing	0	0	2,194

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Juvenile Migration	***	***	***
	Adult Residence	0	0	4,015
Spring	Adult Migration	0	0	4,164
	Fry and Juvenile Rearing	0	0	2,601
	Juvenile Migration	0	0	4,061
	Adult Residence	0	0	4,164
Green Sturgeon				
Fall	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-2,154	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
Winter	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
Spring	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	-2,917	50	0
Summer	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-2,496	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.

*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 12. Sacramento River Portion (ARS_DEFG) portion of the Common Feathers GRR Project Maximum SAM Modelled WRI Deficits and Duration of Deficits by Species, Life-Stage, and Season.

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Late-Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
Summer	Fry and Juvenile Rearing	-578	36	113
Winter-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
Steelhead				
Fall	Adult Migration	-2,053	29	832
	Fry and Juvenile Rearing	-1,156	44	99
	Juvenile Migration	-3,985	50	0
	Adult Residence	-2,053	29	832
Winter	Adult Migration	-1,747	3	1,455
	Fry and Juvenile Rearing	-77	1	3,234
	Juvenile Migration	-3,044	3	3,355
	Adult Residence	-1,747	3	1,455
Spring	Adult Migration	-1,801	3	1,757
	Fry and Juvenile Rearing	-36	1	4,317
	Juvenile Migration	-3,082	3	3,474
	Adult Residence	-1,801	3	1,757
Summer	Adult Migration	-3,793	32	748
	Fry and Juvenile Rearing	-1,206	45	92
	Adult Residence	-3,793	32	748

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
sDPS Green Sturgeon				
Fall	Fry and Juvenile Rearing	-4,674	50	0
	Juvenile Migration	0	0	0
Winter	Adult Migration	NA	NA	NA
	Fry and Juvenile Rearing	-4,397	50	0
	Adult Residence	NA	NA	NA
Spring	Fry and Juvenile Rearing	-4,397	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA
	Adult Migration	NA	NA	NA
Summer	Fry and Juvenile Rearing	-5,009	50	0
	Juvenile Migration	0	0	0
	Adult Residence	NA	NA	NA

* Not applicable because adult fall-run Chinook salmon migrate in early fall.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

2.5.1 Water Diversions and Agricultural Practices

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands are found along the Common Features GRR action area. Depending on the size, location, and season of operation, these unscreened diversions entrain and kill many life stages of aquatic species, including juvenile listed anadromous species. For example, as of 1997, 98.5 percent of the 3,356 diversions included in a CV database were either unscreened or screened insufficiently to prevent fish entrainment (Herren and Kawasaki 2001).

Agricultural practices in the action area may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonid and sDPS green sturgeon reproductive success and survival rates (Dubrovsky *et al.* 1998, 2000; Daughton 2003).

2.5.2 Aquaculture and Fish Hatcheries

More than 32-million fall-run Chinook salmon, 2-million spring-run Chinook salmon, 1-million late fall-run Chinook salmon, 0.25-million winter-run Chinook salmon, and 2-million steelhead are released annually from six hatcheries producing anadromous salmonids in the CV. All of these facilities are currently operated to mitigate for natural habits that have already been permanently lost as a result of dam construction. The loss of this available habitat results in dramatic reductions in natural population abundance which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations. The high level of hatchery production in the CV can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources between hatchery and wild fish, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production. Impacts of hatchery fish can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler *et al.* 1996). Ocean events cannot be predicted with a high degree of certainty at this time. Until good predictive models are developed, there will be years when hatchery production may be in excess of the marine carrying capacity, placing depressed natural fish at a disadvantage by directly inhibiting their opportunity to recover (NPCC 2003).

2.5.3 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This in turn will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.5.4 Global Climate Change

The world is about 1.3°F warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (IPCC 2001). Much of that increase likely will occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes 1998). Using objectively analyzed data Huang and Liu (2000) estimated a warming of about 0.9°F per century in the Northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters in the northeastern Pacific coasts in the next century, mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding, and permanent inundation of low-lying natural ecosystems (*e.g.*, salt marsh, riverine, mud flats) affecting listed salmonid and green sturgeon PCEs. Increased winter precipitation, decreased snow pack, permafrost degradation, and glacier retreat due to warmer temperatures will cause landslides in unstable mountainous regions, and destroy fish and wildlife habitat, including salmon-spawning streams. Glacier reduction could affect the flow and temperature of rivers and streams that depend on glacier water, with negative impacts on fish populations and the habitat that supports them.

Summer droughts along the South Coast and in the interior of the northwest Pacific coastlines will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Global warming may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to overtake native fish species and impact predator-prey relationships (Peterson and Kitchell 2001, Stachowicz *et al.* 2002).

In light of the predicted impacts of global warming, the CV has been modeled to have an increase of between +2^{o}C and +7^{o}C by 2100 (Dettinger *et al.* 2004, Hayhoe *et al.* 2004, Van Rheenen *et al.* 2004, Stewart 2005), with a drier hydrology predominated by rainfall rather than snowfall. This will alter river runoff patterns and transform the tributaries that feed the CV from a spring and summer snowmelt dominated system to a winter rain dominated system. It can be hypothesized that summer temperatures and flow levels will become unsuitable for salmonid survival. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. This will truncate the period of time that suitable cold-water conditions exist downstream of existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures downstream of reservoirs, such as Lake Shasta, could potentially rise above thermal tolerances for juvenile and adult salmonids (*i.e.* Sacramento River winter-run Chinook salmon and CCV steelhead) that must hold and/or rear downstream of the dam over the summer and fall periods.

2.5.5 Rock Revetment and Levee Repair Projects

Cumulative effects include non-Federal riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur within the Sacramento River watershed. For example, most of the levees have roads on top of the levees which are either maintained by the county, reclamation district, owner, or by the state. Landowners may utilize roads at the top of the levees to access part of their agricultural land. The effects of such actions result in continued fragmentation of existing high-quality habitat, and conversion of complex nearshore aquatic to simplified habitats that affect salmonids in ways similar to the adverse effects associated with the Common Features Project.

2.6 Integration and Synthesis

The *Integration and Synthesis* section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of the proposed action. In this section, NMFS performs two evaluations: whether, given the environmental baseline and status of the species and critical habitat, as well as future cumulative effects, it is reasonable to expect the proposed action is not likely to: (1) reduce the likelihood of both survival and recovery of the species in the wild; and (2) result in the destruction or adverse modification of designated critical habitat (as determined by whether the critical habitat will remain functional to serve the intended conservation role for the listed anadromous species or retain its current ability to establish those features and functions essential to the conservation of the species).

The *Analytical Approach* described the analyses and tools we have used to complete this analysis. This section is based on analyses provided in the *Status of the Species*, the *Environmental Baseline*, and the *Effects of the Proposed Action*.

In our *Status of the Species* section, NMFS summarized the current likelihood of extinction of each of the listed species. We described the factors that have led to the current listing of each species under the ESA across their ranges. These factors include past and present human activities and climatological trends and ocean conditions that have been identified as influential to the survival and recovery of the listed species. Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The *Environmental Baseline* reviewed the status of the species and the factors that are affecting their survival and recovery in the action area. The *Effects of the Proposed Action* reviewed the exposure of the species and critical habitat to the proposed action and cumulative effects. NMFS then evaluated the likely responses of individuals, populations, and critical habitat. The

Integration and Synthesis will consider all of these factors to determine the proposed action's influence on the likelihood of both the survival and recovery of the species, and on the conservation value of designated critical habitat.

The criteria recommended for low risk of extinction for Pacific salmonids are intended to represent a species and populations that are able to respond to environmental changes and withstand adverse environmental conditions. Thus, when our assessments indicate that a species or population has a moderate or high likelihood of extinction, we also understand that future adverse environmental changes could have significant consequences on the ability of the species to survive and recover. Also, it is important to note that an assessment of a species having a moderate or high likelihood of extinction does not mean that the species has little or no chance to survive and recover, but that the species faces moderate to high risks from various processes that can drive a species to extinction. With this understanding of both the current likelihood of extinction of the species and the potential future consequences for species survival and recovery, NMFS will analyze whether the effects of the proposed action are likely to in some way increase the extinction risk each of the species faces.

In order to estimate the risk to CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead, and green sturgeon as a result of the proposed action, NMFS uses a hierarchical approach. The condition of the ESU or DPS is reiterated from the *Status of the Species* section of this BO. We then consider how the status of populations in the action area, as described in the *Environmental Baseline*, is affected by the proposed action. Effects to individuals is summarized, and to the consequence of those effects is applied to establish risk to the diversity group, ESU, or DPS.

In designating critical habitat, NMFS considers the physical and biological features (essential features) within the designated areas that are essential to the conservation of the species and that may require special management considerations or protection. Such requirements of the species include, but are not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing offspring, and generally; and (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species [see 50 CFR § 424.12(b)]. In addition to these factors, NMFS also focuses on the principal biological or physical constituent elements within the defined area that are essential to the conservation of the species. Primary constituent elements may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation.

The basis of the "destruction or adverse modification" analysis is to evaluate whether the proposed action results in negative changes in the function and role of the critical habitat in the conservation of the species. As a result, NMFS bases the critical habitat analysis on the affected areas and functions of critical habitat essential to the conservation of the species, and not on how individuals of the species will respond to changes in habitat quantity and quality.

2.6.1 Status of the CV Spring-Run Chinook Salmon ESU

The CV spring-run Chinook salmon ESU is at moderate risk of extinction (Lindley *et al.* 2007). The most recent viability assessment of CV spring-run Chinook salmon was conducted during NMFS' 2011 status review (NMFS 2011b). This review found that the biological status of the ESU has worsened since the last status review. In the 2011, the ESU as a whole could not be considered viable because there were no extant viable populations in the three other diversity groups. In addition, Mill, Deer, and Butte creeks are close together geographically, decreasing the independence of their extinction risks due to catastrophic disturbance. These and other conditions covered in the 2011 status review have not changed since 2011. While the abundance for some populations appears to be slightly improving, the ESU is still demonstrating a high variability in adult abundance (especially in Butte Creek), we cannot say based on the trend over the past three years that the risk of extinction for the ESU has improved.

2.6.2 Summary of the Status of the CCV Steelhead DPS

All indications are that natural Central Valley steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good et al. 2005; NMFS 2011); the long-term trend remains negative. Hatchery production and returns are dominant over natural fish, and one of the four hatcheries is dominated by Eel/Mad River origin steelhead stock. Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin-clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past several years.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show an overall very low abundance, and fluctuating return rates. Lindley et al. (2007) developed viability criteria for Central Valley salmonids. Using data through 2005, Lindley et al. (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild steelhead in the Central Valley provides the spatial structure necessary for the DPS to survive and avoid localized catastrophes. However, most wild CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2011). The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

The CCV steelhead DPS is at high risk of extinction (NMFS 2011c), and the extinction risk is increasing. The most recent viability assessment of CCV steelhead was conducted during NMFS' 2011 status review (NMFS 2011c). This review found that the biological status of the ESU has worsened since the last status review recommend that its status be reassessed in two to three years as opposed to waiting another five years, if it does not respond positively to improvements in environmental conditions and management actions.

2.6.3 Summary of the Status of the Green Sturgeon southern DPS

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010a).

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley et al. (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2010a).

Adult green sturgeon migrate through the action area to reach upstream spawning habitat. Early larval drift and rearing is also likely to occur upstream from the action area near spawning sites. As juveniles migrate downstream toward the ocean, they become more oriented to benthic environments. Juvenile green sturgeon migrate toward seawater portions of natal estuaries as early as one and a half years old (75cm TL, Allen and Cech 2007). Juvenile and subadult green sturgeon may rear in freshwater and brackish water for up to three years. During laboratory experiments, juvenile green sturgeon select low light habitats and are primarily inactive during daylight hours, while they seemed to forage actively during night (Kynard et al. 2005). Juvenile green sturgeon were captured during the summer in shallow shoals (1-3 m deep) in the lower San Joaquin River (Radtke 1966), and are assumed to occupy similar habitats along the lower Sacramento River.

There is a strong need for additional information about sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology.

2.6.4 Summary of Status of the Environmental Baseline and Cumulative Effects in the Action Area

The action area is used by most diversity groups and populations of the salmon, steelhead and green sturgeon ESUs and DPSs that are the subject of this BO. Salmon, steelhead and green sturgeon use the action area as an upstream and downstream migration corridor and for rearing.

Within the action area, the essential features of freshwater rearing and migration habitats for salmon, steelhead and green sturgeon have been transformed from a meandering waterway lined with a dense riparian vegetation, to a highly leveed system under varying degrees of constraint of riverine erosional processes and flooding. Levees have been constructed near the edge of the river and most floodplains have been completely separated and isolated from the Sacramento and American Rivers (USFWS 2000). Severe long-term riparian vegetation losses have occurred in this part of the Sacramento and American Rivers, and there are large open gaps without the presence of these essential features due to the high amount of riprap (USFWS 2000). The change in the ecosystem as a result of halting the lateral migration of the river channel, the loss of floodplains, the removal of riparian vegetation and IWM have likely affected the functional ecological processes that are essential for growth and survival of salmon, steelhead and green sturgeon in the action area.

The *Cumulative Effects* section of this BO describe how continuing or future effects such as non-Federal water diversions, the discharge of point and non-point source chemical contaminant discharges, and climate change affect the species in the action area. These actions typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that reduce the carrying capacity of the rearing and migratory corridors.

2.6.5 Summary of Project Effects on Sacramento River Winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Individuals

1. <u>Construction and O&M-related Effects</u>

During construction and O&M, some injury or death to individual fish could result from rock placement (crushing), or predation related to displacement of individuals away from the shoreline or at the margins or turbidity plumes. These construction type actions will occur during summer and early fall months, when the abundance of individual salmon and steelhead is low and should result in correspondingly low levels of injury or death.

Green sturgeon adults may be migrating downstream through the area during construction (Heublein et al. 2009) and juveniles may be in the area May through September (noted in section 2.4.1, pg. 83). Adults and subadults would likely respond to construction activities by quickly swimming away, escaping injury, but juveniles are not strong swimmers and will experience the greatest exposure and may encounter short-term construction-related noise, physical disturbance, and water quality changes that may cause injury or harm by increasing the susceptibility of some individuals to predation by temporarily disrupting normal behaviors and affecting sheltering abilities.

2. <u>Long-term Effects Related to the Presence of Project Features</u>

For juvenile and outmigrating salmon and steelhead, the proposed action will result in short- and long-term adverse effects to individual salmon and steelhead that are exposed to the project features along the Sacramento and American Rivers. These adverse effects are indexed by SAM model results and expressed as WRI deficits. The long term WRI deficits are highest at fall and summer water surface elevations. We interpret those flow conditions to be consistent with summer and fall months, which are seasons during which individual Sacramento River winter-run, CV spring-run and CCV steelhead is low (fall), or they are absent. For other seasonal water surface elevations, there will be short term reductions in survival and growth as indicated by WRI values, but these values will increase above baseline and result in beneficial conditions that exceed baseline values.

NMFS expects that the most significant habitat deficits will occur at summer and fall flows due to the inherent difficulty of successfully establishing riparian vegetation in a zone that is impacted by boat wake erosion, and variable flow conditions typical of a regulated river system. The modeled summer and fall habitat deficits are expected to affect relatively few fish, since the majority of adult migration and juvenile rearing and emigration within the action area does not occur during these periods. Instead, a significant majority of Chinook salmon and steelhead adult migration and juvenile rearing and emigration occurs during periods of higher flow that are more accurately represented by conditions at average winter and spring WSELs. Long-term effects at the winter and spring WSELs will be substantially positive, with conditions improving beyond existing conditions through year 50.

SAM modeled WRI values for adult salmon and steelhead migration and steelhead residence (outmigrating post spawning adults) are deficits at winter, spring and summer water surface elevations. These effects are considered to be *de minimus* because, although modeled as a result of a reduction in IWM and riparian habitat, the actual survival of adults is unlikely to be affected because there will be no increase in predation, and the upstream migration will not be impeded by any structural features that influence upstream migration.

Project actions along portions of the American River reach will likely not include bank armoring in their final design, which will significantly reduce estimated impacts to fish species. Additional compensatory mitigation design features or improved erosion repair designs may result in reduced impact compared to the legacy designs used for the basis of this analysis. Site specific designs will be implemented on a site by site basis in consultation with resource agencies and project partners to minimize impacts as well as maximize opportunities for implementing onsite compensatory mitigation features.

During project implementation, site specific SAM analyses will be run on final designs to better evaluate impact. SAM results will be used by the Corps and NMFS in the negotiation of appropriate mitigation for project actions. Although short term impacts are expected to be self-mitigating through the development of onsite compensatory mitigation features, the Corps will compensate for the temporal impacts to habitat through the purchase of offsite compensatory mitigation credits. Typically appropriate mitigation will be based on the identification of maximum negative WRI values. Offsite mitigation is expected to provide compensatory mitigation value at all seasonal habitat conditions. Longer term impacts to habitat may not recover to baseline conditions over the life of the project due to design restrictions. These impacts to habitat will be compensated through the purchase of offsite compensatory mitigation credits as well as the incorporation of additional onsite compensatory mitigation features (*i.e.* low water plantings, additional IWM, additional revegetation).

Details regarding the extent of juvenile green sturgeon rear in this reach of the river is not clear, but all juvenile sDPS must pass through the area on their migration to the estuary and ocean. Levee repair actions in the Common Features Study Area are likely to only affect the juvenile rearing life stage and probably have little to no adverse impacts on the adult life stages of green sturgeon because spawning habitat is not present in the action area and upstream migrating adults are probably more influenced by impacts that affect swimming speed and upstream passage than shoreline habitat manipulations. The levee repair actions will cause long-term reductions in shoreline habitat features for juvenile rearing and migrating green sturgeon and a loss of several acres of benthic habitat that is most likely used for foraging.

The implementation of the Corp's Green Sturgeon Conservation Measures will serve several purposes to address scientific uncertainty about the species in the study area and to provide compensatory mitigation for the adverse effects related to shoreline and benthic habitat impacts. The HMMP with ensure that adverse impacts of future Common Features GRR projects are sufficiently compensated in order to allow for the growth, survival and recovery of the species in the study area. Coordination of the HMMP with the IEP will leverage green sturgeon scientific expertise to ensure selected mitigation actions fully address the micro- and macro-ecological and survival needs of the species in the study area. Refinement of the SAM or development of alternative green sturgeon survival and response model using the Corps' Hydrologic Ecosystem Function Model, in consultation with NMFS and the IEP, will result in new modeling capacity that more accurately evaluates adverse project actions and the beneficial effects of mitigation actions relative to the growth and survival of green sturgeon in the study area. Restoring and compensating for the number of acres and ecological function of impacted benthic habitat and the initiation of this compensatory mitigation in the study area prior to the commencement of levee construction will reduce the impact of levee construction actions. The development of SMART compensatory mitigation objectives will ensure that all of the ecological impacts of levee construction actions are fully addressed.

The Corps also will work with local cost share sponsors to ensure GRR-related future flood risk reduction actions related to widening the Sacramento Weir shall fully mitigate upstream and downstream fish passage effects at the weir and within the spillway basin. The goal is to ensure that adult CV spring-run and Sacramento River inter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are able to migrate upstream while the weir is spilling into the bypass and that juvenile stranding in the spillway basin is minimized to the maximum extent possible. Long-term, and once implemented, this measure would be expected to improve the growth and survival of all affected salmon, steelhead and green sturgeon.

2.6.6 Summary of Project Effects on Sacramento River Winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Critical Habitat

Within the action area, the relevant PCEs of the designated critical habitat for listed salmonids are migratory corridors and rearing habitat, and for green sturgeon the six PCEs include food resources, water flow, water quality, migratory corridors, water depth, and sediment quality.

Based on SAM modeled WRIs, we expect small reductions in the value of PCEs for salmon and steelhead freshwater rearing due to the temporary loss of riparian habitat, the conversion of natural substrate river banks with revetment and the short term loss of IWM, but these reductions are at fall and summer water surface elevations and not at water surface elevations when the habitat use is the highest and most significant. Additionally, as planted vegetation begins to grow, the quality of rearing habitat will improve over baseline. There will also be SAM modeled WRI deficits for adult migration-related PCEs for all species. These deficits are temporary and eventually increase over baseline, so over time we do not expect these effects to reduce the conservation value of critical habitat.

The current condition of critical habitat for the green sturgeon sDPS in the action area is degraded over its historical conditions. It does not provide the full extent of conservation values necessary for the survival and recovery of the species. In particular, passage and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the green sturgeon sDPS evolved.

The Corps estimates that approximately 20 acres of soft substrate habitat below the ordinary high water mark will be permanently lost to rock revetment. This is a conceptual estimate that will be further refined during the PED phase before construction begins. This loss of habitat is expected to adversely affect benthic substrate and impair food resources for all life stages; and the quantity of sediment to allow for normal physiological and behavioral responses to the environment. Similar to salmon and steelhead, the SAM serves as a reasonable proxy for measuring impacts to critical habitat. For most life stages and season water surface elevations, the SAM show immediate adverse effects that continue to decline for the life of the project. However, the Corps' Green Sturgeon Conservation Measures will reduce the impact on critical habitat by providing compensatory mitigation within the action area. Specifically, the HMMP shall also restore or compensate for the number of acres and ecological function of soft bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. This compensation will be carried out within the lower Sacramento River/North Delta in order to offset the adverse modification to designated critical habitat. The restored habitat will be capable of providing abundant benthic prey, freshwater or estuarine areas with adequate water quality, temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth and viability of all life stages. It will also provide safe and unobstructed migratory pathways necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats.

The proposed action will permanently destroy up to 20 acres of critical habitat but also includes implementation of a comprehensive suite of conservation measures that will fill important data gaps, address existing modeling insufficiencies and implement compensatory measures with the goal of maintaining green sturgeon growth, survival and recovery in the action area through measures that will be developed in coordination with the IEP's green sturgeon project work team and in consultation with NMFS. The measures will be undertaken prior to or concurrent with project implementation. For these reasons, we expect the proposed action will not reduce the conservation value of critical habitat for sDPS green sturgeon.

2.6.7 Summary

Although there are some short-term and SAM modeled WRI deficits for salmon and steelhead, the effects of these deficits, when added to the environmental baseline and cumulative effects in the action area are small, occur during seasons when fish abundance is low or they are not present at all, and is of short duration. In the case of fry and juvenile rearing and migration for all species, the SAM modeled WRI values show significant increases in the growth and survival of individuals over baseline conditions between years 0 and 13, especially at winter spring water surface elevations, which represent a shoreline area where most emigrating salmon and steelhead would be exposed. Because the WRI measure growth and survival values recover rather quickly and generally exceed baseline conditions, the incremental effects of the action are not expected to increase the extinction risk of the Sacramento River winter-run Chinook salmon and CV spring-run Chinook salmon and ESU CCV steelhead and or reduce the conservation value of their designated critical habitat.

Furthermore, the anticipated growth and survival of salmon, steelhead rearing and juvenile migration are substantially positive and demonstrate how integrating NMFS high priority recovery actions, such as setback levee construction and restoration of floodplain habitat can contribute to an increase in the production and abundance of the Sacramento River winter-run Chinook salmon and CV spring-run Chinook salmon and ESU CCV steelhead.

The project will result in unavoidable impacts to the shoreline and benthic habitat of green sturgeon. However, the Corps' proposed Green Sturgeon Conservation Measures are expected to make significant contributions to monitor the species, address important data gaps in the action area, improve species growth and survival modeling and use the modeling to develop and track the performance of compensatory mitigation with the goal of fully addressing the loss of micro and macro-ecological impacts of the levee construction work in a manner that maintains the growth, survival and recovery of the species. The measures also address critical habitat PCEs and will ensure the conservation value of critical habitat is not reduced.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon or destroy or adversely modify their designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant, contract or permit, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions, or (2) fails to require the permittee, contractor, or grantee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, contract or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

2.8.1 Amount or Extent of Take

NMFS anticipates incidental take of adult and juvenile listed CV spring-run Chinook salmon, CCV steelhead, and juvenile sDPS green sturgeon and juvenile Sacramento River winter-run Chinook salmon in the action area through the implementation of the proposed action.

NMFS cannot, using the best available information, quantify the anticipated incidental take of individual Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use of the project area. However, it is possible to describe the general programmatic conditions and ecological surrogates using negative SAM WRI values.

Accordingly, NMFS is quantifying take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon incidental to the action resulting from short-term construction impacts, as well as long-term impacts as indexed by the SAM model.

The amount and extent of take described below is in the form of harm due to habitat impacts that will reduce the growth and survival of individuals from predation, or by causing fish to relocate and rear in other locations and reduce the carrying capacity of the existing habitat. This SAM values represent the extent of habitat impacts that will harm fish. As described in the *Analytical Approach* and the *Effects Analysis Sections* of this BO, the SAM values represent an index of fish response to habitat variables to which fish respond including bank slope, bank substrate size, instream structure, overhanging shade, aquatic vegetation and floodplain availability. Positive SAM values represent a positive growth and survival response and negative values index negative growth and survival. There is not a stronger ecological surrogate based on the information available. Due to a lack of site-specific fish data, the exact number of fish that will be affected is not known. The following level of incidental take from program activities is anticipated:

Incidental Take Associated with Construction:

1. Take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon in the form of injury and death from predation caused by construction-related turbidity that extends up to 100 feet from the shoreline, and 1,000 feet downstream, along all project reaches for levee construction activities.

2. Take of juvenile and smolt Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon, in the form of harm or injury of fish from O&M actions is expected from habitat-related disturbances from the annual placement of up to 600 cubic yards of material per site for the extent of the project life (*i.e.*, 50 years). Approximately 60 percent of the 600 cubic yards will be at or below the ordinary high water mark, or approximately 360 cubic yards. Take will be in the form of harm to the species through modification or degradation of the PCEs for rearing and migration that reduces the carrying capacity of habitat.

Incidental Take Associated with Exposure to Project Facilities along the Sacramento and American Rivers

Common Features American River North Reaches A and B:

At fall water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The amount and extent of harm is greatest in the first 3 to 5 years for each species at -366 WRI, -712, and -5577, respectively.

2. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The amount and extent of harm is greatest at -2303 WRI.

3. Take in the form of harm to adult migrating CCV steelhead for up to 48 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The amount and extent of harm is greatest at -1554 WRI and exceeds baseline following year 48 to a maximum increase benefit of 8 WRI.

At winter surface elevations:

1. Take in the form of harm to fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction activities due to impacts on riparian habitat,

IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The amount and extent of harm is greatest at -36 WRI for steelhead in the first year and the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected. After year one, survival and growth values improve to 1507 for CCV steelhead. The amount and extent of harm to sDPS green sturgeon are greatest at -5020 and are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon are expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO, harm is greatest in approximately year 3 at -2303 WRI.

3. Take in the form of harm to adult migrating CCV steelhead for up to 48 after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in Table 10 of this BO. The amount and extent of harm is greatest at -1554 WRI. At year 48, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 8 WRI.

At spring water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts to riparian habitat IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm is greatest at -2681 and -5020, respectively. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1418 WRI. The extent and amount of harm to sDPS green sturgeon are greatest at -5020 WRI and are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon and CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm is greatest at -3129 for CV spring-run Chinook salmon and is expected to extend past 50 years. The greatest amount and extent of harm for CCV steelhead is greatest at -2096 WRI. At year 2, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 1173 WRI.

3. Take in the form of harm to adult migrating CCV steelhead after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this harm is quantified in the SAM table 26 in Appendix A and summarized

in table 10 of this BO. The amount and extent of harm is greatest at -1635 WRI. At year 6, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching 407 WRI.

4. Take in the form of harm to adult resident CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm is greatest at -1635 WRI for CCV steelhead in the first six years and the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected. After six years, survival and growth values improve to 407 for CCV steelhead.

At summer surface elevations:

1. Take in the form of harm to fry and juvenile rearing CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm is greatest for each species at -421 WRI, -833, and -7118, respectively.

2. Take in the form of harm to juvenile migrating (smolts) of CCV steelhead is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM in table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm is greatest at -3013 WRI.

3. Take in the form of harm to adult resident CV steelhead is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of harm is quantified in the SAM table 26 in Appendix A and summarized in table 10 of this BO. The amount and extent of harm on the species is greatest at -3061 WRI.

American River North, South Bank sites A, B, and C

***At fall surface elevations*:**

1. Take in the form of harm to fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and S DPS green sturgeon are expected after any construction activities due to impacts riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The amount and extent of harm is greatest for each species at -229 WRI, -489, and -2154, respectively. At year 26 for CV spring run Chinook salmon and year 36 for CCV steelhead, the SAM modeled habitat conditions exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 112 WRI and 88,

respectively. The amount and extent of harm to sDPS green sturgeon are greatest at -2154 and are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CV spring run Chinook salmon is expected after any construction due to impacts riparian habitat, IWM, and bank substrate size. The amount and extent of this amount and extent of harm is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The amount and extent of harm is greater greatest at -620 WRI and exceed baseline conditions and improved growth and survival conditions are expected following year 2 with the maximum increase benefit of 526 WRI.

3. The SAM displays increased survival of adult migrating CV steelhead after construction activities due to impacts), IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 27and summarized in table 11 of this BO. The increased benefit maximizes at 3696 of WRI.

At winter water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts to riparian habitat IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The amount and extent of harm is greatest at – 489 WRI and – 876, respectively. At year 36, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 88 WRI. At year one, the SAM modeled habitat conditions for sDPS green sturgeon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 2941 WRI.

At summer water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CV spring run Chinook salmon and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The amount and extent of harm is greatest at – 239 WRI and – 2496, respectively. At year 26, the SAM modeled habitat conditions for CV spring run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 111 WRI. The amount and extent of harm to sDPS green sturgeon are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CV spring run Chinook salmon is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 27 in Appendix A and summarized in table 11 of this BO. The amount and extent of harm is greatest at -967 WRI. At year 22, the SAM modeled habitat conditions for CV spring run

Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 510 WRI.

Sacramento River Sites D, E, F, and G

At fall water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. Take in the form of harm to fry and juvenile rearing sDPS green sturgeon is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest amount and extent of harm for the salmonids is -558 WRI, -1156, and -558 WRI respectively. The SAM modeled habitat conditions exceed baseline conditions and improve growth and survival is expected in year 35, 44, and 35, respectively. The amount and extent of harm to sDPS green sturgeon is greatest at -4674 WRI and are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM analysis table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest at -3845 WRI, -3985, and -3845, respectively.

3. Take in the form of harm to adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and the extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest amount and extent of harm for the salmonids are -1394 WRI, -2053, and 1394, respectively. The SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected at years 35, 29, and 35 respectively. After these years, survival and growth values improve to 362, WRI, 832, and 362 WRI, respectively.

4. Take in the form of harm to adult resident CCV steelhead after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest at -2053 WRI and exceeds baseline following year 29, where adult resident survival increases to a maximum value of 837 WRI.

At winter surface elevations:

1. Take in the form of harm to fry and juvenile rearing CCV steelhead, CV winter run Chinook salmon, and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM and, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest at -77 WRI, -4397, and -558, respectively. At year 1, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 3234 WRI. At year 35, the SAM modeled habitat conditions for CV winter run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 116 WRI. The amount and extent of harm to sDPS green sturgeon are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CCV spring run Chinook salmon, CCV steelhead, and CV winter run is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -3451 WRI, -3044, and -3085, respectively. At year two, the SAM modeled habitat conditions for CV spring run Chinook salmon and Sacramento River winter-run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4794 WRI for both species. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 3355 WRI.

3. Take in the form of harm to adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon are expected to occur after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -892 WRI, -1801, and -892 WRI, respectively. At year 4, the SAM modeled habitat conditions for CV spring run Chinook salmon and CV winter run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 643 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

4. Take in the form of harm to adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -1801 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

At spring water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CCV steelhead and sDPS green sturgeon are expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest at -36 WRI and -4397, respectively. At year 1, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4317 WRI. The amount and extent of harm to sDPS green sturgeon are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CCV spring run Chinook salmon, CCV steelhead, and CV winter run is expected after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -3484 WRI, -3082, and -3484, respectively. At year 2, the SAM modeled habitat conditions for CV spring run Chinook salmon and Sacramento River winter-run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 4862 WRI for both species. At year three, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

3. Take in the form of harm to adult migrating CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon are expected to occur after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -946 WRI, -1801, and -946 WRI, respectively. At year 4, the SAM modeled habitat conditions for CV spring run Chinook salmon and CV winter run Chinook salmon exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 931 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

4. Take in the form of harm to adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -1801 WRI. At year 3, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 1757 WRI.

At summer water surface elevations:

1. Take in the form of harm to fry and juvenile rearing CV spring run Chinook salmon, CCV steelhead, and CV winter run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. Take in the form of harm to fry and juvenile rearing sDPS green sturgeon is expected to extend past 50 years after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of these effects are quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the salmonids are -578 WRI, -1206, and -578 WRI respectively. The SAM modeled habitat conditions exceed baseline conditions and improve growth and survival is expected in years 36, 45, and 36, respectively, with maximum increased WRI values of 113, 92, and 113. The amount and extent of harm to sDPS green sturgeon are greatest at -5009 WRI and are expected to extend past 50 years.

2. Take in the form of harm to juvenile migrating (smolts) CCV spring run Chinook is expected to extend past 50 years after any construction due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of this adverse of these amount and extent of harm is quantified in the SAM analysis table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest at -4258 WRI.

3. Take in the form of harm to adult migrating CV spring run Chinook salmon, CV steelhead, and Sacramento River winter-run Chinook salmon after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and the extent of these potential effects is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The greatest amount and extent of harm for these species are -2136 WRI, -3793, and -2136 WRI, respectively. The SAM modeled habitat conditions exceed baseline conditions and improved growth and survival is expected at years 37, 32, and 37 respectively. After these years, survival and growth values improve to 319 WRI, 748, and 319 WRI, respectively.

4. Take in the form of harm to adult residence CCV steelhead is expected after any construction activities due to impacts on riparian habitat, IWM, and bank substrate size. The amount and extent of harm is quantified in the SAM table 28 in Appendix A and summarized in table 12 of this BO. The amount and extent of harm is greatest for the species at -3793 WRI. At year 32, the SAM modeled habitat conditions for CCV steelhead exceed baseline conditions and improved growth and survival conditions are expected, reaching a maximum of 748 WRI.

Take along and within the Sacramento Bypass and Weir

1. Take in the form of injury or death to adult and juvenile CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon as a result of stranding in the spillway basin along 3425 linear feet of the expanded Sacramento Weir as a result of impaired upstream or downstream migrations. This take

is expected to occur once every 10 years following the spilling of river water and as the flood flows recede standing these species in the spillway basin.

2. Take in the form of injury or death to adults and juvenile CV spring-run, Sacramento River winter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon due to stranding on the declining hydrograph within 660 acres (Personal Communication, Anne Baker, Army Corps of Engineers) as a result of the widening of the bypass. This take is expected to occur once every ten years following the spilling of river water and as the flood flows recede stranding these species in the Sacramento Bypass.

2.9.2 Effect of the Take

In the BO, NMFS determined that the amount or extent of anticipated take is not likely to result in jeopardy to the Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon or destruction or adverse modification of their critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. Measures shall be taken to ensure that future flood risk reduction projects related to the American River Common Features GRR minimize, to the maximum extent practicable, any adverse effects on federally listed salmon, steelhead and green sturgeon that are subject to this consultation.

2. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures through the HMMP to ensure their effectiveness.

3. Measures shall be taken to minimize the impacts of bank protection and setback levee construction by implementing integrated conservation measures that provide beneficial growth and survival conditions for salmonids, and the sDPS of North American green sturgeon.

4. Measures shall be taken to insure that contractors, construction workers, and all other parties involved with these projects implement the projects as proposed in the biological assessment and this BO.

5. Measures shall be taken to ensure that riparian habitat within the study area is preserved and protected to the maximum extent feasible for protection of fish habitat features that are the subject of this BO.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1: "*Measures shall be taken to ensure that future flood risk reduction projects related to the American River Common Features GRR minimize, to the maximum extent practicable, any adverse effects on federally listed salmon, steelhead and green sturgeon that are subject to this consultation.*"

    a. The Corps shall participate in an existing IWG or work with other agencies to participate in a new BPWG to coordinate stakeholder input into future flood risk reduction actions associated with the American River Common Features GRR. The BPWG will hold technical deliberations over proposed bank protection, including the need (basis of/for design), purpose and proposed designs (emphasis on avoidance and fish-friendly designs). Membership in the BPWG will be subject to agency decisions to participate, but should at a minimum include participation from resource agency staff (USFWS, NMFS, CDFW), CVFPB and SAFCA (local sponsors).
    b. The Corps shall coordinate with NMFS during PED as future flood risk reduction actions are designed to ensure conservation measures are incorporated to the extent practicable and feasible and projects are designed to maximize ecological benefits.
    c. The Corps shall include as part of the HMMP, a Riparian Corridor Improvement Plan with the overall goal of mitigating for the impacts to the ecological function and value of the existing levee system within the GRR study area. The Corps shall coordinate this plan with NMFS prior to the construction of any projects related to the GRS.
    d. The Corps shall ensure the widening of the Sacramento Bypass is designed and constructed to minimize stranding of fish at facilities of the weir and in the depressions of the bypass though grading or construction of drainage channels or other mechanisms as applicable.
    e. During Preconstruction Engineering and Design, the Corps, in coordination with the local sponsor, shall coordinate with NMFS to provide an operation of the Sacramento Weir to allow, without detrimental effects to flood management operations, for controlled ramp down rates of water into the Sacramento Bypass following peak flows.
    f. The Corps, in coordination with the local sponsors, shall compensate for fish passage impacts that result from the widening of the Sacramento Weir by including an adult fish passage facility associated with flood operations at the new weir. The fish passage facility would be designed with NMFS technical experts as part of the design team. Measures also shall be taken to modify the downstream side of the Weir to prevent adult and juvenile green sturgeon from stranding in the spillway basin.

g. The Corps shall update the O&M manual to incorporate, without detrimental effects to flood operations, the following measures: (1) an adaptive management plan for operations of the Sacramento Weir that allows for ramp down flows in a manner that minimize juvenile fish stranding in the Sacramento Bypass, (2) integration of Sacramento Weir operations with the Yolo Bypass.

2. The following terms and conditions implement reasonable and prudent measure 2: "*Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures through the HMMP to ensure their effectiveness*."

    a. The Corps shall develop a HMMP with an overall goal of ensuring the conservation measures achieve a high level of ecological function and value. The HMMP shall include specific goals and objectives and a clear strategy for maintaining all of the project conservation elements for the life of the project. The HMMP shall be consulted on with NMFS prior to the onset of any riverside construction, including the placement of in-water revetment or removal of riparian vegetation.
    b. The HMMP measures shall be monitored by the Corps for 10 years following construction and shall update their O&M manual to ensure the HMMP is adopted by the local sponsor to ensure the goals and objectives of the conservation measures are met for the life of the project.
    c. The HMMP shall include specific goals and objectives and a clear strategy for achieving full compensation for all project-related impacts on the affected species described above.
    d. The HMMP shall include a compensatory mitigation accounting plan to ensure the tracking of compensatory measures associated with future American River Common Features GRR projects as described in the proposed action.
    e. The Corps shall continue to coordinate with NMFS during all phases of construction, implementation, and monitoring by hosting annual meetings and issuing annual reports throughout the construction period as described in the HMMP.
    f. The Corps shall host an annual meeting and issue annual reports for five years following completion of project construction. The purpose is to ensure that conservation features of the project are developing consistent with the MMP.
    g. The Corps shall update their O&M Manual to ensure that the self-mitigating elements are meeting the criteria established in the HMMP with the goal of meeting SAM values.
    h. The Corps, in coordination with the local sponsor, shall ensure that the mitigation and monitoring plan for the Sacramento Bypass includes baseline post-project monitoring of fish stranding. The monitoring plan shall be developed in coordination with NMFS.

3. The following terms and conditions implement reasonable and prudent measure 3: "*Measures shall be taken to minimize the impacts of bank protection and setback levee construction by implementing integrated conservation measures that provide beneficial growth and survival conditions for salmonids, and the sDPS of North American green sturgeon*."

a. The Corps shall ensure that, for salmon and steelhead, the maximum SAM WRI deficits for each seasonal water surface elevation as determined appropriate with input from the IWG or the BPWG are fully offset through habitat improvements along the future American River Common Features GRR project or through the purchase of credits at a NMFS approved conservation bank (as described in the BA).
b. The Corps shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place or if not feasible, new IWM will be anchored in place.
c. The Corps shall ensure that the planting of native vegetation will occur as described in the Corps 2014 BA and within this BO. All plantings must be provided with the appropriate amount of water to ensure successful establishment.
d. The Corps shall compensate for lost habitat using NMFS approved mitigation actions at a 1:1 ratio prior to construction, 2:1 ratio during construction, or a 3:1 ratio if mitigation actions occur after construction. This includes habitat improvements adjacent to the project area, or through conservation bank credit purchase as described in the Corps revised, American River Common Features GRR SAM Analysis as received by email on June 18, 2015 and included in this document in Appendix A.

4. The following terms and conditions implement reasonable and prudent measure 4: "*Measures shall be taken to insure that contractors, construction workers, and all other parties involved with these projects implement the projects as proposed in the biological assessment and this BO*."

a. The Corps shall provide a copy of this BO, or similar documentation, to the prime contractor, making the prime contractor responsible for implementing all requirements and obligations included in these documents and to educate and inform all other contractors involved in the project as to the requirements of this BO. A notification that contractors have been supplied with this information will be provided to the reporting address below.
b. A NMFS-approved Worker Environmental Awareness Training Program for construction personnel shall be conducted by the NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program shall provide workers with information on their responsibilities with regard to Federally-listed fish, their critical habitat, an overview of the life-history of all the species, information on take prohibitions, protections afforded these animals under the ESA, and an explanation of the relevant terms and conditions of this BO. Written documentation of the training must be submitted to NMFS within 30 days of the completion of training.
c. The Corps shall consider installing IWM along future flood risk reduction projects associated with the American River Common Features GRR at 40 to 80 percent shoreline coverage at all seasonal water surface elevations in coordination with the IWG or the BPWG. The purpose is to maximize the refugia and rearing habitats for juvenile fish.

5. The following terms and conditions implement reasonable and prudent measure 5: "*Measures shall be taken to ensure that riparian habitat within the study area is preserved and protected to the maximum extent feasible for protection of fish habitat features that are the subject of this BO*."

    a. The Corps shall develop a vegetation variance in consultation with NMFS to allow for the protection of existing vegetation in place and the planting of new low-risk vegetation on the lower 1/3 slope of the levee system.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. The Corps should integrate the 2017 California Central Valley Flood Protection Plan's Conservation Strategy into all flood risk reduction projects they authorize, fund, or carry out.
2. The Corps should prioritize and continue to support flood management actions that set levees back from rivers and in places where this is not technically feasible, repair in place actions should pursue land-side levee repairs instead of waterside repairs.
3. The Corps should consult with NMFS in the review of ETL variances for future projects that require ETL compliance.
4. The Corps should develop ETL vegetation variances for all flood management actions that are adjacent to any anadromous fish habitat.
5. The Corps should use all of their authorities, to the maximum extent feasible to implement high priority actions in the NMFS Central Valley Salmon and Steelhead Recovery Plan. High priority actions related to flood management include setting levees back from river banks, increasing the amount and extent of riparian vegetation along reaches of the Sacramento River Flood Control Project.
6. The Corps should encourage cost share sponsors and applicants to develop floodplain and riparian corridor enhancement plans as part of their projects.
7. The Corps should seek out opportunities for setback levee and other flood management activities that promote overall riverine system restoration.
8. The Corps should support and promote aquatic and riparian habitat restoration within the Sacramento River and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize negative impacts to listed species should be encouraged.
9. The Corps should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects.

10. The Corps should continue to work with NMFS and other agencies and interests to restore fish passage to support the improved growth, survival and recovery of native fish species in the Yolo Bypass and other bypasses within the Sacramento River Flood Control Project.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

2.10 Reinitiation of Consultation

This concludes formal consultation for the West Sacramento River GRS. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

The proposed action is described in detail in Section 1.4 of the Common Features GRR BO.

3.1 Essential Fish Habitat Affected by the Project

The action area for the Common Features GRR has been identified as EFH for Pacific coast salmon. Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), CV spring-run Chinook salmon (*O. tshawytscha*), and CV fall-/late fall-run Chinook salmon (*O. tshawytscha*) are species managed under the Pacific coast salmon fishery management plan that occur within the proposed action area.
This BO addresses Sacramento River winter-run and CV spring-run Chinook salmon (*O. tshawytscha*). The Sacramento River winter-run and CV spring-run Chinook salmon are listed under both ESA and the MSA and potentially will be affected by the Common Features GRR. This EFH consultation will concentrate on CV fall-/late fall-run Chinook salmon (*O. tshawytscha*) because their habitat is covered under the MSA but not covered in subject BO.

The Habitat Areas of Particular Concern (HAPCs) in the action area include complex channels, floodplain habitats and constrained channels with large woody debris.

3.2 Adverse Effects on Essential Fish Habitat

The effects of the proposed action on Pacific Coast salmon EFH will be similar to those discussed in the *Effects of the Action* section (2.4) for Sacramento River winter-run and CV spring-run Chinook salmon. Based on the information provided, NMFS concludes that the proposed action would adversely affect EFH for federally managed Pacific salmon. A summary of the effects of the proposed action on EFH for Chinook salmon are discussed below.

Adverse effects to the HAPCs of Pacific salmon EFH resulting from the proposed action construction activities may contribute sediment, increase turbidity, and increase localized sound levels, including areas downstream and upstream of the construction site. These impacts will occur only during the time when construction is occurring in or adjacent to the water column. There is potential for toxic compounds to be introduced into EFH during construction. This could occur at any time during the construction, both during in-water and out-of-water phases. All of the above impacts will be short-term. Construction activities may also eliminate or alter habitat that is essential to the life-cycle of Pacific salmon. For example, the addition of rock revetment to a previously vegetated bank may eliminate juvenile rearing habitat. These habitat impacts are better illustrated in Tables 10, 11, and 12 of the BO associated with this EFH consultation and Tables 26, 27 and 28 in Appendix A that summarizes SAM deficits for the Common Features GRR.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH conservation recommendations will protect, by avoiding or minimizing the adverse short-term habitat effects described in section 3.2. The Corps should mitigate for WRI deficits by offsetting the maximum deficits. Below is a summary of WRI that should be mitigated to minimize the adverse effects of the Common Features GRR to Pacific coast salmon species. The Corps should offset deficits either onsite or at a NMFS approved conservation bank. The mitigation should be at a 1:1 ratio if conducted prior to the compensation timing schedule described in the *Analytical Approach* section of the BO, or at a 3:1 ratio if carried out any later.

Common Features American River North Reaches A and B:

At fall water surface elevations:

1. The maximum impact from the Common Features GRR to adult fall-run Chinook salmon migrating habitat is -877 WRI for 39 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon rearing habitat is -366 WRI for 50 years.

3. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -2,303 WRI for 50 years.

At winter surface elevations:

1. The maximum impact from the Common Features GRR to adult fall-run Chinook salmon migrating habitat is -759 WRI for 5 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is –3,002 WRI for 4 years.

At spring water surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -2,681 WRI for 3 years.

2. The maximum impact from the Common Features GRR to adult fall-run Chinook salmon habitat is -773 WRI for 4 years.

At summer surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon rearing habitat is -421 WRI for 50 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -3,129 WRI for 50 years.

American River North, South Bank sites A, B, and C

At fall water surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon rearing habitat is -229 WRI for 26 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -620 WRI for 21 years.

At winter surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -333 WRI for 1 years.

At summer surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon rearing habitat is -239 WRI for 26 years.

2. The maximum impact from the Common Features GRR to juvenile fall- run Chinook salmon migration habitat is -697 WRI for 22 years.

Sacramento River Sites D, E, F, and G

At fall water surface elevations:

1. The maximum impact from the Common Features GRR to adult fall-run and late-fall run Chinook salmon migration habitat is -1,394 WRI for 35 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run and late-fall run Chinook salmon rearing habitat is -558 WRI for 35 years.

3. The maximum impact from the Common Features GRR to juvenile fall-run and late-fall run Chinook salmon migration habitat is -3,845 WRI for 50 years.

At winter surface elevations:

1. The maximum impact from the Common Features GRR to adult fall-run and late-fall run Chinook salmon migration habitat is -892 WRI for 4 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run and late-fall run Chinook salmon migration habitat is -3,451 WRI for 2 years.

At spring water surface elevations:

1. The maximum impact from the Common Features GRR to adult late-fall run Chinook salmon migration habitat is -946 WRI for 4 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -3,484 WRI for 2 years.

At summer surface elevations:

1. The maximum impact from the Common Features GRR to juvenile fall-run and late-fall run Chinook salmon rearing habitat is -578 WRI for 36 years.

2. The maximum impact from the Common Features GRR to juvenile fall-run Chinook salmon migration habitat is -4,258 WRI for 50 years.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, compensate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include SAFCA, USFWS, CDFW, or DWR. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 *et seq*., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and the EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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APPENDIX A.

Appendix A comprises the updated SAM analysis report emailed to NMFS from the USACE on JUNE 11, 2015. This represents the final SAM run agreed upon jointly.

Appendix A
American River Common Features GRR SAM Analysis

ARCF GRR Project Reach SAM Analysis

1.0 Introduction

This document provides the background data and assumptions for the Standard Assessment Methodology (SAM) effects analysis of the American River Common Features General Reevaluation Report (ARCF GRR) project on the following focus fish species (Table 1).

Table 1. ARCF GRR Project Focus Fish Species

Species/ESUs	Federal Status
Chinook salmon (*Oncorhynchus tshawytscha*)	
Central Valley spring-run ESU	Threatened
Central Valley fall-run ESU	Species of concern
Central Valley late fall-run ESU	Species of concern
Sacramento River winter-run ESU	Endangered
Central Valley steelhead DPS (*Oncorhynchus mykiss*)	Threatened
green sturgeon (*Acipenser medirostris*)	Threatened

1.1 Background

The US Army Corps of Engineers (Corps) initiated formal Section 7 consultation with the National Marine Fisheries Service (NMFS) for the ARCF GRR on June 27, 2014. The original SAM analysis included in the Section 7 consultation for the ARCF GRR was determined to be insufficient in detail. Through internal discussions and interagency coordination with the NMFS, a revised set of parameters was developed to better assess the project's impact on focus fish species and their habitat. This report documents and provides justification for the revised SAM analysis and should replace the analysis included in the original Biological Assessment (BA) Appendix B.

1.2 SAM Modeling Approach

Long-term effects of the ARCF GRR project on focus fish species and their habitat were estimated using the SAM. The SAM computations were performed using the SAM Electronic Calculation Template (ECT) Version 4.0 (April 2012) developed by the Corps and Stillwater Sciences, in consultation with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife Service (CDFW), and California Department of Water Resources (DWR), academic contributions from the University of California at Davis and Humboldt State University, and peer reviewed by sixteen professionals in fish biology, river geomorphology, environmental sciences, and engineering (USACE 2012). The SAM allows agencies to quantitatively assess the potential effects of bank protection and stream restoration projects to ensure that these activities do not jeopardize Chinook salmon, steelhead, and green sturgeon, or destroy or adversely modify their critical habitat. The SAM can also determine suitable compensation for habitat loss, by evaluating the benefits of certain design features (*e.g*., planted emergent vegetation) to target fish species.

The SAM employs six habitat variables to characterize near-shore and floodplain habitats of listed fish species:

- *bank slope*—average bank slope of each average seasonal water surface elevation;
- *floodplain availability*—ratio of wetted channel and floodplain area during the 2-year flood, to the wetted channel area during average winter and spring flows;
- *bank substrate size*—the median particle diameter of the bank (*i.e.*, D50) along each average seasonal water surface elevation;
- *instream structure*—percent of shoreline coverage of instream woody material along each average seasonal water surface elevation;
- *aquatic vegetation*—percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
- *overhanging shade*—percent of the shoreline coverage of shade along each average seasonal water surface elevation.

The SAM does not directly model changes in the above variables. Instead, habitat changes are estimated separately by the user and entered into an input data file to an electronic calculation template (ECT) developed within an MS Access database to track species responses to project actions over time. Changes in habitat variables may be fixed in time, such as installation of revetment at a particular slope and substrate size. In other circumstances, habitat evolution over time may be represented by more gradual changes in variables such as changes in floodplain inundation due to meander migration or changes in shade due to growth of planted vegetation. Typically, habitat evolution modeling is restricted to shade estimates from riparian growth models, but the SAM accommodates any number of other habitat modeling approaches such as meander migration modeling or large woody debris recruitment modeling.

Once a particular time series of habitat variable estimates is developed and entered into an ECT input file fish responses are calculated using previously developed relationships between habitat variables and species/life stage responses (USACE 2012). The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (*e.g*., with- or without-project), the ECT uses these relationships to determine the responses of individual species and life stages to the measured or predicted values of each variable, for each season and target year; the ECT then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear distance or area of bank to which it applies; the product is then integrated through time, generating a weighted species response index (WRI expressed as ft or ft^2) in each year of the analysis. The WRI provides a common metric that can be used to quantify habitat values over time, compare project designs to existing conditions, and evaluate the effectiveness of on-site and off-site habitat compensation actions.

2.0 Habitat Analysis

Following procedures described in the SAM (USACE 2012), construction activities at each site were translated into habitat variables for pre-project and with project conditions in each of four seasons using available data sources. The relevant habitat conditions to encode the conceptual response models for the focus fish species from the present to the future (t = 0, 1, 5, 15, 25, and 50 yrs), and under pre-project and with-project conditions are described below. Revisions to the original SAM analysis are summarized in the discussion.

2.1 Project Description

The ARCF GRR project tentatively selected plan – Alternative 2 – Sacramento Bypass and Improve Levees, involves the construction of fix-in-place levee remediation measures along the Sacramento River, American River, and north side tributaries as well as widening of the Sacramento Weir and Bypass. Proposed repair actions for each waterway are presented below (Table 2). This SDAM analysis groups project actions into 4 SAM reaches based on hydrologic connectivity: American River North (ARN_AB), American River South (ARS_ABC), Sacramento River South (ARS_DEFG), and the Sacramento Bypass (SBP).

2.1.1 Sacramento River

The levees along the Sacramento River under Alternative 2 would be improved to address identified seepage, stability, erosion, and a minimal amount of height concerns. Most height concerns along the Sacramento River would be addressed by a widening of the Sacramento Weir and Bypass to divert more flows into the Yolo Bypass.

2.1.2 American River

Levees along the American River under Alternative 2 require improvements to address erosion. The proposed measures for these levees consist of waterside armoring to prevent erosion to the river bank and levee, which could potentially undermine the levee foundation. There are two measures proposed for the American River levees: (1) bank protection, and (2) launchable rock trench. Both of these measures are described in detail in the BA.

2.1.3 East Side Tributaries

Natomas East Main Drain Canal (NEMDC) requires improvements to address seepage and stability at locations where historic creeks had intersected the current levee alignment. A conventional open trench cutoff wall would be constructed at these locations to address the seepage and stability problems. The NEMDC east levee also has height issues which will be addressed with construction of a new floodwall. The floodwall would be placed at the waterside hinge point of the levee and would be designed to disturb a minimal amount of waterside slope and levee crown for construction.

We will be doing no in-water work on NEMDC under the Alternative 2 scenario and after consultation with NMFS, NEMDC was left out of the SAM analyses.

2.1.4 Sacramento Weir and Bypass

Under Alternative 2, the width of the Sacramento Weir and Bypass would be roughly doubled to accommodate increased bypass flows. The expanded Sacramento Weir and Bypass would generally result in an additional 25,000 cfs flow during high water conditions. The frequency of water diversion is expected to be the same, which is to to use the current Sacramento Weir operation based on a stream gage at the I Street Bridge (Schlunegger 2014). Under normal flow conditions the Sacramento Weir and Bypass would be operating at pre-existing conditions described in detail in the ARCF GRR biological assessment (USACE 2014). Implementation of this action would result in the degradation of the existing north levee of the Sacramento Bypass and construction of a new levee approximately 1,500 feet to the north. The existing Sacramento Weir would be expanded to match the wider bypass. At this time, it is not known whether the new segment of weir would be constructed consistent with the 1916 design described above, or whether it would be designed to be a gravity-type weir. The new north levee of the bypass would be designed to be consistent with the existing Sacramento Bypass north levee, however, it would also include a 300-foot-wide seepage berm on the landside with a system of relief wells.

Table 2. ARCF GRR Project Alternative 2 – Proposed Remediation Measures by Waterway.

Waterway	Seepage Measures	Stability Measures	Erosion Protection Measures	Overtopping Measures
American River[1]	---	---	Bank Protection, Launchable Rock Trench	---
Sacramento River	Cutoff Wall	Cutoff Wall	Bank Protection	Sacramento Bypass and Weir Widening, Levee Raise
NEMDC	Cutoff Wall	Cutoff Wall	---	Floodwall
Arcade Creek	Cutoff Wall	Cutoff Wall	---	Floodwall
Dry/Robla Creeks	---	---	---	Floodwall
Magpie Creek[2]	---	---	---	Floodwall, Levee Raise

[1]American River seepage, stability, and overtopping measures were addressed in the American River Common Features, WRDA 1996 and 1999 construction projects.
[2]In addition to the Floodwall, Magpie Creek will include construction of a new levee along Raley Boulevard south of the creek, and construction of a detention basin on both sides of Raley Boulevard. In addition, some improvements would need to occur on Raley Boulevard, including widening of the Magpie Creek Bridge, raising the elevation of the roadway, and removing the Don Julio Creek culvert.

2.1.5 Construction Schedule

The ARCF GRR project reach will be implemented in increments. The timing of each project reach (Table 3) is based on the proposed schedule provided in the Biological Assessment: American River Common Features General Reevaluation Report (USACE 2014).

Table 3. ARCF GRR Project Alternative 2 – Construction Sequence and Duration

Priority	Construction Sequence	Reach	Construction Duration
1	Sacramento River	ARS F	5 years
2	Sacramento River	ARS E	3 years
3	American River	ARS A	4 years
4	Sacramento River	ARS G	3 years
5	Sacramento River	ARS D	3 years
6	American River	ARS B	2 years
7	American River	ARN A	4 years
8	American River	ARS C	3 years
9	American River	ARN B	2 years
10	Sacramento Weir & Bypass		4 years
11	Arcade Creek	ARN D	2 years
12	NEMDC	ARN F	2 years
13	Arcade Creek	ARN E	2 years
14	NEMDC	ARN C	2 years
15	Dry/Robla Creek	ARN G	3 years
16	Magpie Creek	ARN I	3 years

2.1.6 Vegetation on Levees

Compliance with Engineering Technical Letter 1110-2-571 (ETL) vegetation requires implementation of a vegetation-free zone within 15 ft of the waterside and landside toes of a levee. The levees along the Sacramento and American rivers were often set close to the river which has resulted in limited riparian vegetation in the project reach. The Corps is seeking a variance from the ETL vegetation requirements along the Sacramento River and American River portions of this project. This SAM analysis assumes that a Vegetation Variance Request (VVR) was assumed to be in place for the Sacramento and American River reaches. The Corps will obtain an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The Corps will be complying with the ETL on the American River via a System Wide Implementation Framework (SWIF). The VVR is not assumed to apply to the SBP.

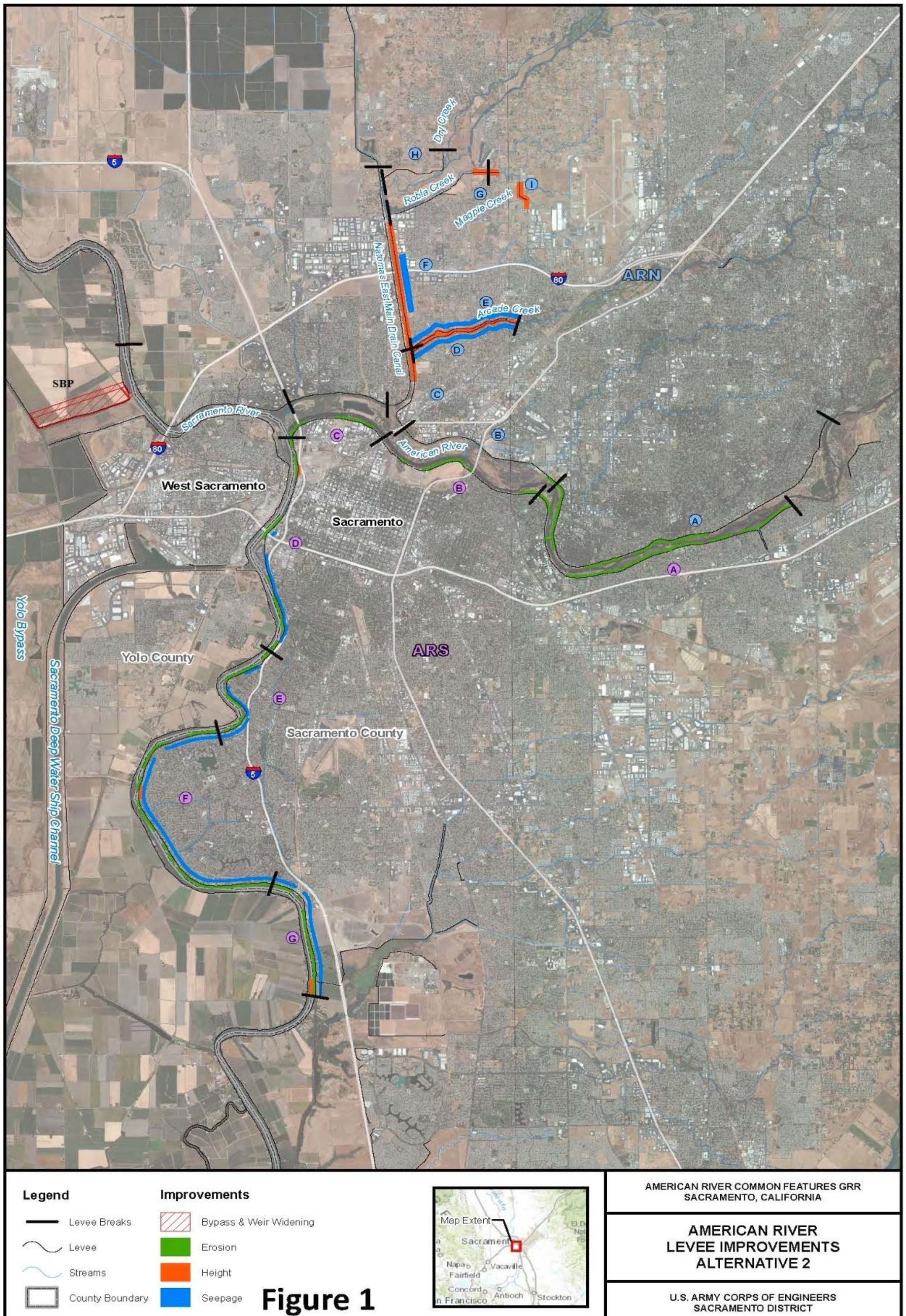
Dry Creek
Robla Creek
Magpie Creek
Natomas East Main Drain Canal
Arcade Creek
ARN
SBP
Sacramento River
American River
West Sacramento
Sacramento
ARS
Yolo Bypass
Sacramento Deep Water Ship Channel
Yolo County
Sacramento County
Legend
Levee Breaks
Levee
Streams
County Boundary
Improvements
Bypass & Weir Widening
Erosion
Height
Seepage
Map Extent
AMERICAN RIVER COMMON FEATURES GRR
SACRAMENTO, CALIFORNIA
AMERICAN RIVER
LEVEE IMPROVEMENTS
ALTERNATIVE 2
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure 1

2.2 Characterization of Existing Conditions

The following data sources were used to characterize SAM habitat conditions (as defined by bank slope, floodplain availability, substrate size, instream structure, aquatic vegetation, and overhanging shade) within the ARCF GRR project area under existing or pre-project conditions.

Sacramento River Revetment Database – This database was used to stratify the project reach into subreaches that encompass relatively uniform bank conditions based on their general physical characteristics (USACE 2007). This database was used to characterize existing habitat conditions within individual reaches where more recent data were unavailable.

Aerial images of the ARCF GRR project reach (Google™ Earth Pro), provided current and historical images of bank conditions that were used to address gaps or uncertainties related to existing cover characteristics within individual subreaches.

The following describes how input values for each of these attributes were derived for existing conditions in the SAM assessment. Specific input values for each site can be seen below at the end of report in (Tables 6-25).

2.2.1 Bank Slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change, dW:dH) along each seasonal shoreline (*i.e.*, the line where the water surface intersects the bank on average fall, winter, spring, and summer) (USACE 2012). Existing bank slopes were extrapolated from cross sections along the Sacramento River, American River, and existing SAM analyses performed on regionally analogous sites. Bank slope along all reaches was assumed to be 2 for existing conditions.

2.2.2 Floodplain Availability

In the SAM, floodplain habitat availability is considered important for juvenile life stages and is defined by areas that are flooded by the 2-year flood event (Q2) and measured by calculating a Floodplain Inundation Ratio (USACE 2012). This ratio is calculated by dividing the wetted channel and inundated floodplain areas during the 2-year flood event (AQ2) by the wetted channel area (AQavg) during average winter and spring flows. The amount of available floodplain habitat is consequently proportional to the ratio's positive deviation from unity (*i.e.*, values greater than 1) (USACE 2012).

In this SAM analysis, it was assumed that the with-project floodplain inundation ratios would be the same as pre-project values, which is consistent with assumptions made during the pre-construction SAM analyses. As a result, no impacts to habitat quality at the ARCF GRR reaches are expected with respect to this habitat variable.

2.2.3 Bank Substrate Size

The median substrate size (D_{50}) along the summer-fall and winter-spring shorelines of the project reach was determined through by referencing the Revetment Database (USACE 2007) and current and historical aerial images. Based on previous analysis of Sacramento River Bank Protection Project (SRBPP) sites (USACE 2008, USACE 2013) sections of shoreline with natural substrate were assigned a D_{50} of 0.25 inches. Sections of shoreline with rock revetment were assigned a D_{50} of 10 inches.

2.2.4 Instream Structure

The shoreline coverage of Instream Woody Material (IWM) along the average summer-fall and winter-spring shorelines of the ARCF GRR project reach were determined by referencing the revetment database (USACE 2007). The revetment database uses four classes of instream structure, based on ranges of percent shoreline having IWM. Table 4 indicates how these revetment database attribute values were converted to a single value for input to SAM. These values were assumed to be appropriate for both the summer-fall and winter-spring seasons. For sub-reaches without available data, an estimate was based on shoreline conditions assessed from aerial images. Shorelines with dense riparian canopy were assigned 5% shoreline coverage of IWM. Shorelines without dense riparian canopy were assigned 0% shoreline coverage of IWM.

Table 4. Conversion of Revetment Database Instream Woody Material Classes to SAM Attribute Value for Instream Structure

Revetment Database IWM Class	SAM Input Value
None	0%
1 - 10%	5%
11 - 50%	30%
> 50%	75%

2.2.5 Aquatic Vegetation

The revetment database attribute for Emergent Vegetation was used for summer-fall aquatic vegetation characterization, and the Ground Cover attribute was used for winter-spring characterization. Within the ARCF GRR project reaches, this approach generally gave a vegetation value of zero for summer-fall conditions, which is appropriate given the scarcity of emergent aquatic vegetation. Table 5 summarizes the conversion of revetment database attribute values for input to the SAM analysis.

Table 5. Conversion of Revetment Database Emergent Vegetation and Ground Cover Classes to SAM Attribute Values for Vegetation.

	Revetment Database IWM Class	SAM Input Value
Summer and Fall Revetment Database: “Emergent Vegetation” Attribute	False	0%
	PEM 1 - 5%	3%
	PEM 6 - 25%	15%
	PEM 26 – 75%	50%
	PEM >75%	85%
Winter and Spring Revetment Database: “Ground Cover” Attribute	<25%	13%
	26-50%	38%
	51-75%	63%
	>75%	88%

2.2.6 Overhanging Shade

The extent of overhanging shade along the summer-fall and winter-spring shorelines was determined through analysis of current and historic aerial images. Summer-fall conditions were analyzed using imagery from late summer and early fall months, typically representative of low water conditions. Winter-spring conditions were analyzed using imagery from late winter and early spring months, typically representative of high water conditions. Values for overhanging shade at winter and spring habitat conditions were modified by factors of 0.25 and 0.75 respectively to account for seasonal defoliation.

2.3 Characterization of With-Project Conditions

The with-project conditions were characterized using the project description outlined for Alternative 2 in the ARCF GRR BA. This analysis was conducted at a feasibility level of design; specific project designs will be developed under a Planning and Engineering Design phase. In the absence of more specific designs, this SAM analysis was developed using a set of “reasonable worst-case” parameters. The parameters were developed by evaluating the applicability of past levee repair designs to the project reach. Past levee repairs were conducted under the Sacramento River Bank Protection Project (SRBPP) within each of the sub-reaches (USACE 2008, USACE 2013). Applicability of design features was evaluated using the professional judgment and experience of the project team. In cases where the applicability of a particular design feature for a particular reach was in question, the analysis erred on the side of caution and applied reduced values or omitted the feature from final analysis. The set of reasonable worst-case parameters is designed to provide a maximum estimation of impact for the purpose of consultation at feasibility planning level. A Vegetation Variance Request (VVR) was assumed to be in place for the Sacramento and American River reaches. The Corps will obtain an ETL-approved vegetation variance exempting the Sacramento River sites from vegetation removal in the lower third of the waterside of the levee prior to final construction and design phase. The

Corps will be complying with the ETL on the American River via a SWIF. The VVR is not assumed to apply to the SBP. Specific habitat attributes are provided by site in (Tables 6-25) and specific justifications for each variable is also provided in those tables.

The following describes how input values for each of the SAM habitat attributes were derived for with-project conditions:

2.3.1 Bank Slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change, dW:dH) along each seasonal shoreline (*i.e.*, the line where the water surface intersects the bank on average fall, winter, spring, and summer) (USACE 2004). With-project bank slopes were based on the description of project actions for each reach. Bank slopes for the Sacramento and American River reaches were assumed to be analogous to associated SRBPP repair sites that were in close proximity to the reach being analyzed. Consequently, bank slopes with a summer-fall slope of 3 and winter-spring slope of 10 were used.

2.3.2 Floodplain Availability

The with-project floodplain inundation ratios used in this SAM analysis remained unchanged from existing conditions. Levee repair and bank stabilization actions typically do not increase floodplain availability (with exception of constructing setback levees). In the absence of levee setback actions, the amount of available floodplain areas and channel cross sections would not be greatly altered during levee repair activities.

In this SAM analysis, it was assumed that the with-project floodplain inundation ratios would be the same as pre-project values. As a result, no impacts to habitat quality at the ARCF GRR reaches are expected with respect to this habitat variable.

2.3.3 Bank Substrate Size

The median substrate size (D_{50}) along the summer-fall and winter-spring shorelines of the project reach were based on the description of project actions for each sub-reach. Bank substrate size along the American River sub-reaches were assumed to be 18 inch rock revetment at summer-fall shoreline and 0.25 inch natural substrate at winter-spring shoreline. Bank substrate size along the Sacramento River sub-reaches were assumed to be 12 inch rock revetment at summer-fall shoreline and 0.25 inch natural substrate at winter-spring shoreline.

2.3.4 Instream Structure

The shoreline coverage of IWM along the average summer-fall and winter-spring shorelines was based on the description of project actions for each reach. In the SAM analysis, IWM coverage along the Sacramento and American River reaches were assumed to include installation of 40% shoreline coverage at summer-fall and winter-spring shoreline conditions.

2.3.5 Aquatic Vegetation

The shoreline coverage of aquatic vegetation along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Aquatic vegetation along the Sacramento and American River sub-reaches were assumed to be analogous to SRBPP repair sites. The vegetation growth models below applied to the Sacramento and American River sub-reaches were taken from previous SAM analysis'. For the American River (ARN_AB, ARS_ABC) four previously constructed SRBPP sites within the ARCF GRR project area were used for analysis (LAR 0.3L, LAR 2.8L, LAR 10.0L, and LAR 10.6L)(USACE, 2013). For the Sacramento River 15 previously constructed SRBPP sites within the ARCF GRR project area were used for analysis (SAC 49.7L, SAC 52.3L, and SAC 53.5R)(USACE 2013) and (RM 47.0L, RM 47.9R, RM 48.2R, RM 49.6R, RM 49.9L, RM 50.2L, RM 50.4L, RM 50.8L, RM 51.5 L, RM 52.4L, RM 53.1L, and RM 56.7L)(USACE 2008). Relevant O&M activities were considered but excluded from this analysis. The assumed vegetation variance would apply to woody vegetation only and O&M activities would be expected to result in the removal of shrubs on the slope of the levee; however, it was assumed that typical SRBPP repair designs would locate the planted riparian bench at appropriate elevations and distance from the levee to allow for revegetation efforts. Any removal of shrubby vegetation as the result of O&M activities would take place on the upper slope of the levee and would not impact the habitat considered in a typical SAM analysis.

2.3.6 Overhanging Shade

The shoreline coverage of overhanging shade along the average summer-fall and winter-spring shorelines was based on the description of project actions for each sub-reach. Overhanging shade along the Sacramento and American River sub-reaches were assumed to be analogous to SRBPP repair sites. It was assumed that a variance would be in place allowing for retention of woody vegetation along the lower 2/3 of the levee slope. As the result of constructing a planted bench, it was assumed that the with-project seasonal shoreline would be shifted away from the existing shade providing canopy. Under this assumption, existing summer-fall values for overhanging shade were taken as the starting point for with-project winter-spring conditions. The with-project winter-spring values were further reduced by 75% (winter) and 25% (spring) to account for defoliation. As a final step, these winter-spring values were reduced by 20% to account for trees removed for construction equipment access. With-project overhanging shade values were expected to start at 0% as the result of a constructed bench shifting the shoreline away from the existing canopy. The shade growth models below were applied to the starting seasonal values for overhanging shade described above along the Sacramento and American River sub-reaches. These shade growth models were taken from previous SRBPP SAM analysis' conducted within the ARCF GRR project area.

3.0 Results

The SAM results are presented as weighted response indices (WRI), that give a relative indication of fish response to a project action over time. A negative WRI can be interpreted as a reduction in habitat value and a positive WRI can be interpreted as a increase in habitat value Although the WRI values are not directly representative of actual lengths or areas, the resource agencies have used those values as proxies in determining determine mitigative requirements. Appropriate mitigation is typically determined by identifying the maximum negative WRI for critical life stages (spawning and egg incubation, fry and juvenile rearing, and juvenile migration) on a site-by-site basis. Therefore this section will present results with a focus on the identification of maximum negative WRIs.

As described above, the ARCF GRR project reaches were grouped into four SAM analysis reaches based on hydrologic connectivity. Results are presented below by reach and species and are summarized in tables 30-32 and figures 2-22 at the end of the document.

3.1 Sacramento River SAM Analysis (ARS_DEFG)

The Sacramento River SAM analysis reach includes the entire left bank (east side) of the Sacramento River from the American River confluence to approximately 4,020 linear feet (lf) below the Freeport Bridge. The response of all runs of Chinook salmon, steelhead, and green sturgeon to project actions were included in the analysis of this reach. The green sturgeon spawning and egg incubation life stage was excluded from the analysis because spawning does not occur in the project area.

3.1.1 Spring/ Fall/ Late-Fall/ Winter Run Chinook Salmon

Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a positive response by year 5 in the winter-spring when most juvenile Chinook salmon are expected in the ARCF GRR project area. Short term negative WRI are expected within the recommended recovery period for Chinook salmon. The maximum negative WRI identified is -4,258 ft for the juvenile migration life stage of Chinook salmon in the summer of year 9. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Table 28). The WRI response curves for juvenile migration and rearing can be located in (Figures 4 and 7). The NMFS SAM effects analysis summary tables can be seen in (Table 32).

3.1.2 Steelhead

Steelhead are expected to show a long term positive response to project actions in the Sacramento River SAM analysis reach over the lifetime of the project. Steelhead should exhibit a positive response by year 4 in the winter-spring when most juvenile steelhead will be migrating and rearing through the project area. The maximum negative WRI identified is -3,985 ft for the juvenile migration life stage of steelhead in the fall of year 10. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer habitat conditions. The WRI response curves for juvenile migration and rearing can be located in (Figures 10 and 13).

3.1.3 Green Sturgeon

SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species. SAM WRI's for green sturgeon generally indicate a negative response or no response to typical onsite mitigative features. Green sturgeon are expected to show long term negative response to project actions in the Sacramento River SAM analysis reach for several life stages at all seasonal habitat conditions over the lifetime of the project. The maximum negative WRI identified is -5,009 for fry and juvenile rearing in the summer of year 1. Negative WRI displayed a general trend toward decreasing beyond the lifetime of the project for fry and juvenile rearing life stages. Negative WRI values for adult life stages will result from the creation of a 10:1 planted bench at winter/spring habitat conditions. The WRI response curves for juvenile rearing can be located in (Figure 16).

3.2 American River SAM Analysis (ARN_AB and ARS_ABC)

The American River SAM analysis reaches include portions of the right and left bank of the American River from Goethe Park to the confluence of the Sacramento. The response of spring and fall runs of Chinook salmon, steelhead, and green sturgeon were included in the analysis of these reaches. Additional seasonal fall run juvenile migration life stage analysis was conducted after consultation with NMFS. Green sturgeon analysis was also included because of critical habitat in the lowest sub-reach (ARS_C) of the American River project area.

3.2.1 Spring/ Fall Chinook Salmon

Chinook salmon are expected to show a long term positive response to project actions in the American River SAM analysis reaches over the lifetime of the project when both IWM and planted benches are incorporated into the with-project conditions. Chinook salmon should exhibit a positive response by year 5. Short term habitat deficits are expected within the recommended recovery period for Chinook salmon. The maximum negative WRI value identified for the American River SAM ARN_AB and ARS_ABC is -3,129 ft for the juvenile migration life stage of fall-run Chinook salmon in the summer of year 1. Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Tables 26-27). The WRI response curves for juvenile migration and rearing can be located in (Figures 2,3,5,and 6). Additional fall-run Chinook salmon juvenile migration life stages not normally set as default in SAM were included on the American River reaches per NMFS request.

3.2.2 Steelhead

Steelhead are expected to show a long term positive response to project actions in the American River SAM analysis reach over the lifetime of the project. Steelhead should exhibit a positive response by year 4. Short term habitat deficits are expected within the recommended recovery period for steelhead. The maximum negative WRI value identified for the American River SAM analysis is -3,061 ft for the adult residence life stage in the summer of year 1 (Figures 20 and 21). Short term negative WRI values will result from the initial loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions. The WRI response curves for juvenile migration and rearing can be located in (Figures 8,9,11, and 12).

3.2.3 Green Sturgeon

Project actions in the American River SAM analysis reach will mimic SRBPP repair site onsite mitigative features. SRBPP onsite mitigative features were designed to maximize habitat response for salmonid species; green sturgeon will exhibit a negative response for juvenile rearing in the summer/fall to these onsite mitigative features. However, during the winter/spring green sturgeon juvenile rearing life stages will exhibit a positive response to these onsite mitigative features. The maximum negative WRI value identified is -7,118 ft for the fry and juvenile rearing life stage in the summer of year 1. The WRI response curves for juvenile rearing can be located in (Figures 14 and 15).

3.3 Sacramento Bypass and Weir SAM Analysis

The Sacramento Bypass SAM analysis reach includes the right bank (north side) of the Sacramento Bypass levee in its entirety from the confluence of the Sacramento River to its termination at the Yolo Bypass. The response of all runs of Chinook salmon, steelhead, and green sturgeon were included in the analysis of this reach.

3.3.1 Spring/ Fall/ Late-Fall/ Winter Run Chinook Salmon

Chinook salmon are expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Chinook salmon should exhibit a negative response by year 1. The maximum negative WRI value identified is -188 ft for the juvenile migration life stage of Spring and Winter-run Chinook salmon in the spring of year 2. Short term and long term negative WRI values will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir. The SAM data iterations for the various life stages for Chinook salmon can be seen in (Table 29). The NMFS SAM effects analysis summary tables can be seen in (Table 33).

3.3.2 Steelhead

Steelhead are also expected to show a small long term negative response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project. Steelhead should exhibit a negative response by year 1. The maximum negative WRI value identified is -174 ft for the juvenile migration life stage in the spring of year 2. Short term and long term negative WRI values will result from the loss of aquatic vegetation and over hanging shade at fall/summer/winter/spring habitat conditions during and after the construction of the extension to the Sacramento Bypass Weir. The NMFS SAM effects analysis summary tables can be seen in (Table 33).

3.3.3 Green Sturgeon

Green Sturgeon are expected to show a long term positive response to project actions in the Sacramento Bypass SAM analysis reach over the lifetime of the project for the fry and juvenile rearing life stages in the winter/spring/summer/fall of year 1. The maximum negative WRI value identified is -8 ft for the adult residence life stage of green sturgeon in the winter/spring/summer of year 1 which carries over through the life of the project into year 50. The SAM data iterations for the various life stages for green sturgeon can be seen in (Table 29). The NMFS SAM effects analysis summary tables can be seen in (Table 33).

4.0 Discussion

The SAM analysis indicates that the project actions in the Sacramento River SAM analysis reach, American River SAM analysis reach, and the Sacramento Bypass SAM analysis reach would result in short and longer-term impacts for focus fish species. Impacts to Chinook salmon, Central Valley steelhead, and green sturgeon are generally the result of reduction in the available natural substrate, shade and the alteration of near-shore slope resulting from bank armoring. Long term recovery of onsite vegetation, addition of IWM, and retention of existing vegetation are all expected to minimize impact as well as contribute to long term gains in habitat value.

This SAM analysis employed a set of worst case scenario parameters developed to capture the maximum potential impacts of the project for the Section 7 consultation process. Future implementation of the project is expected to result in significantly lower impacts. Project actions along portions of the American River reach will likely not include bank armoring in their final design, which will significantly reduce estimated impacts to fish species. Additional mitigative design features or improved erosion repair designs may result in reduced impact compared to the legacy designs used for the basis of this analysis. Site specific designs will be implemented on a site by site basis in consultation with resource agencies and project partners to minimize impacts as well as maximize opportunities for implementing onsite mitigative features.

During project implementation, site specific SAM analyses will be run on final designs to better evaluate impact. SAM results will be used by the Corps and NMFS in the negotiation of appropriate mitigation for project actions. Although short term impacts are generally self mitigating through the development of onsite mitigative features, the Corps will compensate for the temporal impacts to habitat through the purchase of offsite mitigative credits. Typically appropriate mitigation will be based on the identification of maximum negative WRI values. By mitigating for the maximum negative WRI, lesser impacts are expected to be appropriately mitigated. As a general rule, the SAM applies any habitat characteristics at summer/fall conditions to winter/spring conditions with the assumption that those characteristics would provide similar value during inundation. Onsite mitigation at summer/fall conditions is expected to provide similar habitat benefit for winter/spring conditions. Offsite mitigation is expected to provide mitigative value at all seasonal habitat conditions. Longer term impacts to habitat may not recover to baseline conditions over the life of the project due to design restrictions. These impacts to habitat will be compensated through the purchase of offsite mitigative credits as well as the incorporation of additional onsite mitigative features (ie. low water plantings, additional IWM, additional revegetation).

Additional mitigative concerns, not considered in a SAM analysis, will be addressed along the Sacramento Bypass reach, including potential adult and juvenile passage issues, loss of shoreline riparian vs. gain in floodplain, and contradicting ESA species habitat requirements. These issues will be considered and appropriate actions will be taken where possible in coordination with other agencies.

4.1 Chinook Salmon

Impacts to Chinook salmon were analyzed for the Sacramento River SAM analysis reach (ARS_DEFG), American River SAM analysis reach (ARN_AB, ARS_ABC) and the Sacramento Bypass SAM analysis reach. In the Sacramento River SAM analysis reach, negative WRI values are due to short term removal of aquatic vegetation and overhanging shade caused by the repair action. The SAM analysis indicates that repair actions would result in a maximum negative WRI value of -4,258 ft. This value is based on the maximum negative WRI value observed for juvenile migration life stage of Chinook salmon in the summer of year 9. USACE will mitigate for -4,258 ft of equivalent habitat as described above in Section 4.0.

In the American River SAM analysis reaches ARN_AB and ARS_ABC negative WRI values are due to short term removal of aquatic vegetation and overhanging shade caused by the repair action. The SAM analysis incorporating planted benches and IWM indicates that repair actions would result in a maximum habitat deficit of -3,129 ft. This value is based on the maximum negative WRI value observed for the juvenile migration life stage of spring and fall-run Chinook salmon in the summer and fall of year 1. USACE will mitigate for -3,129 ft of equivalent habitat as described above in Section 4.0.

There were no initial construction impact negative WRI values for the juvenile rearing life stage of Chinook salmon in the winter and spring water levels on the American and Sacramento River reaches. A possible explanation is that the SAM ECT does not produce an output at Year-0. It does not calculate the difference from the baseline to with-Project results. SAM at Year-0 is zero. The relative response for Year-1 is actually the Year-0 results+Year-1 results divided by 2, see pages 5-29 to 5-31 in the SAM Certification Update for SAM formula detailed explanation. In Year-0 revetment will be added, vegetation will be removed and slope will have a positive change. In Year-1 IWM will be added, soil and planting on the bench will occur, and the VVR will kick in. Year-0 habitat deficits would be more than the Year-1 deficits where the positive and negative deficits are equal.

In the Sacramento Bypass SAM analysis reach negative WRI values are due to short and long term removal of aquatic vegetation and overhanging shade for the upstream extension of the Sacramento Bypass Weir. The SAM analysis indicates that repair and removal actions would result in a maximum negative WRI value of -146 ft. This value is based on the maximum negative WRI value observed for juvenile migration of Chinook salmon in the winter of year 1. USACE will mitigate for -146 ft of equivalent habitat as described above in Section 4.0.

4.2 Steelhead

Impacts to steelhead were analyzed for the Sacramento River SAM analysis reach, American River SAM analysis reach, and the Sacramento Bypass SAM analysis reach. The Sacramento River SAM analysis indicates that repair actions would result in maximum negative WRI values of -3,985 ft. This value is based on the maximum negative WRI value observed for the juvenile migration life stage of steelhead in the fall of year 10.

The American River SAM analysis ARN_AB and ARS_ABC indicates that repair actions would result in negative WRI values of -3,061 ft. This negative WRI is expected to be adequately compensated through mitigation of a greater negative WRI for Chinook salmon.

There were no initial construction impact negative WRI values for the juvenile rearing life stage of steelhead in the winter and spring water levels on the Sacramento River reaches. A possible explanation is that the SAM ECT does not produce an output at Year-0. It does not calculate the difference from the baseline to with-Project results. SAM at Year-0 is zero. The relative response for Year-1 is actually the Year-0 results+Year-1 results divided by 2, see pages 5-29 to 5-31 in the SAM Certification Update for SAM formula detailed explanation. In Year-0 revetment will be added, vegetation will be removed and slope will have a positive change. In Year-1 IWM will be added, soil and planting on the bench will occur, and the VVR will kick in. Year-0 habitat deficits would be more than the Year-1 habitat deficits where the positive and negative deficits are equal.

The Sacramento Bypass SAM analysis indicates that repair actions would result in maximum negative WRI values of -174 ft. This value is based on the maximum

\negative WRI value observed for the juvenile migration life stage of steelhead in the spring of year 4. This negative WRI is expected to be adequately compensated through mitigation of a greater negative WRI for Chinook salmon.

4.3 Green Sturgeon

Impacts to green sturgeon were analyzed for the Sacramento and American River SAM and Sacramento Bypass analysis reaches. Green sturgeon critical habitat in the American River extends from the confluence of the Sacramento River to the Highway 160 bridge (ARS_C). Additional SAM elements were incorporated to address potential green sturgeon effects in the American River reaches (ARN_AB and ARS_AB), as per NMFS request, even though use of these reaches by green sturgeon has not been documented. Recently a white sturgeon (161mm) was collected in a rotary screw trap (RST) by the U.S. Fish and Wildlife Service (USFWS) at the Watt Avenue bridge, the first such documented catch of a sturgeon since records have been kept dating back to approximately 1996. There have been no green sturgeon collected, and the correlation of green sturgeon presence to white sturgeon presence is not well understood for larval life stages in this region of the river. This additional analysis allowed for a more conservative estimate of impacts and may not necessarily reflect the true impacts from the project.

The habitat requirements of green sturgeon are not well understood; assumptions built into the SAM on fish response to shoreline features were based on limited information. Habitat use of the American River, Sacramento River, and Sacramento Bypass project reaches by green sturgeon are likely limited to use as a migration corridor by adults and potential rearing area by juvenile life stages. Although the SAM indicates negative response to habitat by adult life stages, it is unlikely that shoreline repair activities would significantly impact the river for residence or as a migration corridor. SRBPP style repairs are designed to mimic naturally occurring habitat types and are not expected to significantly alter the width of the river. USACE does not expect any significant impacts to the adult residence or adult migration life stages in the American or Sacramento River and does not propose any additional mitigation.

No suitable spawning habitat exists in the Sacramento River, American River, and Sacramento Bypass project reaches. Green sturgeon spawning with concurrent egg incubation and early life history primarily takes place upriver of Colusa on the Sacramento River and in the lower Feather River outside of the project area. Because no suitable spawning habitat is present in the project reaches under existing conditions, USACE does not expect any significant impacts to the spawning and egg incubation life stage of green sturgeon and does not propose any additional mitigation.

The American River SAM analysis ARN_AB and ARS_ABC indicates that repair actions would result in a maximum negative WRI values of -7,118 ft. for fry and juvenile rearing in the summer of year one. The Sacramento River SAM analysis ARS_DEFG indicates that repair actions would result in a maximum negative WRI values of -5,009 for fry and juvenile rearing in the summer of year one.

The Sacramento Bypass SAM analysis indicates that repair actions would result in maximum negative WRI values of -8 ft in response to the removal of aquatic vegetation and SRA for the expansion of the Sacramento Bypass and Weir. This value is based on the maximum negative WRI values observed for the adult residence life stage of green sturgeon in the winter/spring /summer of year 1 continuing through the life of the project to year 50.

Little is known about the fry and juvenile rearing and juvenile migration life stages of green sturgeon. The SAM does not evaluate response to specific habitat attributes for the juvenile migration life stage. For the purpose of this analysis it is assumed that these life stages exhibit similar responses to analogous life stages of Chinook and steelhead. This approach assumes that fry and juvenile rearing and juvenile migration life stages of green sturgeon will exhibit a positive response to “good riparian habitat” (*i.e.* increased shoreline coverage of overhanging shade, aquatic vegetation, and IWM). During the planning and design phase of the project, opportunities for the incorporation of additional onsite mitigative features will be evaluated in coordination with resource agencies to ensure the projected longer term impacts are appropriately compensated for green sturgeon. Potential onsite mitigative features include the planting of vegetation at the low water line, the incorporation of additional IWM, and limitations in instream revetment.

Table 6
SAM data summary of existing conditions at site Lower American River RM 10.0L and 10.6L (ARN_AB).

Habitat Parameter	Water Year	Seasonal Values Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	18,576	18,576	18,576	18,576
	2074	18,576	18,576	18,576	18,576
Bank Slope (dH:dV) [2]	2024	2	2	2	2
	2074	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	2.5	2.5	2.5	2.5
	2074	2.5	2.5	2.5	2.5
Instream Structure (% shoreline) [5]	2024	31	31	31	31
	2074	31	31	31	31
Vegetation (% shoreline) [6]	2024	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [7]	2024	60	15	45	60
	2074	60	15	45	60

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 7
SAM data summary of with-project conditions at site Lower American River RM 10.0L and 10.6L (ARN_AB).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	18,576	18,576	18,576	18,576
	2074	18,576	18,576	18,576	18,576
Bank Slope (dH:dV) [2]	2024	2	3	3	3
	2025	3	10	10	3
	2074	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	2.5	18	18	18
	2025	18	0.25	0.25	18
	2074	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2024	31	0	0	0
	2025	40	40	40	40
	2074	40	40	40	40
Vegetation (% shoreline) [6]	2024	0	0	0	0
	2025	0	25	50	0
	2029	0	88	88	0
	2039	0	88	88	0
	2049	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [6]	2024	0	13	38	0
	2025	0	13	40	0
	2029	0	25	75	0
	2039	100	25	75	100
	2049	100	25	75	100
	2074	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee.

Table 8
SAM data summary of existing conditions at site Lower American River RM 10.0L and 10.6L (ARS_A).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	14,345	14,345	14,345	14,345
	2070	14,345	14,345	14,345	14,345
Bank Slope (dH:dV) [2]	2020	2.00	2.00	2.00	2.00
	2070	2.00	2.00	2.00	2.00
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	1.2	1.2	1.2	1.2
	2070	1.2	1.2	1.2	1.2
Instream Structure (% shoreline) [5]	2020	1.7	1.7	1.7	1.7
	2070	1.7	1.7	1.7	1.7
Vegetation (% shoreline) [6]	2020	0	63	63	0
	2070	0	63	63	0
Shade (% shoreline) [7]	2020	42	11	32	42
	2070	42	11	32	42

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 9
SAM data summary of with-project conditions at site Lower American River RM 10.0L and 10.6L (ARS_A).

Habitat Parameter	Water Year	Seasonal Values Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	14,345	14,345	14,345	14,345
	2070	14,345	14,345	14,345	14,345
Bank Slope (dH:dV) [2]	2020	2.0	3.0	3.0	3.0
	2021	3.0	10.0	10.0	3.0
	2070	3.0	10.0	10.0	3.0
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	1.2	18	18	18
	2021	18	0.25	0.25	18
	2070	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2020	1.7	0.0	0.0	0
	2021	40	40	40	40
	2070	40	40	40	40
Vegetation (% shoreline) [6]	2020	0	0	0	0
	2021	0	25	50	0
	2025	0	88	88	0
	2035	0	88	88	0
	2045	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [6]	2020	0	9	27	0
	2021	0	9	29	0
	2025	0	24	74	0
	2035	100	25	75	100
	2045	100	25	75	100
	2070	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 10
SAM data summary of existing conditions at site Lower American River RM 2.8L (ARS_B).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2023	5,472	5,472	5,472	5,472
	2073	5,472	5,472	5,472	5,472
Bank Slope (dH:dV) [2]	2023	2	2	2	2
	2073	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2023	1	1	1	1
	2073	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2023	1.5	1.5	1.5	1.5
	2073	1.5	1.5	1.5	1.5
Instream Structure (% shoreline) [5]	2023	5	5	5	5
	2073	5	5	5	5
Vegetation (% shoreline) [6]	2023	0	65	65	0
	2073	0	65	65	0
Shade (% shoreline) [7]	2023	30	7	22	30
	2073	30	7	22	30

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 1 SRBPP repair site modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 11
SAM data summary of with-project conditions at site Lower American River RM 2.8L (ARS_B).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2023	5,472	5,472	5,472	5,472
	2073	5,472	5,472	5,472	5,472
Bank Slope (dH:dV) [2]	2023	2	3	3	3
	2024	3	10	10	3
	2073	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2023	1	1	1	1
	2073	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2023	1.5	18	18	18
	2024	18	0.25	0.25	18
	2073	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2023	5	0	0	0
	2024	40	40	40	40
	2073	40	40	40	40
Vegetation (% shoreline) [6]	2023	0	0	0	0
	2024	0	25	50	0
	2028	0	88	88	0
	2038	0	88	88	0
	2048	0	88	88	0
	2073	0	88	88	0
Shade (% shoreline) [6]	2023	0	7	20	0
	2024	0	7	22	0
	2028	0	22	67	0
	2038	100	25	75	100
	2048	100	25	75	100
	2073	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 12
SAM data summary of existing conditions at site Lower American River RM 0.3L (ARS_C).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2026	3,988	3,988	3,988	3,988
	2076	3,988	3,988	3,988	3,988
Bank Slope (dH:dV) [2]	2026	2	2	2	2
	2076	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2026	1	1	1	1
	2076	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2026	0.25	0.25	0.25	0.25
	2076	0.25	0.25	0.25	0.25
Instream Structure (% shoreline) [5]	2026	5	5	5	5
	2076	5	5	5	5
Vegetation (% shoreline) [6]	2026	0	88	88	0
	2076	0	88	88	0
Shade (% shoreline) [7]	2026	67	16	50	67
	2076	67	16	50	67

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 1 SRBPP repair site modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 13
SAM data summary of with-project conditions at site Lower American River RM 0.3L (ARS_C).

Habitat Parameter	Water Year	Seasonal Values Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2026	3,988	3,988	3,988	3,988
	2076	3,988	3,988	3,988	3,988
Bank Slope (dH:dV) [2]	2026	2	3	3	3
	2027	3	10	10	3
	2076	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2026	1	1	1	1
	2076	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2026	0.25	18	18	18
	2027	18	0.25	0.25	18
	2076	18	0.25	0.25	18
Instream Structure (% shoreline) [5]	2026	5	0	0	0
	2027	40	40	40	40
	2076	40	40	40	40
Vegetation (% shoreline) [6]	2026	0	0	0	0
	2027	0	25	50	0
	2031	0	88	88	0
	2041	0	88	88	0
	2051	0	88	88	0
	2076	0	88	88	0
Shade (% shoreline) [6]	2026	0	14	42	0
	2027	0	14	44	0
	2031	0	25	75	0
	2041	100	25	75	100
	2051	100	25	75	100
	2076	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 18 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 14
SAM data summary of existing conditions at site Sacramento River RM 56.7L (ARS_D).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2025	9,131	9,131	9,131	9,131
	2075	9,131	9,131	9,131	9,131
Bank Slope (dH:dV) [2]	2025	1.8	1.8	1.8	1.8
	2075	1.8	1.8	1.8	1.8
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2025	1	1	1	1
	2075	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2025	7.6	7.6	7.6	7.6
	2075	7.6	7.6	7.6	7.6
Instream Structure (% shoreline) [5]	2025	22	22	22	22
	2075	22	22	22	22
Vegetation (% shoreline) [6]	2025	0	88	88	0
	2075	0	88	88	0
Shade (% shoreline) [7]	2025	40	10	30	40
	2075	40	10	30	40

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 1 SRBPP repair site modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 15
SAM data summary of with-project conditions at site Sacramento River RM 56.7L (ARS_D).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2025	9,131	9,131	9,131	9,131
	2075	9,131	9,131	9,131	9,131
Bank Slope (dH:dV) [2]	2025	2.5	1.5	1.5	1.5
	2026	1.5	6.5	6.5	1.5
	2075	1.5	6.5	6.5	1.5
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2025	1	1	1	1
	2075	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2025	7.6	12	12	12
	2026	12	0.25	0.25	12
	2075	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2025	22	0	0	0
	2026	0	0	0	0
	2075	0	0	0	0
Vegetation (% shoreline) [6]	2025	0	0	0	0
	2026	0	0	0	0
	2030	10	60	60	10
	2040	10	88	88	10
	2050	10	88	88	10
	2075	10	88	88	10
Shade (% shoreline) [6]	2025	0	8	24	0
	2026	0	8	25	0
	2030	0	9	35	0
	2040	61	13	66	61
	2050	97	15	75	97
	2075	99	15	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume no installation of shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 16
SAM data summary of existing conditions at site Sacramento River RM 53.1L and RM 53.5R (ARS_E).

		Seasonal Values			
Habitat Parameter	Water Year	Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2021	9,149	9,149	9,149	9,149
	2071	9,149	9,149	9,149	9,149
Bank Slope (dH:dV) [2]	2021	1.7	1.7	1.7	1.7
	2071	1.7	1.7	1.7	1.7
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2021	1	1	1	1
	2071	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2021	7	7	7	7
	2071	7	7	7	7
Instream Structure (% shoreline) [5]	2021	30	30	30	30
	2071	30	30	30	30
Vegetation (% shoreline) [6]	2021	0	88	88	0
	2071	0	88	88	0
Shade (% shoreline) [7]	2021	60	15	45	60
	2071	60	15	45	60

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 17
SAM data summary of with-project conditions at site Sacramento River RM 53.1L and 53.5R (ARS_E).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2021	9,149	9,149	9,149	9,149
	2071	9,149	9,149	9,149	9,149
Bank Slope (dH:dV) [2]	2021	1.7	2	2	2
	2022	2	6	6	2
	2071	2	6	6	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2021	1	1	1	1
	2071	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2021	7	12	12	12
	2022	12	0.25	0.25	12
	2071	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2021	30	0	0	0
	2022	40	40	40	40
	2071	40	40	40	40
Vegetation (% shoreline) [6]	2021	0	0	0	0
	2022	0	50	50	0
	2026	0	88	88	0
	2036	0	88	88	0
	2046	0	88	88	0
	2071	0	88	88	0
Shade (% shoreline) [6]	2021	0	12	36	0
	2022	0	12	37	0
	2026	0	13	42	0
	2036	61	17	75	61
	2046	97	19	75	97
	2071	99	19	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Assume no significant change to Bank Slope.
[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.
[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.
[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 18

SAM data summary of existing conditions at site Sacramento River RM 48.2L-52.4L (ARS_F).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	21,379	21,379	21,379	21,379
	2070	21,379	21,379	21,379	21,379
Bank Slope (dH:dV) [2]	2020	1.8	1.8	1.8	1.8
	2070	1.8	1.8	1.8	1.8
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	8.7	8.7	8.7	8.7
	2070	8.7	8.7	8.7	8.7
Instream Structure (% shoreline) [5]	2020	17	17	17	17
	2070	17	17	17	17
Vegetation (% shoreline) [6]	2020	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [7]	2020	73	18	54	73
	2070	73	18	54	73

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 10 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 19

SAM data summary of with-project conditions at site Sacramento River RM 48.2L-52.4L (ARS_F).

Habitat Parameter	Water Year	Seasonal Values Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2020	21,379	21,379	21,379	21,379
	2070	21,379	21,379	21,379	21,379
Bank Slope (dH:dV) [2]	2020	1.8	2.0	2.0	2
	2021	2	6	6	2
	2070	2	6	6	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2020	1	1	1	1
	2070	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2020	8.7	12	12	12
	2021	12	0.25	0.25	12
	2070	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2020	17	0	0	0
	2021	40	40	40	40
	2070	40	40	40	40
Vegetation (% shoreline) [6]	2020	0	0	0	0
	2021	0	50	50	0
	2025	0	88	88	0
	2035	0	88	88	0
	2045	0	88	88	0
	2070	0	88	88	0
Shade (% shoreline) [6]	2020	0	14	43	0
	2021	0	14	44	0
	2025	0	15	54	0
	2035	61	19	75	61
	2045	97	21	75	97
	2070	99	21	75	99

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

[2] Assume no significant change to Bank Slope.

[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).

[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.

[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 20

SAM data summary of existing conditions at site Sacramento River RM 47.0L and 47.9R (ARS_G).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	11,066	11,066	11,066	11,066
	2074	11,066	11,066	11,066	11,066
Bank Slope (dH:dV) [2]	2024	2	2	2	2
	2074	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	9.40	9.40	9.40	9.40
	2074	9.40	9.40	9.40	9.40
Instream Structure (% shoreline) [5]	2024	5.5	5.5	5.5	5.5
	2074	5.5	5.5	5.5	5.5
Vegetation (% shoreline) [6]	2024	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [7]	2024	90	22	67	90
	2074	90	22	67	90

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[2] Existing slopes taken from 2 SRBPP repair sites modeled by SAM.
[3] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of one for all seasons in all ARCF GRR Reaches.
[4] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[5] Instream Structure data taken from USACE Revetment Database (2007).
[6] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[7] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 21

SAM data summary of with-project conditions at site Sacramento River RM 47.0L and 47.9R (ARS_G).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Shoreline Length (feet) [1]	2024	11,066	11,066	11,066	11,066
	2074	11,066	11,066	11,066	11,066
Bank Slope (dH:dV) [2]	2024	2.5	3	3	3
	2025	3	10	10	3
	2074	3	10	10	3
Floodplain Inundation Ratio (AQ2:AQavg) [3]	2024	1	1	1	1
	2074	1	1	1	1
Bank Substrate Size (D50 in inches) [4]	2024	9.4	12	12	12
	2025	12	0.25	0.25	12
	2074	12	0.25	0.25	12
Instream Structure (% shoreline) [5]	2024	5.5	0	0	0
	2025	40	40	40	40
	2074	40	40	40	40
Vegetation (% shoreline) [6]	2024	0	0	0	0
	2025	0	50	50	0
	2029	0	88	88	0
	2039	0	88	88	0
	2049	0	88	88	0
	2074	0	88	88	0
Shade (% shoreline) [6]	2024	0	18	54	0
	2025	0	18	55	0
	2029	0	19	65	0
	2039	100	23	75	100
	2049	100	25	75	100
	2074	100	25	75	100

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.

[1] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).

[2] Assume no significant change to Bank Slope.

[3] Assume no significant increase in floodplain between seasonal water surface elevations or as a result of project construction.

[4] Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).

[6] Assume installation of 40% shoreline coverage of IWM at summer/fall and winter/spring.

[6] Assume a variance in place allowing existing woody vegetation to remain in place on bottom 2/3 of levee

Table 22

SAM data summary of existing conditions at site Sacramento River 50.0L (SBP Levee).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	8,799,296	8,799,296	8,799,296	8,799,296
	2062	8,799,296	8,799,296	8,799,296	8,799,296
Shoreline Length (feet) [2]	2012	9,047	9,047	9,047	9,047
	2062	9,047	9,047	9,047	9,047
Bank Slope (dH:dV) [3]	2012	2	2	2	2
	2062	2	2	2	2
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	2.4	2.4	2.4	2.4
	2062	2.4	2.4	2.4	2.4
Instream Structure (% shoreline) [6]	2012	3.9	3.9	3.9	3.9
	2062	3.9	3.9	3.9	3.9
Vegetation (% shoreline) [7]	2012	0	71	71	0
	2062	0	71	71	0
Shade (% shoreline) [8]	2012	48	12	36	48
	2062	48	12	36	48

[1] Wetted area estimated from aerial images in Google Earth Pro. Length x Width

[2] USACE Revetment Database (2007) and Google Earth Pro.

[3] Repairs not expected to affect slope, assume slope of 2 for consistency with USACE standards.

[4] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.

[5] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.

[6] Instream Structure data taken from USACE Revetment Database (2007).

[7] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.

[8] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation.

Table 23
SAM data summary of with-project conditions at site Sacramento River RM 50.0L (SBP Levee).

Habitat Parameter	Water Year	Seasonal Values			
		Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	23,022,296	23,022,296	23,022,296	23,022,296
	2062	23,022,296	23,022,296	23,022,296	23,022,296
Shoreline Length (feet) [2]	2012	9,047	9,047	9,047	9,047
	2062	9,047	9,047	9,047	9,047
Bank Slope (dH:dV)	2012	2.5	2.5	2.5	2.5
	2013	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg)	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [3]	2012	2.4	2.4	2.4	2.4
	2013	2.4	2.4	2.4	2.4
	2062	2.4	2.4	2.4	2.4
Instream Structure (% shoreline) [3]	2012	3.9	3.9	3.9	3.9
	2013	3.9	3.9	3.9	3.9
	2062	3.9	3.9	3.9	3.9
Vegetation (% shoreline) [3]	2012	0	71	71	0
	2013	0	71	71	0
	2017	0	71	71	0
	2027	0	71	71	0
	2037	0	71	71	0
	2062	0	71	71	0
Shade (% shoreline)[3]	2012	48	12	36	48
	2013	48	12	36	48
	2017	48	12	36	48
	2027	48	12	36	48
	2037	48	12	36	48
	2062	48	12	36	48

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Wetted area calculated by aerial images and a length x width with-project conditions
[2] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[3] Assumed to stay the same due to only degrading and moving levee

Table 24
SAM data summary of existing conditions at site Sacramento River RM 50.0L (SBP Weir).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	283,968	283,968	283,968	283,968
	2062	283,968	283,968	283,968	283,968
Shoreline Length (feet) [2]	2012	1,500	1,500	1,500	1,500
	2062	1,500	1,500	1,500	1,500
Bank Slope (dH:dV) [3]	2012	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	10	10	10	10
	2062	10	10	10	10
Instream Structure (% shoreline) [6]	2012	0	0	0	0
	2062	0	0	0	0
Vegetation (% shoreline) [7]	2012	0	88	88	0
	2062	0	88	88	0
Shade (% shoreline) [8]	2012	48	12	36	48
	2062	48	12	36	48

[1] Wetted area estimated from aerial images in Google Earth Pro. Length x Width
[2] USACE Revetment Database (2007) and Google Earth Pro.
[3] Repairs not expected to affect slope, assume slope of 2 for consistency with USACE standards.
[4] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Bank substrate data taken from USACE Revetment Database (2007) and confirmed with aerial imagery. Natural substrate assigned a D50 of 0.25 inches. Revetment substrate assigned a D_{50} of 10 inches.
[6] Instream Structure data taken from USACE Revetment Database (2007).
[7] Shoreline coverage of Vegetation taken from USACE Revetment Database and evaluated against aerial imagery. Summer/Fall values taken from "Emergent Veg" attribute. Winter/ Spring values taken from "Veg Cover%" attribute.
[8] Attribute coverage determined from analysis of aerial imagery. Winter/ Spring values modified by 0.25/ 0.75 respectively to represent seasonal defoliation

Table 25
SAM data summary of with-project conditions at site Sacramento River RM 50.0L (SBP Weir).

Habitat Parameter	Water Year	Seasonal Values: Fall	Winter	Spring	Summer
Wetted Area (square feet) [1]	2012	742,968	742,968	742,968	742,968
	2062	742,968	742,968	742,968	742,968
Shoreline Length (feet) [2]	2012	1,500	1,500	1,500	1,500
	2062	1,500	1,500	1,500	1,500
Bank Slope (dH:dV) [3]	2012	2.5	2.5	2.5	2.5
	2013	2.5	2.5	2.5	2.5
	2062	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg) [4]	2012	1	1	1	1
	2062	1	1	1	1
Bank Substrate Size (D50 in inches) [5]	2012	10	10	10	10
	2013	10	10	10	10
	2062	10	10	10	10
Instream Structure (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2062	0	0	0	0
Vegetation (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2017	0	0	0	0
	2027	0	0	0	0
	2037	0	0	0	0
	2062	0	0	0	0
Shade (% shoreline) [6]	2012	0	0	0	0
	2013	0	0	0	0
	2017	0	0	0	0
	2027	0	0	0	0
	2037	0	0	0	0
	2062	0	0	0	0

-WY = water year; spans fall, winter, spring and summer; rock and soil placement and IWM installation assumed during Winter in the initial WY and revegetation planting assumed during Spring of the initial WY.
[1] Wetted area calculated by aerial images and a length x width with-project conditions
[2] Shoreline Length Estimated from Aerial images. Attribute surveyed in the field following the field data collection protocol for the USACE Revetment Database (2007).
[3] Repairs not expected to affect slope, assume slope of 2.5 for consistency with USACE standards.
[4] Assume no significant increase in floodplain between seasonal water surface elevations. Assume floodplain inundation ratio of 1 for all seasons in all ARCF GRR Reaches.
[5] Assume installation of rock revetment at summer/fall (D_{50} of 12 in) and natural substrate at winter/spring (D_{50} of 0.25 in).
[6] Assume no vegetation variance and no placement of IWM and O&M activities

Table 26
American River SAM Analysis Reach
ARN_AB
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0			0	0				0	0				0					0		
1			-366	-1,945				59	-3,002				124					-421		
2			-365	-2,166				411	-1,357				634					-392		
3			-365	-2,240				564	-662				827					-383		
4			-364	-2,277				667	-201				941					-378		
5			-364	-2,299				751	167				1,024					-375		
6			-361	-2,303				816	450				1,085					-370		
7			-353	-2,288				863	653				1,129					-360		
8			-341	-2,260				897	805				1,161					-348		
9			-328	-2,225				925	924				1,187					-334		
10			-314	-2,183				946	1,018				1,207					-319		
11			-298	-2,138				964	1,096				1,224					-303		
12			-282	-2,089				979	1,160				1,238					-287		
13			-265	-2,038				991	1,215				1,250					-270		
14			-248	-1,985				1,002	1,261				1,260					-252		
15			-230	-1,930				1,011	1,302				1,268					-234		
25			-124	-1,600				1,063	1,529				1,317					-126		
50			-44	-1,352				1,102	1,699				1,354					-45		
Fall-run Chinook																				
0	0	0	0	0		0	0	0	0			0	0	0					0	
1	-877	0	-366	-1,945		-759	0	59	-3,002			0	124	-2,681					-3,129	
2	-853	0	-365	-2,166		-339	0	411	-1,357			0	634	-755					-2,759	
3	-845	0	-365	-2,240		-180	0	564	-662			0	827	-80					-2,635	
4	-841	0	-364	-2,277		-87	0	667	-201			0	941	282					-2,573	
5	-839	0	-364	-2,299		-20	0	751	167			0	1,024	519					-2,536	
6	-828	0	-361	-2,303		29	0	816	450			0	1,085	686					-2,501	
7	-804	0	-353	-2,288		64	0	863	653			0	1,129	805					-2,457	
8	-773	0	-341	-2,260		90	0	897	805			0	1,161	894					-2,408	
9	-736	0	-328	-2,225		111	0	925	924			0	1,187	963					-2,356	
10	-695	0	-314	-2,183		127	0	946	1,018			0	1,207	1,018					-2,302	
11	-652	0	-298	-2,138		141	0	964	1,096			0	1,224	1,064					-2,245	
12	-606	0	-282	-2,089		152	0	979	1,160			0	1,238	1,102					-2,188	
13	-559	0	-265	-2,038		161	0	991	1,215			0	1,250	1,134					-2,129	
14	-511	0	-248	-1,985		170	0	1,002	1,261			0	1,260	1,161					-2,069	
15	-462	0	-230	-1,930		177	0	1,011	1,302			0	1,268	1,185					-2,009	
25	-164	0	-124	-1,600		216	0	1,063	1,529			0	1,317	1,318					-1,647	
50	59	0	-44	-1,352		245	0	1,102	1,699			0	1,354	1,418					-1,375	

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 26 (cont.)
American River SAM Analysis Reach
ARN_AB
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall: Adult migration	Fall: Spawning and egg incubation	Fall: Fry and juvenile rearing	Fall: Juvenile migration	Fall: Adult residence	Winter: Adult migration	Winter: Spawning and egg incubation	Winter: Fry and juvenile rearing	Winter: Juvenile migration	Winter: Adult residence	Spring: Adult migration	Spring: Spawning and egg incubation	Spring: Fry and juvenile rearing	Spring: Juvenile migration	Spring: Adult residence	Summer: Adult migration	Summer: Spawning and egg incubation	Summer: Fry and juvenile rearing	Summer: Juvenile migration	Summer: Adult residence
Steelhead																				
0	0		0		0	0	0	0		0	0	0	0	0	0			0	0	0
1	-1,554		-701		-1,554	-1,558	0	-36		-1,558	-1,635	0	-1	-2,096	-1,635			-833	-3,013	-3,061
2	-1,508		-708		-1,508	-701	0	519		-701	-739	0	734	-520	-739			-774	-2,634	-2,262
3	-1,493		-711		-1,493	-381	0	750		-381	-411	0	1,009	23	-411			-755	-2,507	-1,996
4	-1,486		-712		-1,486	-195	0	900		-195	-225	0	1,168	309	-225			-745	-2,444	-1,862
5	-1,481		-712		-1,481	-63	0	1,018		-63	-96	0	1,282	491	-96			-739	-2,406	-1,782
6	-1,463		-707		-1,463	34	0	1,109		34	-3	0	1,365	617	-3			-729	-2,369	-1,714
7	-1,423		-693		-1,423	103	0	1,174		103	63	0	1,424	708	63			-712	-2,323	-1,639
8	-1,371		-674		-1,371	155	0	1,222		155	113	0	1,469	775	113			-691	-2,271	-1,559
9	-1,309		-651		-1,309	196	0	1,260		196	152	0	1,504	828	152			-666	-2,215	-1,477
10	-1,242		-626		-1,242	228	0	1,290		228	183	0	1,531	870	183			-639	-2,156	-1,392
11	-1,170		-599		-1,170	254	0	1,315		254	209	0	1,554	904	209			-611	-2,095	-1,307
12	-1,095		-571		-1,095	276	0	1,335		276	230	0	1,573	933	230			-582	-2,033	-1,220
13	-1,017		-541		-1,017	295	0	1,353		295	248	0	1,589	957	248			-551	-1,970	-1,133
14	-937		-511		-937	311	0	1,367		311	263	0	1,603	978	263			-520	-1,906	-1,044
15	-855		-480		-855	325	0	1,380		325	276	0	1,615	996	276			-489	-1,841	-956
25	-362		-293		-362	402	0	1,453		402	351	0	1,681	1,097	351			-298	-1,450	-422
50	8		-153		8	460	0	1,507		460	407	0	1,731	1,173	407			-156	-1,157	-22
Green Sturgeon																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	-3,250	-2,873	0	-11	0	-3,250	-5,020	0	-2,750	0	-3,250	-5,020	0	-2,750	0	-6,500	-7,118	0	-942
2	0	-4,875	-4,304	0	-16	0	-1,625	-3,280	0	-3,194	0	-1,625	-3,280	0	-3,194	0	-6,500	-6,426	0	-482
3	0	-5,417	-4,781	0	-18	0	-1,083	-2,699	0	-3,343	0	-1,083	-2,699	0	-3,343	0	-6,500	-6,196	0	-328
4	0	-5,688	-5,019	0	-19	0	-812	-2,409	0	-3,417	0	-812	-2,409	0	-3,417	0	-6,500	-6,081	0	-252
5	0	-5,850	-5,162	0	-20	0	-650	-2,235	0	-3,461	0	-650	-2,235	0	-3,461	0	-6,500	-6,011	0	-206
6	0	-5,958	-5,258	0	-20	0	-541	-2,119	0	-3,491	0	-541	-2,119	0	-3,491	0	-6,500	-5,965	0	-175
7	0	-6,036	-5,326	0	-20	0	-464	-2,036	0	-3,512	0	-464	-2,036	0	-3,512	0	-6,500	-5,932	0	-153
8	0	-6,094	-5,377	0	-20	0	-406	-1,974	0	-3,528	0	-406	-1,974	0	-3,528	0	-6,500	-5,908	0	-137
9	0	-6,139	-5,417	0	-20	0	-361	-1,926	0	-3,540	0	-361	-1,926	0	-3,540	0	-6,500	-5,888	0	-124
10	0	-6,175	-5,448	0	-21	0	-325	-1,887	0	-3,550	0	-325	-1,887	0	-3,550	0	-6,500	-5,873	0	-114
11	0	-6,205	-5,475	0	-21	0	-295	-1,855	0	-3,558	0	-295	-1,855	0	-3,558	0	-6,500	-5,860	0	-105
12	0	-6,229	-5,496	0	-21	0	-271	-1,829	0	-3,565	0	-271	-1,829	0	-3,565	0	-6,500	-5,850	0	-98
13	0	-6,250	-5,515	0	-21	0	-250	-1,807	0	-3,570	0	-250	-1,807	0	-3,570	0	-6,500	-5,841	0	-92
14	0	-6,268	-5,530	0	-21	0	-232	-1,787	0	-3,575	0	-232	-1,787	0	-3,575	0	-6,500	-5,833	0	-87
15	0	-6,283	-5,544	0	-21	0	-216	-1,771	0	-3,579	0	-216	-1,771	0	-3,579	0	-6,500	-5,827	0	-83
25	0	-6,370	-5,620	0	-21	0	-130	-1,678	0	-3,603	0	-130	-1,678	0	-3,603	0	-6,500	-5,790	0	-58
50	0	-6,435	-5,677	0	-21	0	-65	-1,608	0	-3,621	0	-65	-1,608	0	-3,621	0	-6,500	-5,762	0	-40

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 27
American River SAM Analysis Reach
ARS_ABC
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0			0	0				0	0				0					0		
1			-200	-620				114	-333				194					-229		
2			-192	-507				366	912				561					-207		
3			-201	-522				467	1,280				689					-214		
4			-212	-557				571	1,647				816					-225		
5			-217	-568				691	2,137				965					-228		
6			-224	-588				779	2,453				1,068					-234		
7			-229	-602				861	2,736				1,169					-239		
8			-229	-595				947	3,058				1,278					-237		
9			-224	-577				1,019	3,328				1,368					-232		
10			-216	-549				1,079	3,554				1,441					-223		
11			-206	-513				1,131	3,748				1,502					-212		
12			-193	-471				1,175	3,915				1,553					-199		
13			-179	-422				1,213	4,056				1,596					-184		
14			-163	-369				1,246	4,177				1,634					-167		
15			-145	-312				1,275	4,283				1,666					-150		
25			-11	126				1,440	4,881				1,849					-14		
50			100	488				1,564	5,329				1,986					99		
Fall-run Chinook																				
0	0	0	0	0		0	0	0	0			0	0	0					0	
1	9	0	-200	-620		456	0	114	-333			0	194	52					-967	
2	284	0	-192	-507		783	0	366	912			0	561	1,529					-681	
3	347	0	-201	-522		886	0	467	1,280			0	689	1,860					-694	
4	399	0	-212	-557		994	0	571	1,647			0	816	2,176					-728	
5	463	0	-217	-568		1,119	0	691	2,137			0	965	2,612					-705	
6	497	0	-224	-588		1,202	0	779	2,453			0	1,068	2,845					-723	
7	536	0	-229	-602		1,282	0	861	2,736			0	1,169	3,072					-735	
8	592	0	-229	-595		1,367	0	947	3,058			0	1,278	3,353					-712	
9	646	0	-224	-577		1,436	0	1,019	3,328			0	1,368	3,577					-681	
10	701	0	-216	-549		1,492	0	1,079	3,554			0	1,441	3,758					-642	
11	758	0	-206	-513		1,539	0	1,131	3,748			0	1,502	3,908					-598	
12	815	0	-193	-471		1,580	0	1,175	3,915			0	1,553	4,034					-548	
13	875	0	-179	-422		1,614	0	1,213	4,056			0	1,596	4,141					-494	
14	936	0	-163	-369		1,643	0	1,246	4,177			0	1,634	4,232					-436	
15	999	0	-145	-312		1,669	0	1,275	4,283			0	1,666	4,311					-374	
25	1,452	0	-11	126		1,815	0	1,440	4,881			0	1,849	4,755					89	
50	1,821	0	100	488		1,926	0	1,564	5,329			0	1,986	5,088					469	

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 27 (cont.)
American River SAM Analysis Reach
ARS_ABC
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0		0	0	0	0		0	0	0	0	0	0			0	0	0
1	203		-406		203	979	0	83		979	1,019	0	146	-10	1,019			-482	-970	90
2	763		-399		763	1,642	0	489		1,642	1,715	0	686	1,201	1,715			-437	-677	707
3	899		-419		899	1,857	0	633		1,857	1,938	0	857	1,465	1,938			-454	-688	821
4	1,016		-444		1,016	2,080	0	779		2,080	2,169	0	1,026	1,715	2,169			-477	-720	926
5	1,156		-458		1,156	2,337	0	955		2,337	2,437	0	1,231	2,066	2,437			-485	-694	1,084
6	1,235		-474		1,235	2,507	0	1,077		2,507	2,615	0	1,366	2,250	2,615			-500	-711	1,160
7	1,325		-487		1,325	2,673	0	1,190		2,673	2,789	0	1,497	2,431	2,789			-512	-722	1,248
8	1,442		-489		1,442	2,849	0	1,312		2,849	2,974	0	1,643	2,656	2,974			-511	-697	1,375
9	1,552		-484		1,552	2,990	0	1,414		2,990	3,122	0	1,762	2,835	3,122			-504	-663	1,492
10	1,660		-472		1,660	3,106	0	1,499		3,106	3,243	0	1,859	2,980	3,243			-490	-621	1,606
11	1,765		-456		1,765	3,203	0	1,571		3,203	3,343	0	1,939	3,099	3,343			-472	-573	1,716
12	1,872		-435		1,872	3,286	0	1,634		3,286	3,427	0	2,007	3,198	3,427			-450	-519	1,827
13	1,980		-411		1,980	3,356	0	1,687		3,356	3,499	0	2,065	3,283	3,499			-425	-460	1,938
14	2,089		-384		2,089	3,416	0	1,732		3,416	3,560	0	2,114	3,355	3,560			-396	-397	2,051
15	2,200		-354		2,200	3,468	0	1,773		3,468	3,614	0	2,157	3,418	3,614			-366	-330	2,164
25	2,988		-124		2,988	3,766	0	2,002		3,766	3,914	0	2,399	3,769	3,914			-131	171	2,967
50	3,627		67		3,627	3,991	0	2,175		3,991	4,140	0	2,581	4,033	4,140			64	583	3,616
Green Sturgeon																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	-2,510	-714	0	564	0	-2,510	-876	0	-980	0	-2,510	-876	0	-980	0	-5,020	-2,496	0	417
2	0	-3,765	-1,071	0	846	0	-1,255	468	0	-1,323	0	-1,255	468	0	-1,323	0	-5,020	-1,962	0	772
3	0	-4,183	-1,190	0	940	0	-1,156	654	0	-1,482	0	-1,156	654	0	-1,482	0	-5,339	-2,046	0	846
4	0	-4,632	-1,344	0	1,021	0	-1,106	807	0	-1,661	0	-1,106	807	0	-1,661	0	-5,738	-2,183	0	916
5	0	-5,092	-1,512	0	1,096	0	-885	1,104	0	-1,821	0	-885	1,104	0	-1,821	0	-5,977	-2,183	0	1,013
6	0	-5,399	-1,624	0	1,147	0	-854	1,249	0	-1,943	0	-854	1,249	0	-1,943	0	-6,253	-2,236	0	1,061
7	0	-5,718	-1,707	0	1,197	0	-831	1,416	0	-2,072	0	-831	1,416	0	-2,072	0	-6,550	-2,276	0	1,109
8	0	-6,045	-1,771	0	1,247	0	-727	1,634	0	-2,193	0	-727	1,634	0	-2,193	0	-6,772	-2,268	0	1,171
9	0	-6,299	-1,820	0	1,286	0	-647	1,803	0	-2,287	0	-647	1,803	0	-2,287	0	-6,945	-2,263	0	1,218
10	0	-6,502	-1,860	0	1,317	0	-582	1,939	0	-2,362	0	-582	1,939	0	-2,362	0	-7,084	-2,258	0	1,256
11	0	-6,668	-1,893	0	1,343	0	-529	2,050	0	-2,423	0	-529	2,050	0	-2,423	0	-7,197	-2,254	0	1,287
12	0	-6,807	-1,920	0	1,364	0	-485	2,142	0	-2,475	0	-485	2,142	0	-2,475	0	-7,292	-2,251	0	1,313
13	0	-6,924	-1,943	0	1,382	0	-448	2,220	0	-2,518	0	-448	2,220	0	-2,518	0	-7,371	-2,249	0	1,335
14	0	-7,024	-1,962	0	1,397	0	-416	2,287	0	-2,555	0	-416	2,287	0	-2,555	0	-7,440	-2,247	0	1,354
15	0	-7,111	-1,979	0	1,411	0	-388	2,346	0	-2,587	0	-388	2,346	0	-2,587	0	-7,499	-2,245	0	1,370
25	0	-7,599	-2,075	0	1,486	0	-233	2,671	0	-2,767	0	-233	2,671	0	-2,767	0	-7,832	-2,234	0	1,461
50	0	-7,964	-2,146	0	1,542	0	-116	2,915	0	-2,902	0	-116	2,915	0	-2,902	0	-8,081	-2,226	0	1,529

4.0 defaults used for all response curves

Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28
Sacramento River SAM Analysis Reach
ARS_DEFG
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0	0	
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193	-3,484		-2,136		-460	-3,759	
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900	-1,147		-1,776		-468	-3,638	
3	-1,058		-434	-2,738		-121		836	15		-141		1,302	289		-1,525		-462	-3,479	
4	-1,125		-459	-2,923		-16		940	430		-23		1,470	753		-1,514		-483	-3,555	
5	-1,197		-498	-3,127		44		1,046	642		47		1,638	990		-1,604		-526	-3,809	
6	-1,266		-532	-3,373		110		1,183	999		124		1,847	1,366		-1,659		-559	-4,037	
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017	1,726		-1,679		-575	-4,171	
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159	2,045		-1,676		-578	-4,237	
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282	2,337		-1,656		-573	-4,258	
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393	2,608		-1,621		-561	-4,244	
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490	2,847		-1,571		-542	-4,201	
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574	3,047		-1,507		-518	-4,138	
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648	3,218		-1,433		-490	-4,059	
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714	3,366		-1,351		-459	-3,968	
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774	3,495		-1,263		-426	-3,867	
25	-396		-144	-2,879		497		2,094	3,968		731		3,136	4,242		-491		-150	-3,038	
50	298		94	-2,269		631		2,366	4,728		914		3,419	4,810		251		91	-2,349	
Fall-run Chinook																				
0	0		0	0		0		0	0				0	0		0		0	0	
1	-1,101		-400	-2,119		-892		97	-3,451				193	-3,484		-2,136		-460	-3,759	
2	-1,075		-427	-2,526		-415		571	-1,306				900	-1,147		-1,776		-468	-3,638	
3	-1,058		-434	-2,738		-121		836	15				1,302	289		-1,525		-462	-3,479	
4	-1,125		-459	-2,923		-16		940	430				1,470	753		-1,514		-483	-3,555	
5	-1,197		-498	-3,127		44		1,046	642				1,638	990		-1,604		-526	-3,809	
6	-1,266		-532	-3,373		110		1,183	999				1,847	1,366		-1,659		-559	-4,037	
7	-1,342		-551	-3,601		160		1,296	1,340				2,017	1,726		-1,679		-575	-4,171	
8	-1,381		-558	-3,738		200		1,390	1,645				2,159	2,045		-1,676		-578	-4,237	
9	-1,394		-555	-3,815		233		1,472	1,926				2,282	2,337		-1,656		-573	-4,258	
10	-1,385		-544	-3,845		261		1,545	2,187				2,393	2,608		-1,621		-561	-4,244	
11	-1,357		-527	-3,838		286		1,611	2,421				2,490	2,847		-1,571		-542	-4,201	
12	-1,311		-504	-3,806		308		1,668	2,621				2,574	3,047		-1,507		-518	-4,138	
13	-1,252		-478	-3,752		329		1,719	2,797				2,648	3,218		-1,433		-490	-4,059	
14	-1,183		-448	-3,683		348		1,765	2,952				2,714	3,366		-1,351		-459	-3,968	
15	-1,105		-415	-3,602		366		1,807	3,091				2,774	3,495		-1,263		-426	-3,867	
25	-396		-144	-2,879		497		2,094	3,968				3,136	4,242		-491		-150	-3,038	
50	298		94	-2,269		631		2,366	4,728				3,419	4,810		251		91	-2,349	

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28 (cont.)
Sacramento River SAM Analysis Reach
ARS_DEFG
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Late-fall-run Chinook																				
0	0		0	0		0		0	0		0		0					0		
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193					-460		
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900					-468		
3	-1,058		-434	-2,738		-121		836	15		-141		1,302					-462		
4	-1,125		-459	-2,923		-16		940	430		-23		1,470					-483		
5	-1,197		-498	-3,127		44		1,046	642		47		1,638					-526		
6	-1,266		-532	-3,373		110		1,183	999		124		1,847					-559		
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017					-575		
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159					-578		
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282					-573		
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393					-561		
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490					-542		
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574					-518		
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648					-490		
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714					-459		
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774					-426		
25	-396		-144	-2,879		497		2,094	3,968		731		3,136					-150		
50	298		94	-2,269		631		2,366	4,728		914		3,419					91		
Winter-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0		
1	-1,101		-400	-2,119		-892		97	-3,451		-946		193	-3,484		-2,136		-460		
2	-1,075		-427	-2,526		-415		571	-1,306		-453		900	-1,147		-1,776		-468		
3	-1,058		-434	-2,738		-121		836	15		-141		1,302	289		-1,525		-462		
4	-1,125		-459	-2,923		-16		940	430		-23		1,470	753		-1,514		-483		
5	-1,197		-498	-3,127		44		1,046	642		47		1,638	990		-1,604		-526		
6	-1,266		-532	-3,373		110		1,183	999		124		1,847	1,366		-1,659		-559		
7	-1,342		-551	-3,601		160		1,296	1,340		187		2,017	1,726		-1,679		-575		
8	-1,381		-558	-3,738		200		1,390	1,645		241		2,159	2,045		-1,676		-578		
9	-1,394		-555	-3,815		233		1,472	1,926		289		2,282	2,337		-1,656		-573		
10	-1,385		-544	-3,845		261		1,545	2,187		333		2,393	2,608		-1,621		-561		
11	-1,357		-527	-3,838		286		1,611	2,421		374		2,490	2,847		-1,571		-542		
12	-1,311		-504	-3,806		308		1,668	2,621		411		2,574	3,047		-1,507		-518		
13	-1,252		-478	-3,752		329		1,719	2,797		446		2,648	3,218		-1,433		-490		
14	-1,183		-448	-3,683		348		1,765	2,952		480		2,714	3,366		-1,351		-459		
15	-1,105		-415	-3,602		366		1,807	3,091		512		2,774	3,495		-1,263		-426		
25	-396		-144	-2,879		497		2,094	3,968		731		3,136	4,242		-491		-150		
50	298		94	-2,269		631		2,366	4,728		914		3,419	4,810		251		91		

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 28 (cont.)
Sacramento River SAM Analysis Reach
ARS_DEFG
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
1	-1,747		-820	-2,239	-1,747	-1,747		-77	-3,044	-1,747	-1,801		-36	-3,082	-1,801	-3,793		-964		-3,793
2	-1,656		-871	-2,645	-1,656	-772		649	-1,266	-772	-774		946	-1,173	-774	-3,047		-970		-3,047
3	-1,609		-887	-2,848	-1,609	-170		1,060	-188	-170	-132		1,508	-16	-132	-2,536		-952		-2,536
4	-1,702		-938	-3,038	-1,702	56		1,206	116	56	119		1,722	324	119	-2,465		-998		-2,465
5	-1,780		-1,021	-3,256	-1,780	195		1,339	234	195	280		1,917	463	280	-2,574		-1,089		-2,574
6	-1,865		-1,094	-3,513	-1,865	345		1,525	482	345	450		2,177	731	450	-2,634		-1,161		-2,634
7	-1,984		-1,139	-3,749	-1,984	457		1,684	735	457	581		2,397	1,002	581	-2,644		-1,196		-2,644
8	-2,040		-1,156	-3,887	-2,040	545		1,818	961	545	688		2,583	1,244	688	-2,617		-1,206		-2,617
9	-2,053		-1,154	-3,961	-2,053	617		1,936	1,170	617	779		2,747	1,467	779	-2,566		-1,199		-2,566
10	-2,030		-1,137	-3,985	-2,030	678		2,042	1,367	678	858		2,896	1,675	858	-2,492		-1,177		-2,492
11	-1,974		-1,106	-3,971	-1,974	732		2,137	1,544	732	928		3,027	1,861	928	-2,394		-1,143		-2,394
12	-1,890		-1,065	-3,929	-1,890	780		2,220	1,696	780	991		3,141	2,017	991	-2,274		-1,098		-2,274
13	-1,784		-1,016	-3,866	-1,784	824		2,293	1,828	824	1,048		3,240	2,152	1,048	-2,139		-1,047		-2,139
14	-1,661		-960	-3,786	-1,661	864		2,359	1,946	864	1,101		3,329	2,269	1,101	-1,990		-989		-1,990
15	-1,524		-900	-3,692	-1,524	901		2,420	2,051	901	1,151		3,409	2,372	1,151	-1,832		-926		-1,832
25	-343		-391	-2,871	-343	1,167		2,823	2,718	1,167	1,472		3,899	2,973	1,472	-528		-407		-528
50	734		58	-2,166	734	1,431		3,200	3,301	1,431	1,733		4,282	3,433	1,733	641		50		641
Green Sturgeon																				
0			0	0		0		0		0	0		0	0	0	0		0	0	0
1			-708	0		0		-4,397		-1,551	0		-4,397	0	-1,551	0		-5,009	0	-1,298
2			-1,391	0		0		-3,248		-1,199	0		-3,248	0	-1,199	0		-4,297	0	-765
3			-1,830	0		0		-2,485		-966	0		-2,485	0	-966	0		-3,767	0	-436
4			-2,032	0		0		-2,310		-923	0		-2,310	0	-923	0		-3,709	0	-344
5			-2,076	0		0		-2,380		-1,146	0		-2,380	0	-1,146	0		-3,899	0	-323
6			-2,305	0		0		-2,394		-1,476	0		-2,394	0	-1,476	0		-4,077	0	-288
7			-2,685	0		0		-2,368		-1,731	0		-2,368	0	-1,731	0		-4,203	0	-264
8			-2,970	0		0		-2,348		-1,923	0		-2,348	0	-1,923	0		-4,298	0	-245
9			-3,191	0		0		-2,333		-2,072	0		-2,333	0	-2,072	0		-4,372	0	-231
10			-3,369	0		0		-2,321		-2,191	0		-2,321	0	-2,191	0		-4,431	0	-220
11			-3,514	0		0		-2,311		-2,288	0		-2,311	0	-2,288	0		-4,480	0	-210
12			-3,634	0		0		-2,302		-2,369	0		-2,302	0	-2,369	0		-4,520	0	-203
13			-3,737	0		0		-2,295		-2,438	0		-2,295	0	-2,438	0		-4,554	0	-196
14			-3,824	0		0		-2,289		-2,497	0		-2,289	0	-2,497	0		-4,583	0	-190
15			-3,900	0		0		-2,284		-2,548	0		-2,284	0	-2,548	0		-4,609	0	-185
25			-4,326	0		0		-2,255		-2,834	0		-2,255	0	-2,834	0		-4,751	0	-158
50			-4,645	0		0		-2,233		-3,048	0		-2,233	0	-3,048	0		-4,857	0	-138

4.0 defaults used for all response curves
Non-default timing tables (see sheet [Custom Timing Tables] in this workbook)

Table 29
Sacramento Bypass Levee and Weir SAM Analysis Reach
SBP Weir and Levee
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0	0	
1	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
2	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
3	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
4	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
5	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
6	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
7	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
8	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
9	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
10	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
11	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
12	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
13	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
14	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
15	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
25	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
50	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4	-26	
Fall-run Chinook																				
0	0		0			0		0	0				0			0		0		
1	-60		-4			-21		-9	-146				-21			-60		-4		
2	-60		-4			-21		-9	-146				-21			-60		-4		
3	-60		-4			-21		-9	-146				-21			-60		-4		
4	-60		-4			-21		-9	-146				-21			-60		-4		
5	-60		-4			-21		-9	-146				-21			-60		-4		
6	-60		-4			-21		-9	-146				-21			-60		-4		
7	-60		-4			-21		-9	-146				-21			-60		-4		
8	-60		-4			-21		-9	-146				-21			-60		-4		
9	-60		-4			-21		-9	-146				-21			-60		-4		
10	-60		-4			-21		-9	-146				-21			-60		-4		
11	-60		-4			-21		-9	-146				-21			-60		-4		
12	-60		-4			-21		-9	-146				-21			-60		-4		
13	-60		-4			-21		-9	-146				-21			-60		-4		
14	-60		-4			-21		-9	-146				-21			-60		-4		
15	-60		-4			-21		-9	-146				-21			-60		-4		
25	-60		-4			-21		-9	-146				-21			-60		-4		
50	-60		-4			-21		-9	-146				-21			-60		-4		

4.0 defaults used for all response curves
4.0 defaults used for all timing tables

Table 29 (cont.)
Sacramento Bypass Levee and Weir SAM Analysis Reach
SBP Weir and Levee
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Late-fall-run Chinook																				
0	0		0	0		0		0	0		0		0					0		
1	-60		-4	-26		-21		-9	-146		-51		-21					-4		
2	-60		-4	-26		-21		-9	-146		-51		-21					-4		
3	-60		-4	-26		-21		-9	-146		-51		-21					-4		
4	-60		-4	-26		-21		-9	-146		-51		-21					-4		
5	-60		-4	-26		-21		-9	-146		-51		-21					-4		
6	-60		-4	-26		-21		-9	-146		-51		-21					-4		
7	-60		-4	-26		-21		-9	-146		-51		-21					-4		
8	-60		-4	-26		-21		-9	-146		-51		-21					-4		
9	-60		-4	-26		-21		-9	-146		-51		-21					-4		
10	-60		-4	-26		-21		-9	-146		-51		-21					-4		
11	-60		-4	-26		-21		-9	-146		-51		-21					-4		
12	-60		-4	-26		-21		-9	-146		-51		-21					-4		
13	-60		-4	-26		-21		-9	-146		-51		-21					-4		
14	-60		-4	-26		-21		-9	-146		-51		-21					-4		
15	-60		-4	-26		-21		-9	-146		-51		-21					-4		
25	-60		-4	-26		-21		-9	-146		-51		-21					-4		
50	-60		-4	-26		-21		-9	-146		-51		-21					-4		
Winter-run Chinook																				
0	0		0	0		0		0	0		0		0	0		0		0		
1	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
2	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
3	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
4	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
5	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
6	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
7	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
8	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
9	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
10	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
11	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
12	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
13	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
14	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
15	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
25	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		
50	-60		-4	-26		-21		-9	-146		-51		-21	-188		-60		-4		

4.0 defaults used for all response curves
4.0 defaults used for all timing tables

Table 29 (cont.)
Sacramento Bypass Levee and Weir SAM Analysis Reach
SBP Weir and Levee
Bankline weighted relative response (feet)

Focus Fish Species and Water Year	Fall					Winter					Spring					Summer				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Steelhead																				
0	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
1	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
2	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
3	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
4	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
5	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
6	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
7	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
8	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
9	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
10	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
11	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
12	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
13	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
14	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
15	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
25	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
50	-100		-17	-35	-100	-40		-29	-127	-40	-87		-55	-174	-87	-100		-17		-100
Green Sturgeon																				
0			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
1			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
2			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
3			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
4			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
5			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
6			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
7			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
8			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
9			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
10			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
11			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
12			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
13			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
14			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
15			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
25			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8
50			115	0		0		115		-8	0	0	115	0	-8	0	0	115	0	-8

4.0 defaults used for all response curves
4.0 defaults used for all timing tables

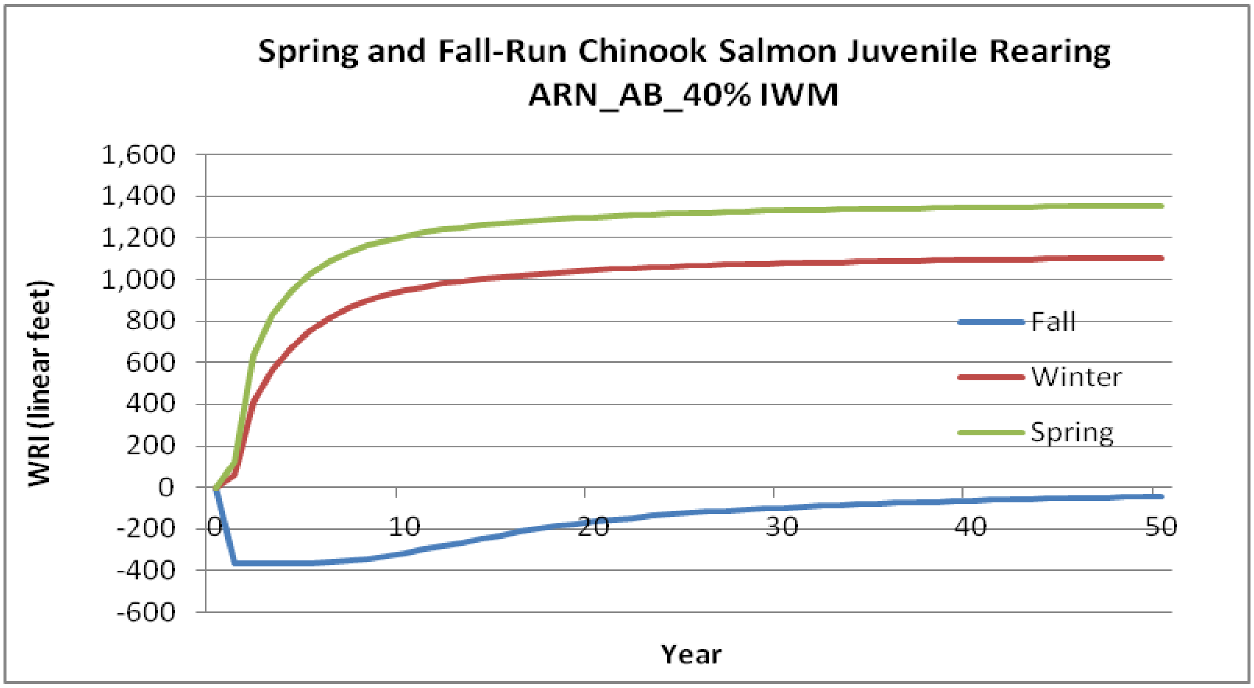

Figure 2. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for spring and fall-run Chinook salmon juvenile rearing.

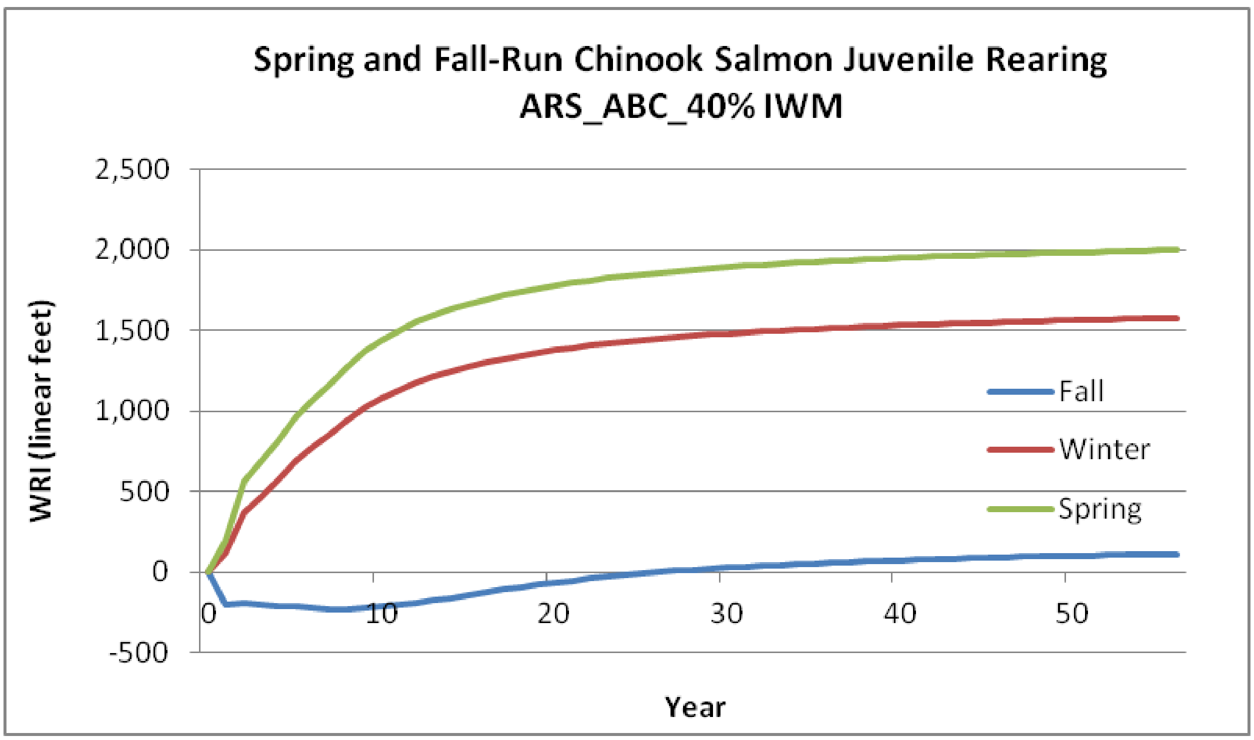

Figure 3. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for spring and fall-run Chinook salmon juvenile rearing.

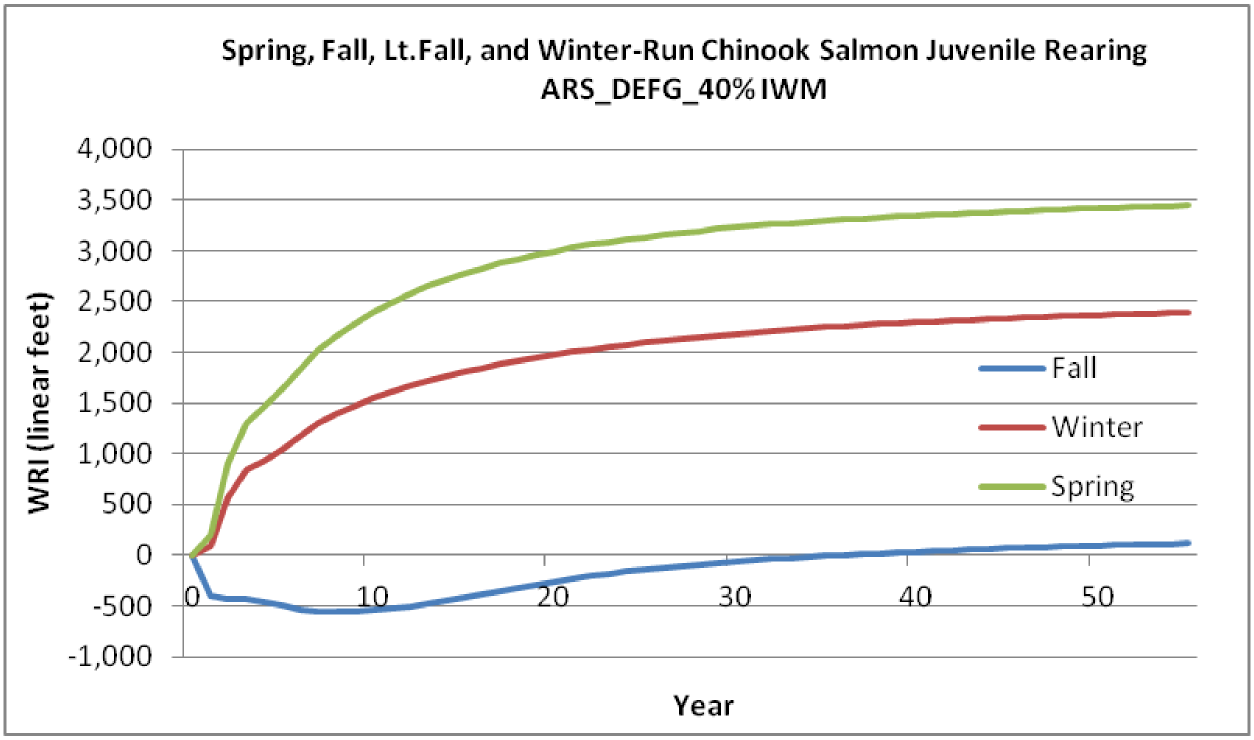

Figure 4. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for Chinook salmon juvenile rearing.

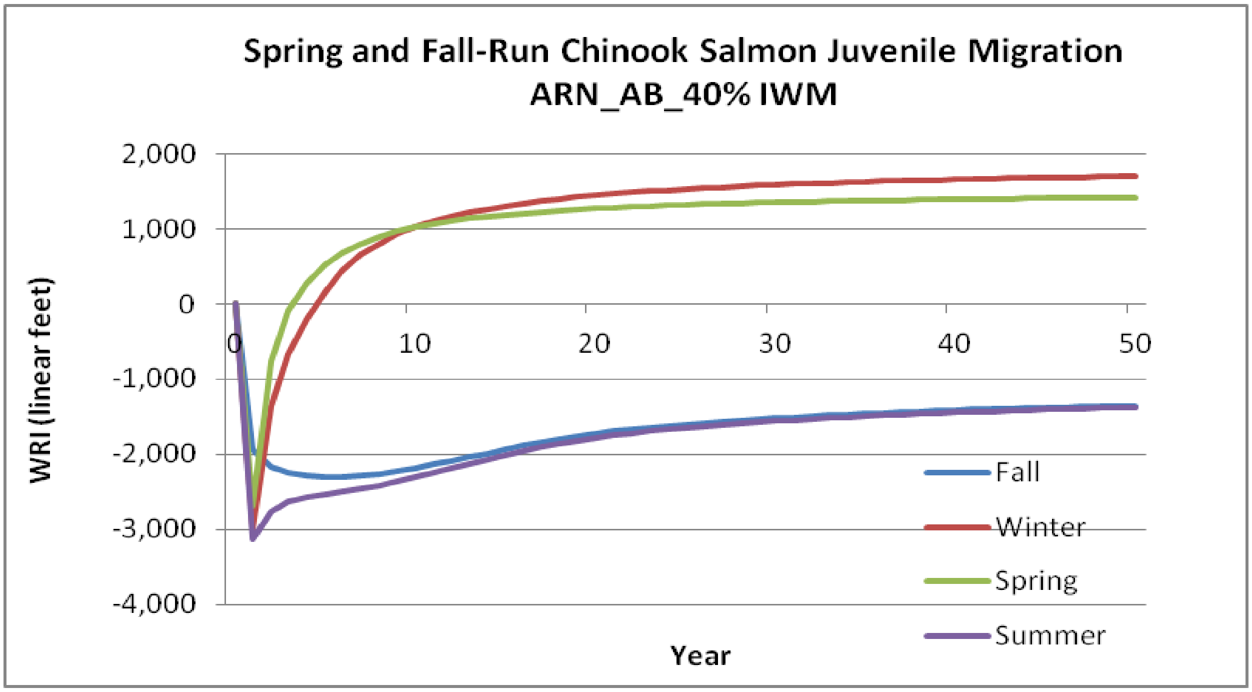

Figure 5. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for spring and fall-run Chinook salmon juvenile migration.

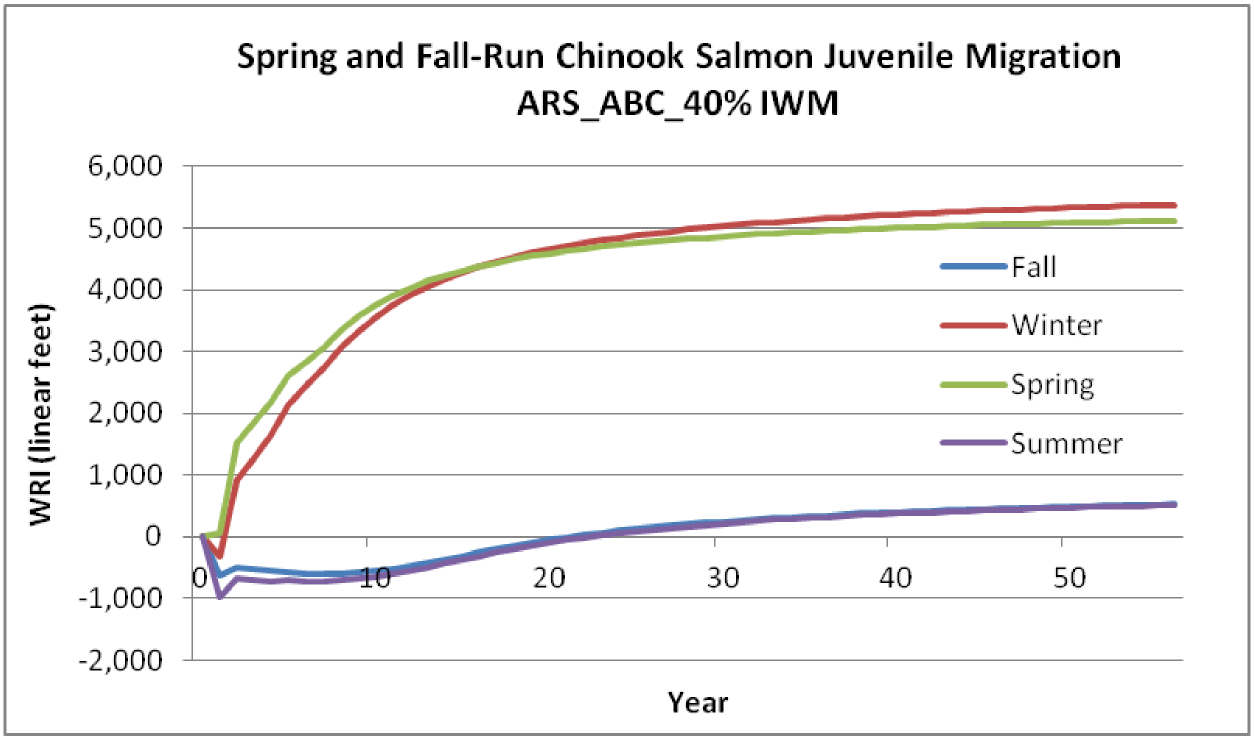

Figure 6. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for spring and fall-run Chinook salmon juvenile migration.

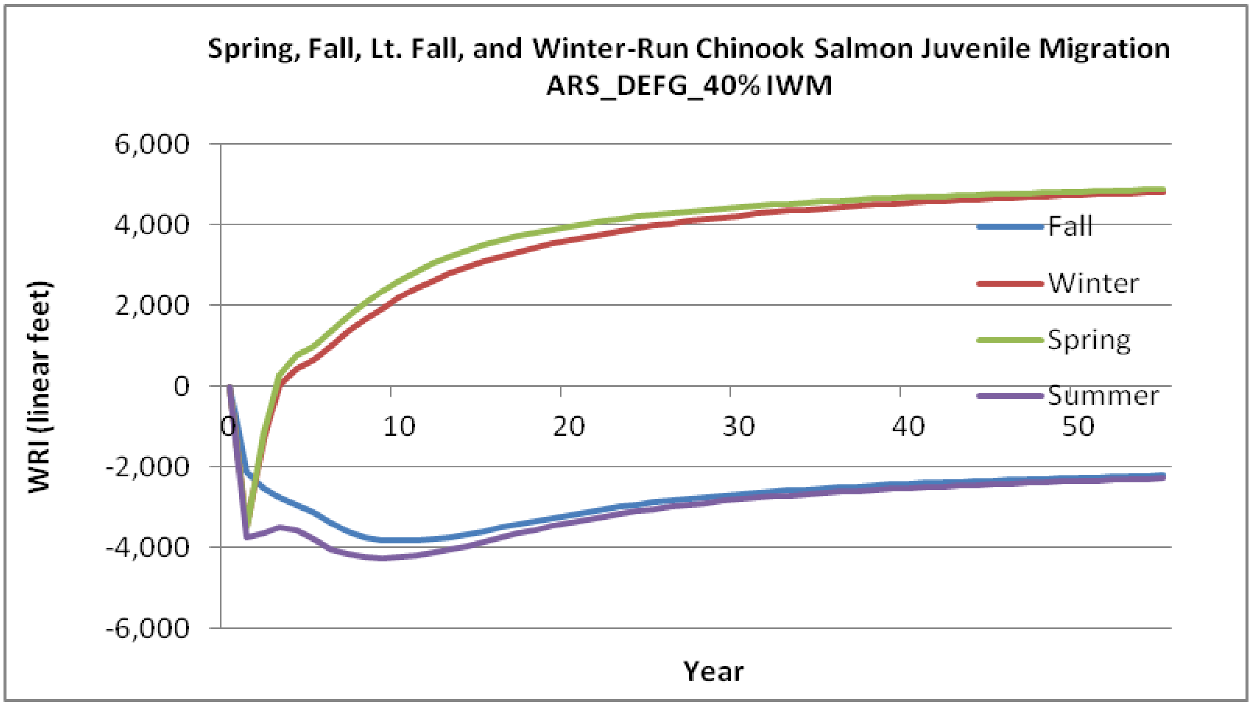

Figure 7. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for Chinook salmon juvenile migration.

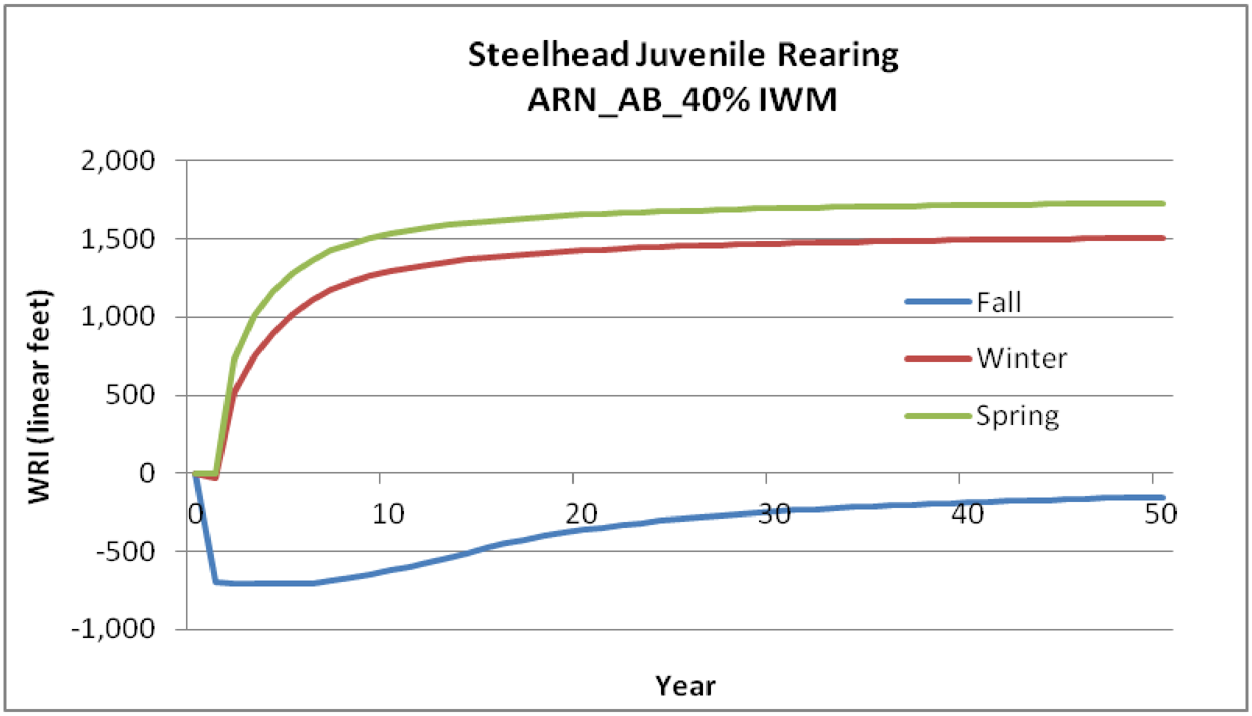

Figure 8. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for steelhead juvenile rearing.

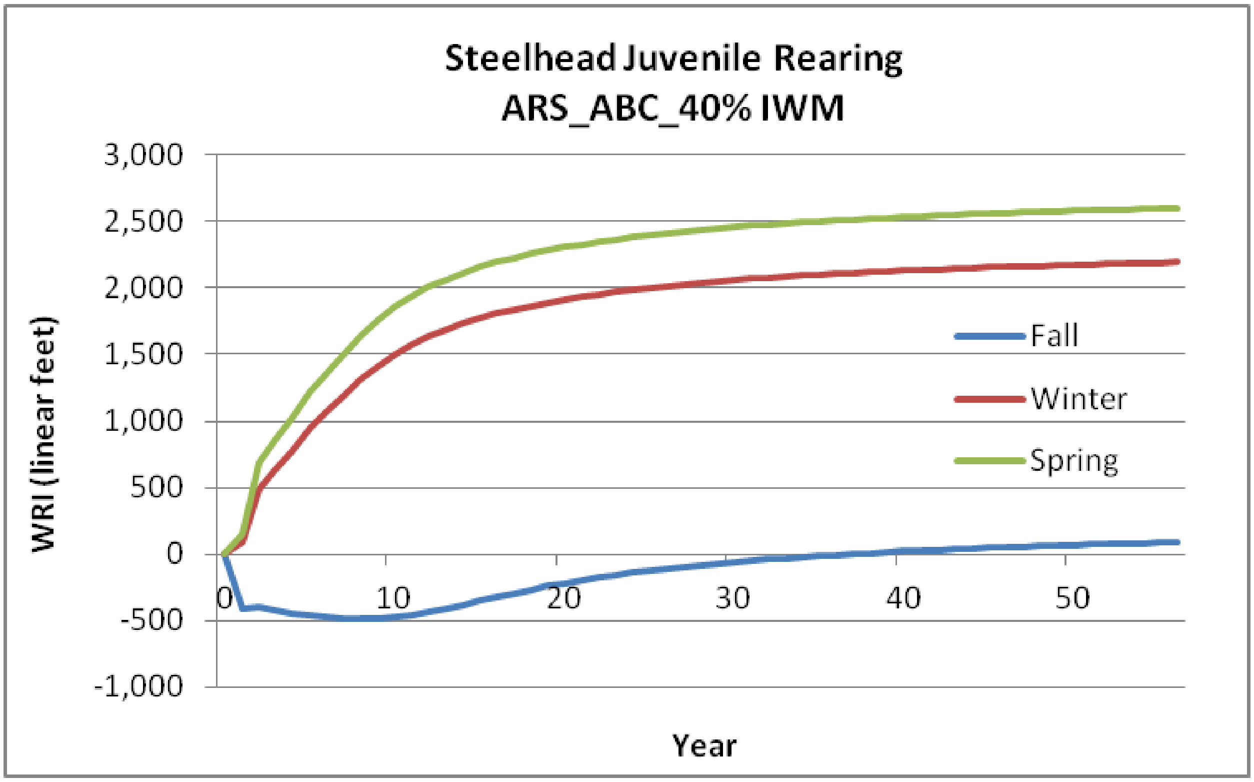

Figure 9. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for steelhead juvenile rearing.

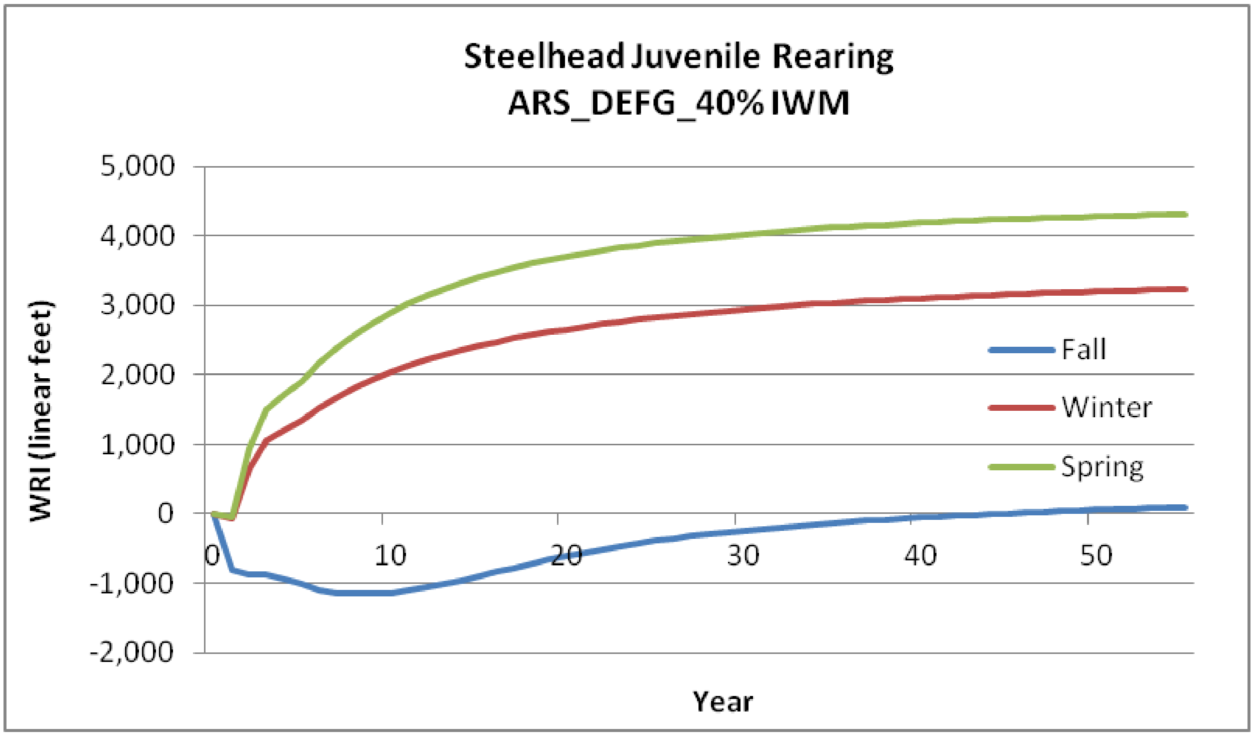

Figure 10. Weighted response indices at 40% IWM placement on the American River (ARS_DEFG) for steelhead juvenile rearing.

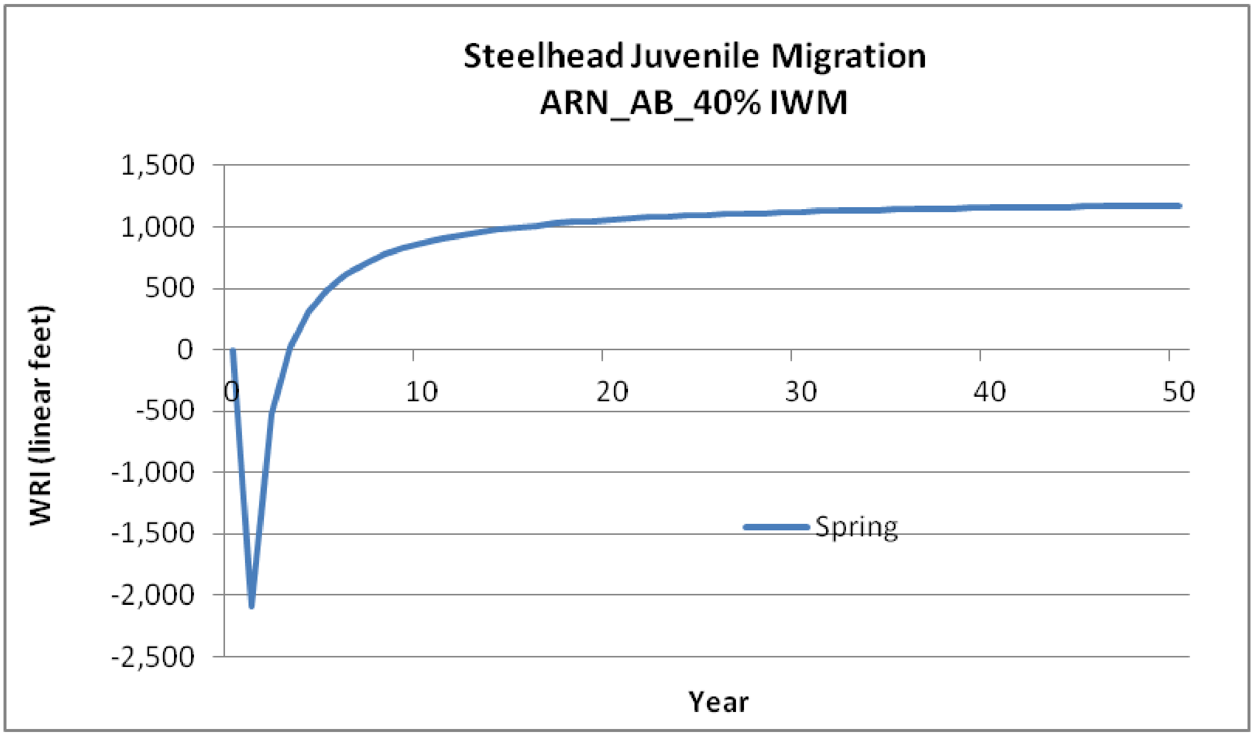

Figure 11. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for steelhead juvenile migration.

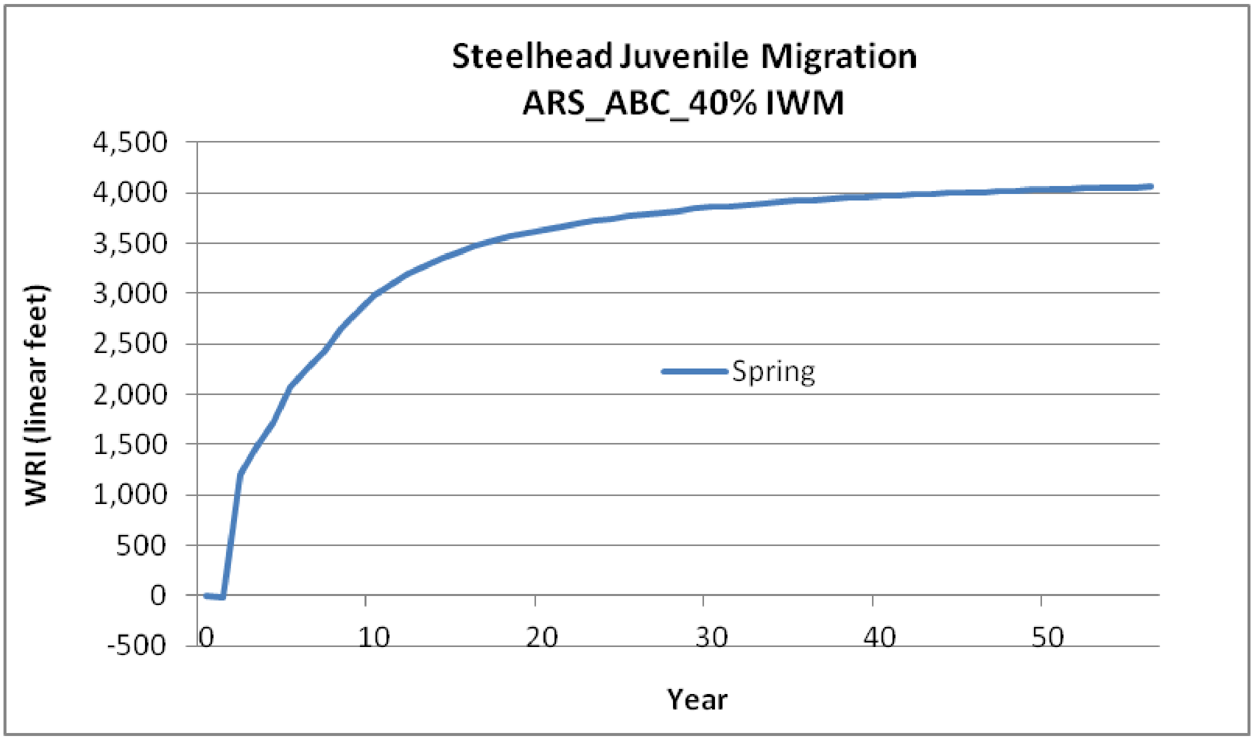

Figure 12. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for steelhead juvenile migration.

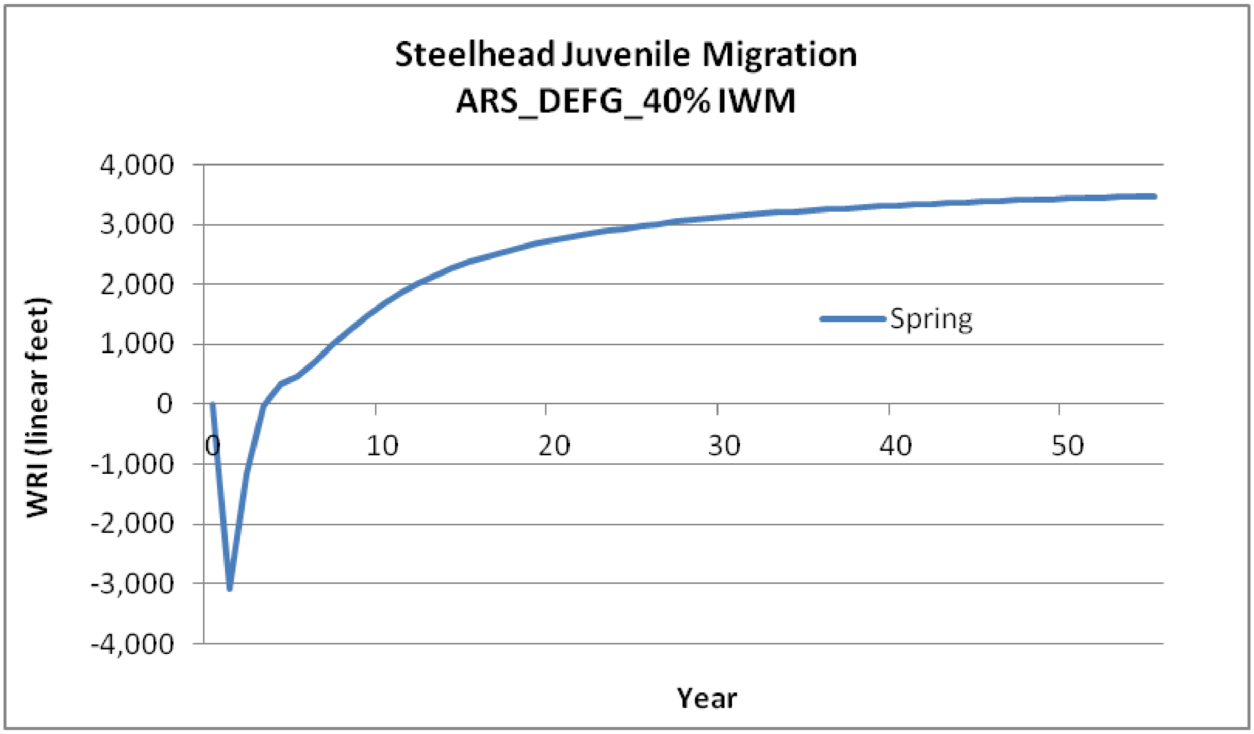

Figure 13. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead juvenile migration.

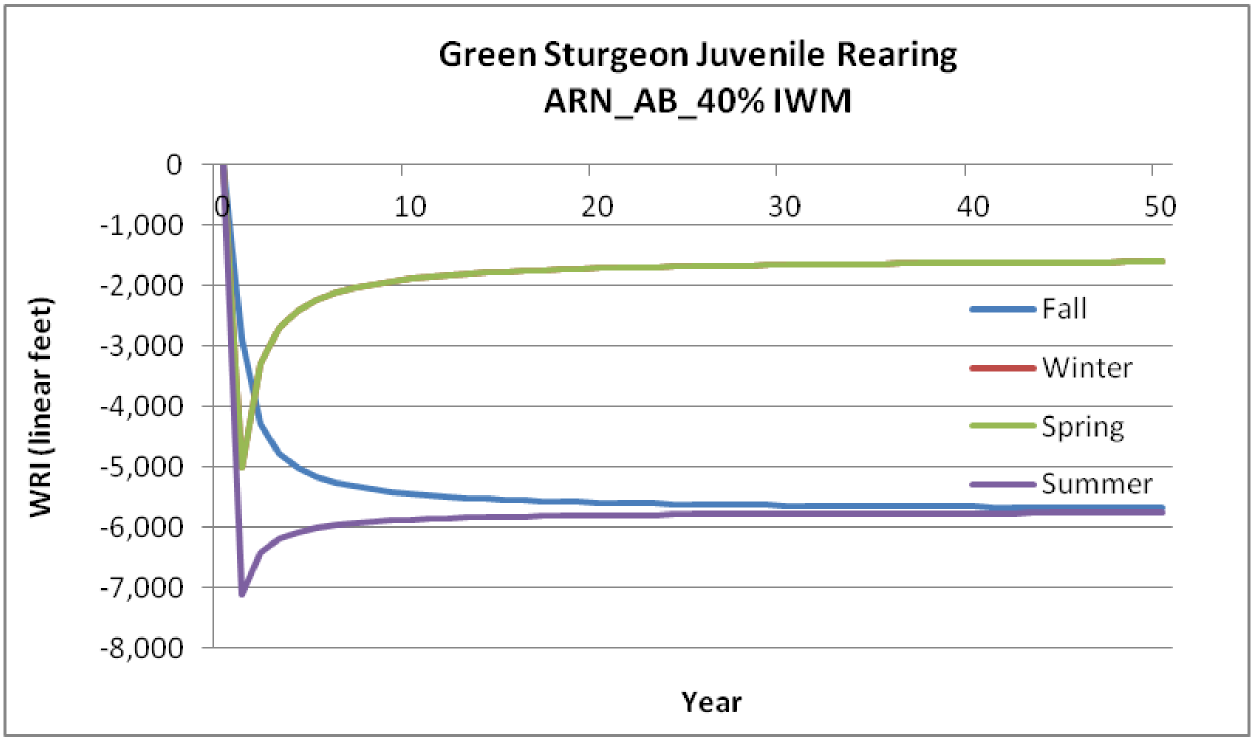

Figure 14. Weighted response indices at 40% IWM placement on the American River (ARN_AB) for green sturgeon juvenile rearing.

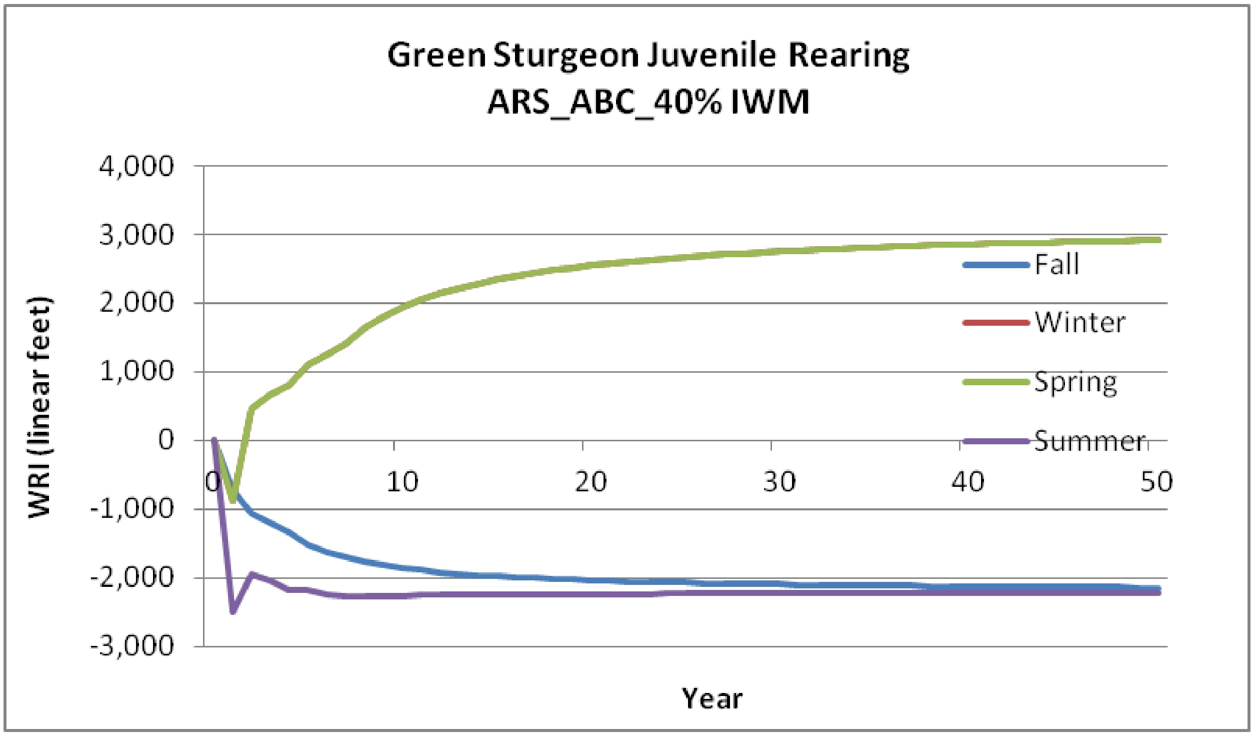

Figure 15. Weighted response indices at 40% IWM placement on the American River (ARS_ABC) for green sturgeon juvenile rearing.

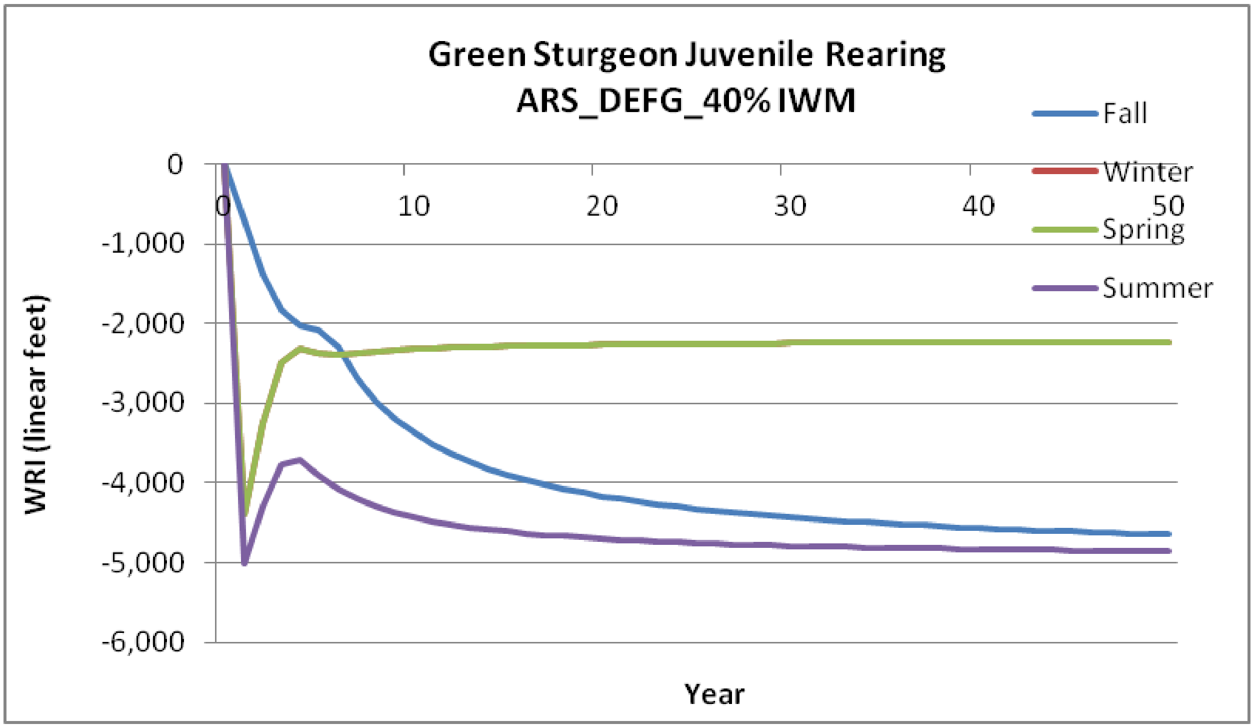

Figure 16. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for green sturgeon juvenile rearing.

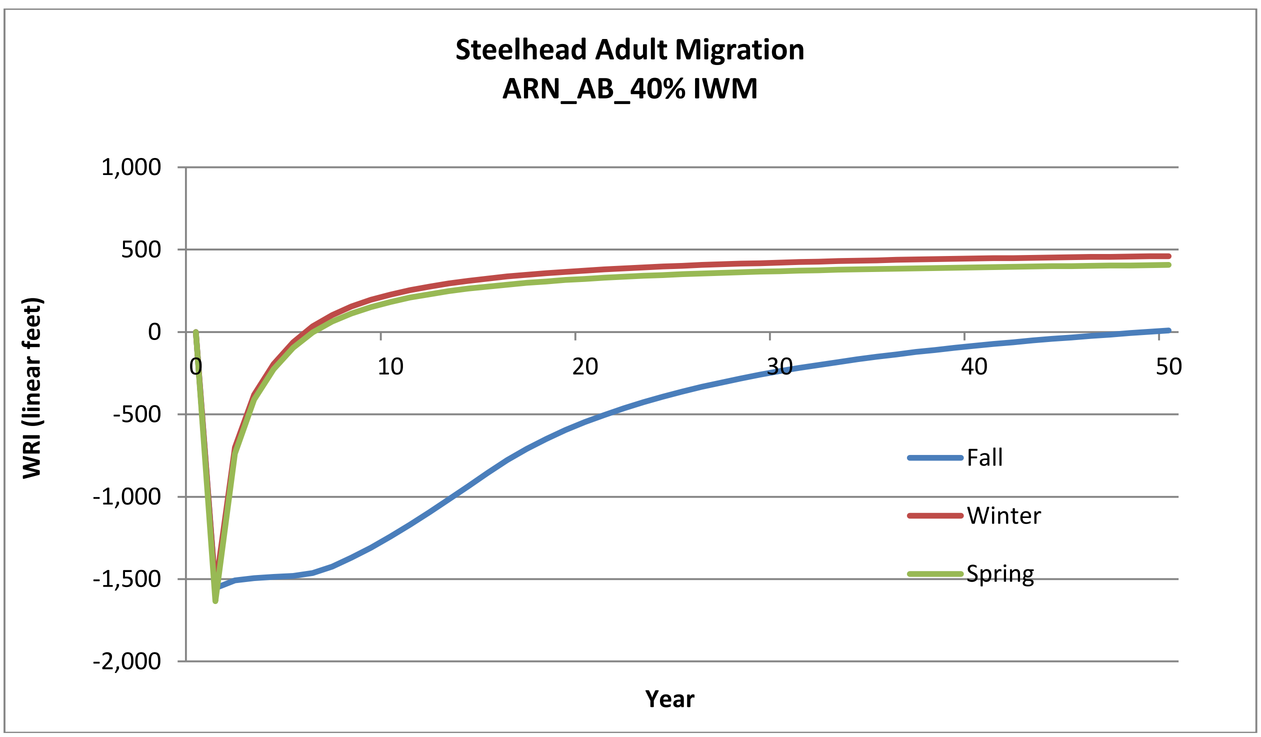

Figure 17. Weighted response indices at 40% IWM placement on the Sacramento River (ARN_AB) for steelhead adult migration.

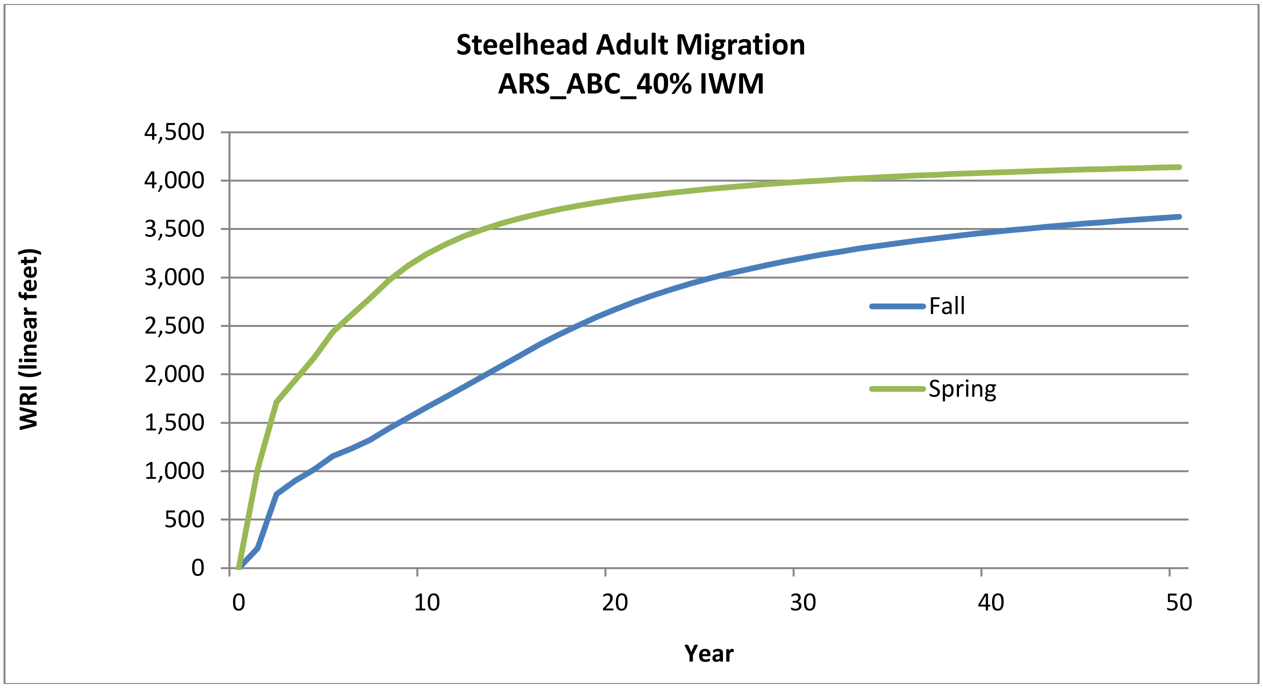

Figure 18. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_ABC) for steelhead adult migration.

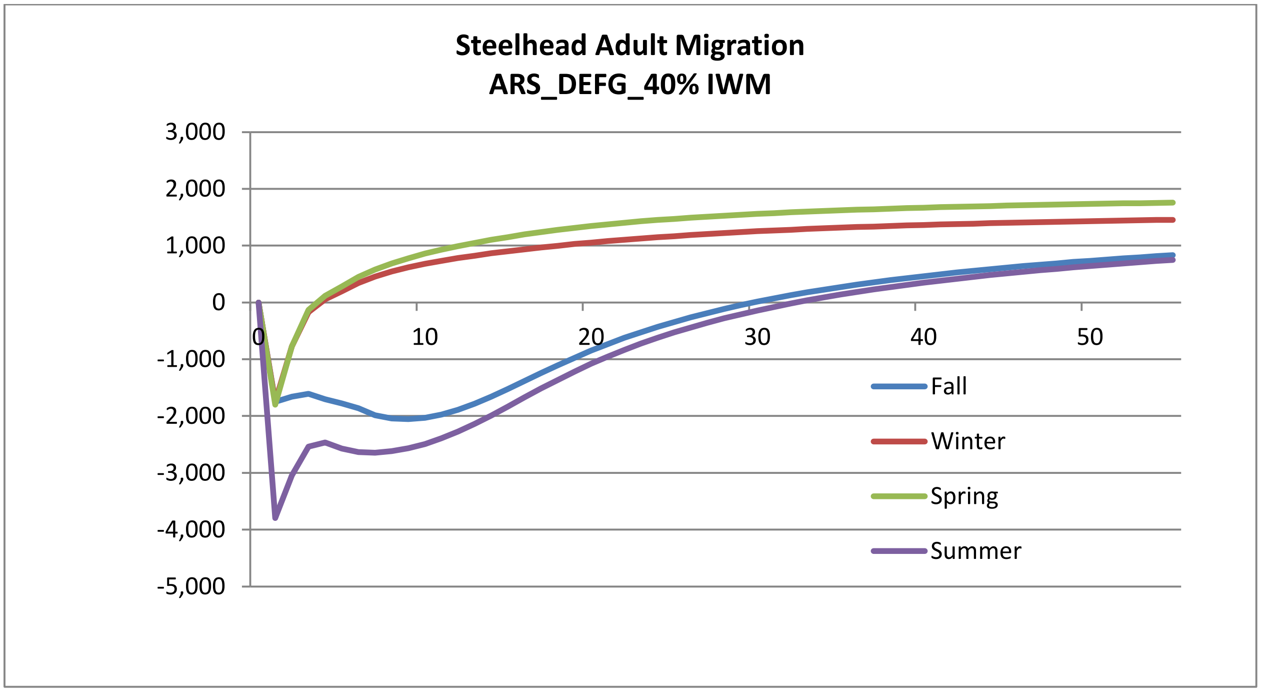

Figure 19. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead adult migration.

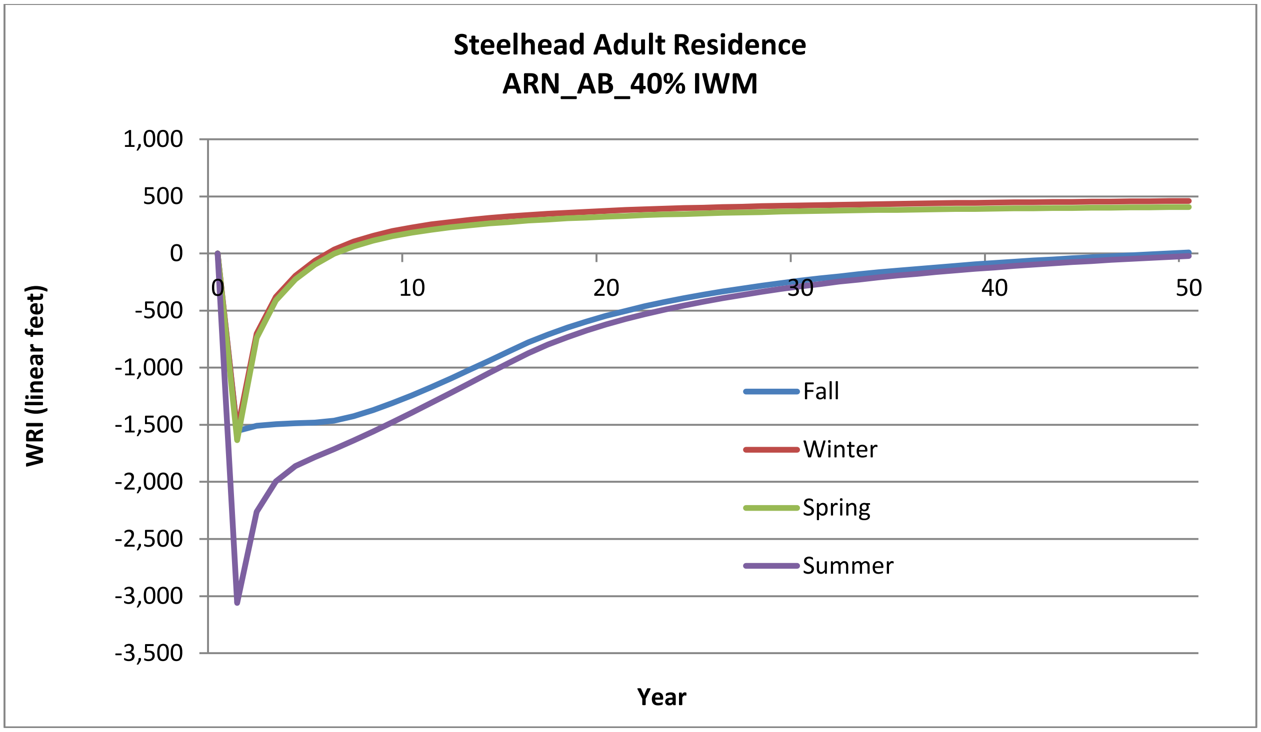

Figure 20. Weighted response indices at 40% IWM placement on the Sacramento River (ARN_AB) for steelhead adult residence.

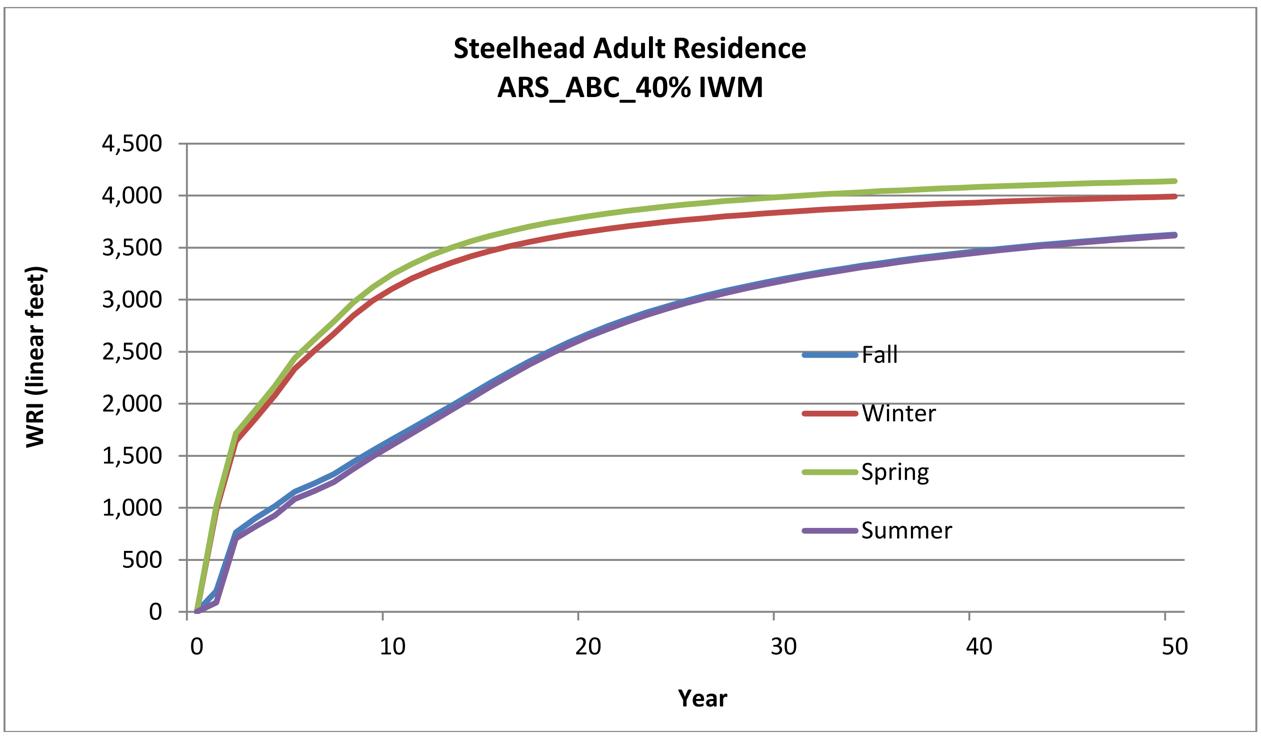

Figure 21. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_ABC) for steelhead adult residence.

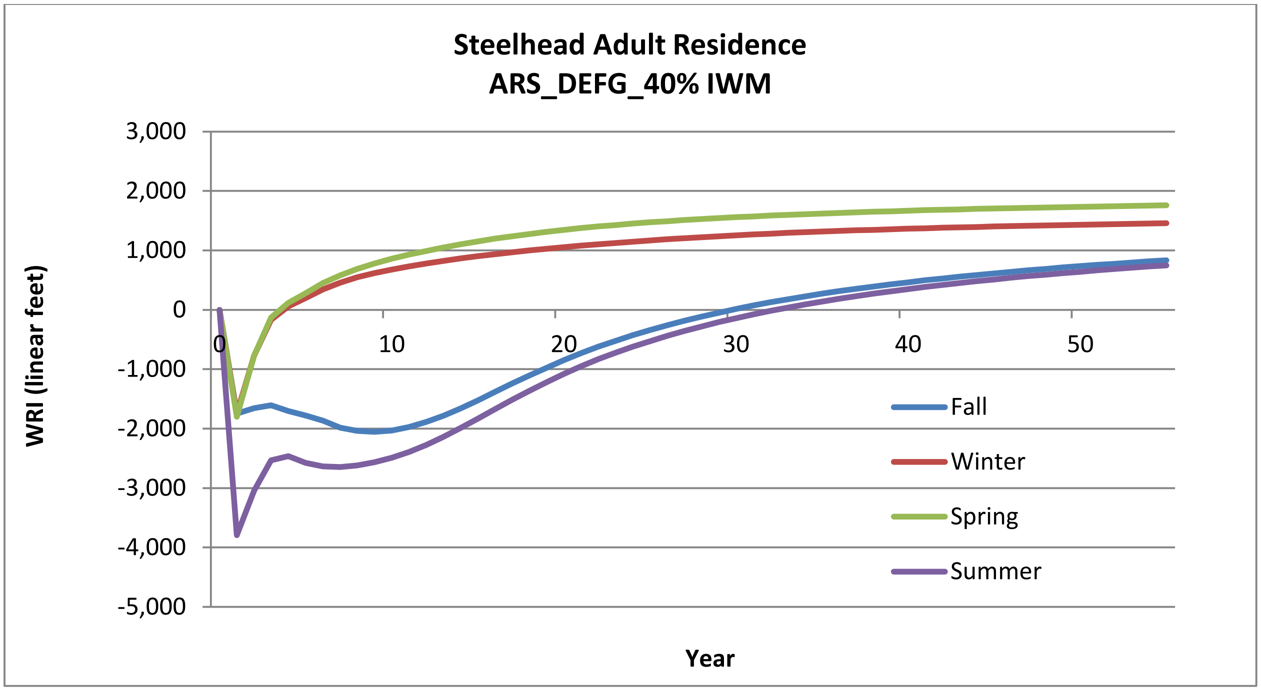

Figure 22. Weighted response indices at 40% IWM placement on the Sacramento River (ARS_DEFG) for steelhead adult residence.

Table 30
ARN_AB_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	2	1,699
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	4	1,699
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-877	39	59
	Fry and Juvenile Rearing	-366	50	0
	Juvenile Migration	-2,303	50	0
Winter	Adult Migration	-759	5	245
	Fry and Juvenile Rearing	0	0	1,102
	Juvenile Migration	-3,002	4	1,699
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	1,354
	Juvenile Migration	-2,681	3	1,418
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-421	50	0
	Juvenile Migration	-3,129	50	0
Steelhead				
Fall	Adult Migration	-1,554	48	8
	Fry and Juvenile Rearing	-712	50	0
	Juvenile Migration	***	***	***
	Adult Residence	-1,554	48	8
Winter	Adult Migration	-1,558	5	460
	Fry and Juvenile Rearing	-36	1	1,507
	Juvenile Migration	***	***	***

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Adult Residence	-1,558	5	460
Spring	Adult Migration	-1,635	6	407
	Fry and Juvenile Rearing	-1	1	1,731
	Juvenile Migration	-2,096	2	1,173
	Adult Residence	-1,635	6	407
Summer	Fry and Juvenile Rearing	-833	50	0
	Juvenile Migration	-3,013	50	0
	Adult Residence	-3,061	50	0
Green Sturgeon				
Fall	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,677	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-21	50	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,621	50	0
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-5,020	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,621	50	0
Summer	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-7,118	0	0
	Juvenile Migration	0	0	0
	Adult Residence	-942	50	0

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.
*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 31
ARS_ABC_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	2,001
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Fall-Run Chinook Salmon				
Fall	Adult Migration	0	0	1,860
	Fry and Juvenile Rearing	-229	26	112
	Juvenile Migration	-620	21	526
Winter	Adult Migration	0	0	1,937
	Fry and Juvenile Rearing	0	0	1,578
	Juvenile Migration	-333	1	5,377
Spring	Adult Migration	**	**	**
	Fry and Juvenile Rearing	0	0	965
	Juvenile Migration	0	0	5,123
Summer	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-239	26	111
	Juvenile Migration	-967	22	510
Steelhead				
Fall	Adult Migration	0	0	3,696
	Fry and Juvenile Rearing	-489	36	88
	Juvenile Migration	***	***	***
	Adult Residence	0	0	3,696
Winter	Adult Migration	0	0	4,015
	Fry and Juvenile Rearing	0	0	2,194
	Juvenile Migration	***	***	***

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Adult Residence	0	0	4,015
Spring	Adult Migration	0	0	4,164
	Fry and Juvenile Rearing	0	0	2,601
	Juvenile Migration	0	0	4,061
	Adult Residence	0	0	4,164
Green Sturgeon				
Fall	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-2,154	50	0
	Juvenile Migration	0	0	0
	Adult Residence	0	0	1,548
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	-2,917	50	0
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-876	1	2,941
	Juvenile Migration	0	0	0
	Adult Residence	-2,917	50	0
Summer	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-2,496	50	0
	Juvenile Migration	0	0	0
	Adult Residence	0	0	1,537

* Not applicable, adult spring-run Chinook salmon are not present on the American River

** Not applicable, adult migration of fall-run Chinook begins in early fall.

*** Not applicable, historically juvenile steelhead migration occurs in spring and summer.

Table 32
ARS_DEFG_40% IWM

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	*	*	*
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Fry and Juvenile Rearing	-578	36	113
	Juvenile Migration	-4,258	50	0
Late-Fall-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Fry and Juvenile Rearing	0	0	3,445
Summer	Fry and Juvenile Rearing	-578	36	113
Winter-Run Chinook Salmon				
Fall	Adult Migration	-1,394	35	362
	Fry and Juvenile Rearing	-558	35	116
	Juvenile Migration	-3,845	50	0
Winter	Adult Migration	-892	4	643
	Fry and Juvenile Rearing	0	0	2,390
	Juvenile Migration	-3,451	2	4,797
Spring	Adult Migration	-946	4	931
	Fry and Juvenile Rearing	0	0	3,445
	Juvenile Migration	-3,484	2	4,862
Summer	Adult Migration	-2,136	37	319
	Fry and Juvenile Rearing	-578	36	113
Steelhead				
Fall	Adult Migration	-2,053	29	832
	Fry and Juvenile Rearing	-1,156	44	99
	Juvenile Migration	-3,985	50	0
	Adult Residence	-2,053	29	832
Winter	Adult Migration	-1,747	3	1,455
	Fry and Juvenile Rearing	-77	1	3,234
	Juvenile Migration	-3,044	3	3,355
	Adult Residence	-1,747	3	1,455
Spring	Adult Migration	-1,801	3	1,757
	Fry and Juvenile Rearing	-36	1	4,317
	Juvenile Migration	-3,082	3	3,474
	Adult Residence	-1,801	3	1,757
Summer	Adult Migration	-3,793	32	748
	Fry and Juvenile Rearing	-1,206	45	92
	Adult Residence	-3,793	32	748
sDPS Green Sturgeon				
Fall	Fry and Juvenile Rearing	-4,674	50	0

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
	Juvenile Migration	0	0	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	-4,397	50	0
	Adult Residence	-3,068	50	0
Spring	Fry and Juvenile Rearing	-4,397	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-3,068	50	0
	Adult Migration	0	0	0
Summer	Fry and Juvenile Rearing	-5,009	50	0
	Juvenile Migration	0	0	0
	Adult Residence	-1,298	50	0

* Not applicable because adult fall-run Chinook salmon migrate in early fall.

Table 33
SBP

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Spring-Run Chinook Salmon				
Fall	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	*	*	*
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	-51	50	0
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Winter-Run Chinook Salmon				
Fall	Adult Migration	**	**	**
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	-51	50	0
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Fall-Run Chinook Salmon				
Fall	Adult Migration	-60	50	0
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	***	***	***
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Late-Fall-Run Chinook Salmon				
Fall	Adult Migration	-60	50	0
	Fry and Juvenile Rearing	-4	50	0
	Juvenile Migration	-26	50	0

Season	Life Stage	Maximum WRI Deficits	Duration of Deficit (in years)	Maximum WRI Benefits
Winter	Adult Migration	-21	50	0
	Fry and Juvenile Rearing	-9	50	0
	Juvenile Migration	-146	50	0
Spring	Adult Migration	****	****	****
	Fry and Juvenile Rearing	-21	50	0
	Juvenile Migration	-188	50	0
Steelhead				
Fall	Adult Migration	-100	50	0
	Fry and Juvenile Rearing	-17	50	0
	Juvenile Migration	-35	50	0
Winter	Adult Migration	-40	50	0
	Fry and Juvenile Rearing	-29	50	0
	Juvenile Migration	-127	50	0
Spring	Adult Migration	-87	50	0
	Fry and Juvenile Rearing	-55	50	0
	Juvenile Migration	-174	50	0
sDPS Green Sturgeon				
Fall	Fry and Juvenile Rearing	0	0	115
	Juvenile Migration	0	0	0
Winter	Adult Migration	0	0	0
	Fry and Juvenile Rearing	0	0	115
Spring	Adult Migration	0	0	0
	Fry and Juvenile Rearing	0	0	115
	Juvenile Migration	0	0	0

* Not applicable, adult spring-run Chinook salmon migrate upstream in the spring

** Not applicable, adult winter-run Chinook salmon migrate upstream in the winter

*** Not applicable, adult fall-run Chinook salmon migrate upstream in the fall

**** Not applicable, adult lt.fall-run Chinook salmon migrate upstream in the late fall and winter

7.0 References

USACE (U. S. Army Corps of Engineers). 2008. Standard assessment methodology (SAM) analysis of 29 constructed bank repair sites for the Sacramento River Bank Protection Project. Final. Contract No. W91238-07-C-0002. Prepared by Stillwater Sciences, Berkeley, California for USACE, Sacramento District, Sacramento, California. July.

USACE (U. S. Army Corps of Engineers). 2012. Standard Assessment Methodology for the Sacramento River Bank Protection Project, 2010–2012 Certification Update, Final. Prepared for U.S. Army Corps of Engineers, Sacramento District by Stillwater Sciences, Berkeley, California. Contract W91238-09-P-0249 Task Order 3.

USACE (U. S. Army Corps of Engineers). 2013. Standard Assessment Methodology (SAM) for the Sacramento River Bank Protection Project (SRBPP), Cumulative Analysis of 22 Sites. Final June 2013.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request
Name of Project American River Common Features	Federal Agency Involved U.S. Army Corps of Engineers
Proposed Land Use Floodway	County and State Sacramento County, CA
PART II *(To be completed by NRCS)*	Date Request Received By NRCS / Person Completing Form:

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☐ NO ☐	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount of Farmland As Defined in FPPA Acres: %	
Name of Land Evaluation System Used	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		0	427.7		
B. Total Acres To Be Converted Indirectly		0	0		
C. Total Acres In Site		0	427.7		
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide Important or Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)					
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)		10		
2. Perimeter In Non-urban Use	(10)		10		
3. Percent Of Site Being Farmed	(20)		20		
4. Protection Provided By State and Local Government	(20)		20		
5. Distance From Urban Built-up Area	(15)		5		
6. Distance To Urban Support Services	(15)		10		
7. Size Of Present Farm Unit Compared To Average	(10)		10		
8. Creation Of Non-farmable Farmland	(10)		5		
9. Availability Of Farm Support Services	(5)		5		
10. On-Farm Investments	(20)		15		
11. Effects Of Conversion On Farm Support Services	(10)		1		
12. Compatibility With Existing Agricultural Use	(10)		0		
TOTAL SITE ASSESSMENT POINTS	160	0	111	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	0	111	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	111	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form: U.S. Army Corps of Engineers	Date: 9/9/15

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map**,** or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

MITIGATION, MONITORING, AND REPORTING PLAN

AMERICAN RIVER WATERSHED COMMON FEATURES

GENERAL REEVALUATION REPORT

SACRAMENTO COUNTY, CALIFORNIA

This mitigation monitoring or reporting plan (MMRP) is designed to fulfill Section 21081.6 (a) of the California Environmental Quality Act (CEQA). Which requires public agencies to adopt a reporting or monitoring program whenever a project or program is approved that includes mitigation measures identified in an environmental document for which the agency makes a finding pursuant to CEQA Section 21081 (a) (1). The mitigation measures and strategies described below and in the attached table are to be used to avoid, minimize, or reduce any potentially significant environmental impacts.

The MMRP table includes the following:

- Section and Impacts – identifies the issue area section of the EIR/EIS and corresponding impact.
- Mitigation Measures – lists the adopted mitigation measures from the EIR/EIS.
- Implementation Timing – identifies the timing of implementation of the action described in the mitigation measures.
- Responsible for Implementation – identifies the agency/party responsible for implementing the actions described in the mitigation measures.
- Responsible for Monitoring/Reporting Action – identifies the agency/party responsible for monitoring implementation of the actions described in the mitigation measures. Verification will be carried-out during the project and an MMRP completion report will be submitted to the CVFPB staff upon completion of the project.

Section and Impacts	Mitigation Measures	Implementation Timing	Responsible for Mitigation	Responsible for Monitoring/ Reporting Action
3.2 Geologic Resources Alternative 1 Excavation for borrow material or during construction could increase soil erosion or permanent loss of topsoil. Alternative 2 Similar impact as alternative 1, but a greater magnitude.	Both Alternatives Prior to construction, USACE or its contractor would be required to acquire all applicable permits for construction. Prior to construction, a Stormwater Pollution Protection Plan (SWPPP) would be prepared, and best management practices (BMPs) would be proposed to reduce potential erosion and runoff during rain events. Minimize ground and vegetation disturbance during project construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of any grading operations. Stockpile soil on the landside of the levee reaches, and install sediment barriers (e.g., silt fences, fiber rolls, and straw bales) around the base of stockpiles to intercept runoff and sediment during storm events. If necessary, cover stockpiles with geotextile fabric to provide further protection against wind and water erosion.	D,P,C	USACE	CVFPB Monitor measures applicable to site: Verify that all required permits have been acquired. Verify that SWPPP and BMP's have been prepared. Review plans to see that stockpiles will be on landside. Monitor construction periodically to assure ground and vegetation

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	Install sediment barriers on graded or otherwise disturbed slopes as needed to prevent sediment from leaving the project site and entering nearby surface waters. Install plant materials to stabilize cut and fill slopes and other disturbed areas once construction is complete. Temporary structural BMPs, such as sediment barriers, erosion control blankets, mulch, and mulch tackifier, could be installed as needed to stabilize disturbed areas until vegetation becomes established.			disturbance is minimal. Verify use of sediment barriers and instillation of stabilizing plant materials. Verify establishment of vegetation.
3.3 Land Use Alternative 1 Acquisition of properties for levee easements along the Sacramento River and Arcade Creek. Alternative 2 Acquisition of properties for levee easements along the Sacramento River and Arcade Creek (fewer properties impacted than Alternative 1). Conversion of agricultural lands to floodway.	Coordination with Sacramento County Department of Parks and Recreation, the National Park Service, the other Federal and State agencies responsible for managing the resources of the Parkway, and non-governmental stakeholders will ensure consistency with existing plans. All property acquisitions would be conducted in compliance with Federal and State relocation law, and relocation services would be accomplished in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1960. Mitigation for the lands converted from parkway land to flood control uses will be mitigated by paying fees to the County under the Habitat Restoration Program Fees (HRP).	D	USACE	CVFPB Coordinate with stakeholders to ensure consistency. Verify that acquisitions are conducted in accordance with Uniform Relocation Act. Verify payment of fees.
3.4 Hydrology and Hydraulics				

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Alternative 1 No impact Alternative 2 Reduce water surface elevation in the Sacramento River downstream of the confluence of the American River without significantly increasing water surface elevation in the Yolo Bypass downstream of the confluence of the Sacramento Bypass.	None required.	D	USACE	CVFPB
3.5 Water Quality and Groundwater Resources Alternative 1 Increased turbidity during bank protection construction, runoff of exposed soils, and cement, slurry, or fuel spills during construction. Rock revetment placement in open water would result in significant indirect effects as the sediment and turbidity plume drifts further downstream and later effect the water qualify in those areas found further downstream of the project area. Alternative 2 Same impacts as alternative 1 plus, a potential for water quality impacts to occur if the weir is constructed in a way that debris or other construction materials could enter the Sacramento River.	Monitor turbidity in the adjacent water bodies, where applicable criteria apply, to determine whether turbidity is being affected by construction and to ensure that construction does not result in a rise in turbidity levels above ambient conditions, in accordance with the Central Valley RWQCB Basin Plan turbidity objectives Prepare a SWPPP, Spill Prevention Control and Countermeasures Plan (SPCCP), and a bentonite slurry spill contingency plan (BSSCP) • Conduct earthwork during low flow periods (July 1 through November 30). • To the extent possible, stage construction equipment and materials on the landside of the subject levee reaches in areas that have already been disturbed.	P, C	USACE	CVFPB Verify coordination with RWQCB. Review SWPPP, SPCCP, and BSSCP. Verify measures are in place during construction.

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	• Minimize ground and vegetation disturbance during project construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of any grading operations. • Stockpile soil on the landside of the levee reaches, and install sediment barriers (e.g., silt fences, fiber rolls, and straw bales) around the base of stockpiles to intercept runoff and sediment during storm events • Install sediment barriers on graded or otherwise disturbed slopes as needed to prevent sediment from leaving the project site and entering nearby surface waters. • Install plant materials to stabilize cut and fill slopes and other disturbed areas once construction is complete. Plant materials could include an erosion control seed mixture or shrub and tree container stock. Temporary structural BMPs, such as sediment barriers, erosion control blankets, mulch, and mulch tackifier, could be installed as needed to stabilize disturbed areas until vegetation becomes established. • Conduct water quality tests specifically for increases in turbidity and sedimentation caused by construction activities.			

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	• Water samples for determining background levels shall be collected in the adjacent water body for each erosion construction site. • During working hours, the construction activity shall not cause the turbidity in the adjacent water body down current from the construction sites to exceed the Basin Plan turbidity objectives.			
3.6 Vegetation and Wildlife Alternative 1 The launchable rock trenches would result in the removal of a maximum of 65 acres of riparian habitats within the American River Parkway. Bank protection measure would result in impacts to a maximum of 31,000 linear feet of SRA habitat. The existing levee structure would be degraded by one half to create a working platform for slurry wall installation. As the levee is degraded, all vegetation located in the degraded area would be removed. The maximum degraded area (the upper one half of the levee) is approximately 110 acres and contains about 750 trees of various sizes and species. On the landside of the levee, where levee raises are required, all trees would	During the design refinement phase, plans will be evaluated to reduce the impact on vegetation and wildlife to the extent practicable. Refinements that could be implemented to reduce the loss of riparian habitat include: reduced footprint, constructing bank protection rather than launchable rock trench whenever feasible, and designing planting berms in areas where significant riparian habitat exists adjacent to the levee toe. To compensate for the removal of a maximum of 65 acres of riparian habitat, approximately 130 acres of replacement habitat would be created to account for the temporal loss of habitat while newly created habitat is growing. Surveys would be conducted prior to construction to determine if any birds are nesting within 0.5 miles of the construction activities. If nests are located within the vicinity of construction for any given year, coordination with the appropriate resource agencies would occur to determine what	D, P, C	USACE	CVFPB Verify impact refinement for smaller footprint. Verify replacement habitat creation. Verify and participate in nesting bird surveys. Verify that tree removal occurs outside of nesting season. Verify vegetation

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be removed from the levee slope and within 15 feet of the levee toe to construct the levee raise. A landside maintenance easement would be required along the levee toe within the 8 miles of levee raise. This easement will be left in place after construction as access. There are approximately 1,300 trees of various species and size within this landside easement that once removed would not be replaced on-site. There would be a maximum of 200 trees removed from both the landside and waterside to construct the project. These trees compose approximately 2 acres of oak woodland habitat on NEMDC, and approximately 10.5 acres of riparian on Arcade Creek. Alternative2 Because the amount of levee raising is significantly reduced under Alternative 2 due to the widening of the Sacramento Weir and Bypass, effects to the landside vegetation on the levees would be less than under implementation of Alternative 1. This would result in the removal of approximately 750 trees of various species	action should be taken to reduce impacts. Trees would not be removed if an active nest is found; however, once the young have fledged, the tree can be removed for construction. If survey results determine that no nests are in the vicinity of construction scheduled for that year, construction may commence without further coordination on this issue. Avoidance and minimization measures incorporated as part of the Sacramento River design include: compliance with the USACE vegetation policy through a vegetation variance, installation of a planting berm where erosion protection is required, and narrowing of the levee footprint by construction of a retaining wall, when feasible. The vegetation variance would allow waterside trees on the lower half of the slope to remain in place. This would allow approximately 930 trees along 10 miles of the Sacramento River to continue to provide habitat for fish and wildlife species. Along with retaining the trees, additional plantings of small vegetation would be done on the newly constructed berm. Species of plants would be coordinated with NMFS, USFWS, and State and local partners. Off-Site mitigation for the removal of 50 trees in the Arcade Creek area would be done in compliance with the Sacramento City tree ordinance. It is estimated that 2 acres would be required to accommodate the planting of			variance is in place to minimize tree removal. Verify mitigation area for trees planted off-site.

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	approximately 450 trees. Alternative 2 Compensation was determined by evaluating other projects with similar impacts in the Central Valley, coordination with resource agencies, and evaluation of compensation plantings' ability to provide similar wildlife habitat. A total of 16 acres would be needed to compensate for the removal of the vegetation along the Sacramento River and within the new weir footprint, due to the temporal loss of habitat while the new habitat is establishing. Plantings could be accomplished within the expanded bypass, other nearby available lands, or through the purchase of credits at an approved mitigation bank.			
3.7 Fisheries Alternative 1 Rock placement would most likely disturb the native resident fish by increasing noise, water turbulence, and turbidity, causing them to move away from the area of placement. In some pelagic native juvenile species utilizing the near shore habitat for cover, moving away from that cover could put them at a slight risk of predation. Construction during the project may disturb soils and the nearshore	Mitigation measures for vegetation and wildlife, and water quality will also apply for fisheries. Additionally; • In-water construction would be restricted to the general estimated work window of August 1 through November 30. For the purpose of this study however, during PED, the work window will be adjusted on a site specific basis taking into account periods of low fish abundance, and in-water construction outside the principal spawning and migration season. Typical construction season generally corresponds to the dry	D, P, C	USACE	CVFPB Verify implementation of vegetation and wildlife mitigation measures. Verify implementation of water quality mitigation measures.

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environment, leading to increases in sediment in the nearshore aquatic habitat. This in turn may increase sedimentation (i.e., deposition of sediment on the substrate), suspended sediments, and turbidity. Alternative 2 By widening the Sacramento Weir and Bypass, the project would create additional floodplain habitat within the Sacramento Bypass, which could benefit native fish.	season, but construction may occur outside the limits of the dry season, only as allowed by applicable permit conditions. • Due to the deleterious effects of numerous chemicals on native resident fish used in construction, if a hazardous materials spill does occur, a detailed analysis will be performed immediately by a registered environmental assessor or professional engineer to identify the likely cause and extent of contamination. This analysis will conform to American Society for Testing and Materials standards, and will include recommendations for reducing or eliminating the source or mechanisms of contamination. Based on this analysis, the USACE and its contractors will select and implement measures to control contamination, with a performance standard that surface water quality and groundwater quality must be returned to baseline conditions. • If mitigation or compensation sites are planned within the Sacramento Bypass for the overall ARCF project, information gained from the 2013 Knaggs Ranch Pilot Study would be reviewed for potential beneficial habitat for native fish species to be			

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	incorporated into the sites.			
3.8 Special Status Species Alternative 1 <u>Valley Elderberry Longhorn Beetle</u> Within the surveyed study area, approximately 250 shrubs were located along the American River Parkway and 50 shrubs were located along the Sacramento River. Prior to project construction, a qualified biologist would conduct focused surveys of elderberry shrubs within 100 feet of the project area for construction in accordance with the USFWS guidelines.	Mitigation measures are similar for both Alternatives 1 and 2 <u>Valley Elderberry Longhorn Beetle</u> The following is a summary of measures that would be implemented during construction based on the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a). These measures will be implemented to minimize any potential effects on valley elderberry longhorn beetles or their habitat, including restoration and maintenance activities, long-term, protection, and compensation if shrubs cannot be avoided: • When a 100-foot (or wider) buffer is established and maintained around elderberry shrubs, complete avoidance (i.e., no adverse effects) will be assumed. • Where encroachment on the 100-foot buffer has been approved by the USFWS, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible. • During construction activities, all areas to be avoided will be fenced and flagged. • Contractors will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with	D, P, C , M	USACE	CVFPB Verify that all BMP's and mitigation measures are followed during construction. Verify setback distances Verify that environmental awareness training has been implemented

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VELB continued	these requirements. • Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area. • Any damage done to the buffer area will be restored. • Buffer areas will continue to be protected after construction. • No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas. • Trimming of elderberry plants will be subject to mitigation measures. • Elderberry compensation would be planted in the American River Parkway. The USACE has six existing sites which are offsetting previous USACE flood control projects along the lower American River and near Folsom Dam. The USACE will find areas within the lower American River parkway which will either expand existing compensation areas or provide for connectivity between conserved valley elderberry longhorn beetle habitat. Sites within the Parkway will be coordinated with County Parks and the Service during the design phase of the project. Sites will be designed and developed prior to any effects to valley elderberry longhorn beetle habitat. The USACE will create 69.91 acres of riparian habitat which supports valley elderberry longhorn beetle within the lower American			Verify sign placement.

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VELB continued Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp There is approximately 0.25 acre of land within the construction footprint of the new levee and floodwall that could potentially include vernal pool habitat. This 0.25 acre could be adversely affected from ground disturbing activities, operation of construction	River parkway. • If possible, elderberry shrubs would be transplanted during their dormant season (approximately November, after they have lost their leaves, through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation ratios will apply. • Any areas that receive transplanted elderberry shrubs and elderberry cuttings will be protected in perpetuity. • The USACE will work to develop off-site compensation areas prior to or concurrent with any take of valley elderberry longhorn beetle habitat. • Management of these lands will include all measures specified in USFWS's conservation guidelines (1999a) related to weed and litter control, fencing, and the placement of signs. • Monitoring will occur for ten consecutive years or for seven non-consecutive years over a 15-year period. Annual monitoring reports will be submitted to USFWS. Vernal Pool Fairy Shrimp and Tadpole Shrimp The following measures from the 2004 Biological Opinion from the Magpie Creek Flood Control Project would be implemented to avoid and minimize impacts to potential vernal pools in the vicinity of the Magpie Creek construction area: • Preservation component: For every acre of			

Notes:

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vehicles, by construction of the new levee and maintenance road, or due to the alteration of the natural flows of the area due to construction of the new levee. Prior to initiation of any construction activities, field surveys and a wetland delineation would occur to verify the occurrence of vernal pools in the construction footprint and to determine if any nearby vernal pools could be indirectly affected by construction.	habitat directly or indirectly affected, at least two vernal pool credits will be dedicated within a Service-approved ecosystem preservation bank or, based on Service evaluation of site-specific conservation values, three acres of vernal pool habitat may be preserved on the project site or another nonbank site as approved by the Service. • Creation component: For every acre of habitat directly affected, at least one vernal pool creation credit will be dedicated within a Service-approved habitat creation bank or, based on Service evaluation of site-specific conservation values, two acres of vernal pool habitat will be created and monitored on the project site or another non-bank site as approved by the Service. • Listed vernal pool crustacean habitat and associated uplands utilized as on-site compensation will be protected from adverse effects and managed in perpetuity or until the USACE, the applicant, and the Service agree on a process to exchange such areas for credits within a Service-approved conservation banking system. Off-site conservation at a Service-approved non-bank location will be protected and managed in perpetuity through a Service-approved conservation easement, Service-approved management plan, and a sufficient endowment fund to manage the site in perpetuity in accordance with the management plan. • If habitat is avoided (preserved) on site, then a Service-approved biologist (monitor) will			Verify that preconstruction bird surveys have occurred.

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<u>Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp continued</u>	inspect any construction-related activities at the proposed project site to ensure that no unnecessary take of listed species or destruction of their habitat occurs. The biologist will have the authority to stop all activities that may result in such take or destruction until appropriate corrective measures have been completed. The biologist also will be required to immediately report any unauthorized impacts to the Service and the California Department of Fish and Game. • Adequate fencing will be placed and maintained around any avoided (preserved) vernal pool habitat to prevent impacts from vehicles. • All on-site construction personnel will receive instruction regarding the presence of listed species and the importance of avoiding impacts to these species and their habitat. • The applicant will ensure that activities that are inconsistent with the maintenance of the suitability of remaining habitat and associated on-site watershed are prohibited. This includes, but is not limited to: (i) alteration of existing topography or any other alteration or uses for any purposes, including the exploration for or development of mineral extraction; (ii) placement of any new structures on these parcels; (iii) dumping, burning, and/or burying of rubbish, garbage, or any other wastes or fill materials; (iv) building of any new roads or trails; (v) killing, removal, alteration, or replacement of any existing native vegetation; (vi) placement of storm			

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<u>Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp continued</u> <u>Giant Garter Snake (GGS)</u> The East Side Tributaries (NEMDC, Magpie Creek, and Arcade Creek) have some potential GGS habitat, however, the creeks in this area lack year round water and connectivity to rice fields, a major component of GGS habitat. The closest rice fields are about 5 miles away up the NEMDC and above a pump plant	water drains; (vii) fire protection activities not required to protect existing structures at the project site; and (viii) use of pesticides or other toxic chemicals. The proposed project will result in 0.25 acre of indirect effects to vernal pools/swales of potentially suitable vernal pool shrimp and vernal pool tadpole shrimp habitat. The applicant has identified and agreed to purchase 0.5 vernal pool preservation credits at a Service-approved conservation bank or Service-approved fund. Credits will be purchased prior to the effect on any vernal pool habitat. The agreed upon conservation responsibilities of the applicant are as follows: • Prior to any earth-moving activities at the proposed project site, the applicant shall purchase at least 0.5 vernal pool preservation credits within a Service-approved ecosystem preservation bank or fund account. <u>Giant Garter Snake</u> The following measures will be implemented to minimize effects on giant garter snake habitat that occurs within 200 feet of any construction activity. These measures are based on USFWS guidelines for restoration and standard avoidance measures included as appendices in USFWS (1997).			

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located on the NEMDC just above Dry/Robla Creek. Additionally, Arcade Creek and NEMDC both have segments that include large cover vegetation that would make them undesirable for GGS.	• Unless approved otherwise by USFWS, construction will be initiated only during the giant garter snakes' active period (May 1 to October 1, when they are able to move away from disturbance). • Construction personnel will participate in USFWS-approved worker environmental awareness program. • A giant garter snake survey would be conducted 24 hours prior to construction in potential habitat. Should there be any interruption in work for greater than two weeks, a biologist would survey the project area again no later than 24 hours prior to the restart of work. • Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own. • Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.			

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GGS continued	• Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel. • Habitat temporarily affected for more than three or more seasons will be restored and twice as much habitat will be created. • The USACE has estimated that approximately 15 acres of aquatic habitat (drainage ditches and irrigation canals) and 30 acres of associated upland habitat would be permanently affected due to the widening of the Sacramento Weir and Bypass. Habitat permanently affected in the Sacramento Bypass will be compensated for through the purchase of 135 acres of credits at a USFWS-approved conservation bank. Due to the spatial and temporal loss of habitat, and the lack of permanent on-site replacement, the ecological value associated with doing all mitigation at an off-site location was reduced to an overall 70% habitat value. This reduction is offset by the increase of mitigation credits at ratios specified by USFWS in the Biological Opinion included as Appendix J.			

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<u>GGS continued</u> <u>Western Yellow-Billed Cuckoo</u> The project area is unlikely to support western yellow-billed cuckoo nesting habitat due to the narrow riparian corridors along the waterways, with the exception of the American River Parkway. However, migrant individuals are likely to pass through the area in transit to breeding sites along the Sacramento River north of Colusa. Potential long-term effects to the cuckoo could result from the loss of 65 acres of riparian habitat in the footprint of the rock trench sites within the American River Parkway. For the American River, impacts to trees would be the width of the launchable rock trenches (currently proposed at approximately 40-feet wide) for a total of approximately 65 acres. Additionally, approximately 110 acres of riparian habitat would be impacted along the Sacramento River. <u>Swainson's Hawks</u>	• One year of monitoring will be conducted for the 80.5 acres that are temporarily affected. • The USACE will purchase credits at a conservation bank prior to any permanent disturbance of giant garter snake habitat. <u>Western Yellow-Billed Cuckoo, Swainson's Hawk, White-Tailed Kite, and Purple Martin</u> The following BMPs will be implemented: • Before ground disturbance, all construction personnel would participate in a CDFW-approved worker environmental awareness program. A qualified biologist would inform all construction personnel about the life history of Swainson's hawk and the importance of nest sites and foraging habitat. • A breeding season survey for nesting birds would be conducted for all trees and shrubs that would be removed or disturbed which are located within 500 feet (0.5 mile for Swainson's hawk) of construction activities, including grading. Swainson's hawk surveys would be completed during at least two of the following survey periods: January 1 to March 20, March 20 to April 5, April 5 to April 20, and June 10 to July 30 with no fewer than three surveys completed in at least two survey periods, and with at least one of these surveys occurring immediately prior to project initiation (Swainson's Hawk Technical Advisory Committee 2000). Other			

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Approximately 175 acres of riparian habitat used by Swainson's hawk for roosting and nesting could be affected by project construction. Additionally, approximately 2.5 acres of non-native grassland intermixed with barren ground would be removed or disturbed as a result of construction activities at levees. Much of this habitat is within the Sacramento urban area, where Swainson's hawks nest and forage along the American and Sacramento Rivers. <u>White-Tailed Kite</u> Construction activities conducted during nesting season, including vegetation removal, could significantly impact the white-tailed kite by removing nesting habitat or causing the species to abandon any active nests. In addition, the short-term loss of approximately 175 acres of riparian habitat on the landside of the levees that could support white-tailed kite nesting and foraging could result in significant effects to this species. <u>Purple Martin</u> Construction activities conducted during	migratory bird nest surveys could be conducted concurrent with Swainson's hawk surveys with at least one survey to be conducted no more than 48 hours from the initiation of project activities to confirm the absence of nesting. If the biologist determines that the area surveyed does not contain any active nests, construction activities, including removal or pruning of trees and shrubs, could commence without any further mitigation. • If active nests are found, the USACE would maintain a 0.25-mile buffer between construction activities and the active nest(s). In addition, a qualified biologist would be present on-site during construction activities to ensure the buffer distance is adequate and the birds are not showing any signs of stress. If signs of stress that could cause nest abandonment are noted, construction activities would cease until a qualified biologist determines that fledglings have left an active nest. • Tree and shrub removal, and other areas scheduled for vegetation clearing, grading, or other construction activities would not be conducted during the nesting season (generally February 15 through August 31 depending on the species and environmental conditions for any given year) . These construction activities could affect them by removing or causing abandonment of active nests of migratory birds protected under the Migratory Bird Treaty Act and California Fish			

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nesting season, including vegetation removal, could significantly impact the purple martin by removing nesting habitat or causing the species to abandon any active nests. In addition, the short-term loss of approximately 175 acres of riparian habitat on the landside of the levees that could support purple martin nesting and foraging could result in significant effects to this species. <u>Burrowing Owl</u> Construction activities, including grading and clearing activities within or adjacent to potential burrowing owl habitat, could result in nesting failure, death of nestlings, or loss of eggs. In addition, the short-term loss of approximately 175 acres of riparian habitat on the landside of the levees that could support burrowing owl nesting and foraging could result in significant effects to this species.	and Game Code To reduce the impact on migratory birds habitat the USACE will seek a vegetation variance on lower half of the waterside levee slope. Additionally, where bank protection work is performed the sites would be planted with vegetation and trees that over time will provide habitat for the hawks. To compensate for the removal of 134 acres of riparian habitat supporting Western yellow-billed cuckoos, Swainson's hawks, and other migratory birds approximately 268 acres of replacement habitat will be created, as discussed in the vegetation and wildlife section. <u>Burrowing Owl</u> • Prior to the implementation of construction, surveys will be conducted to determine the presence of burrows or signs of burrowing owl presence within the project area. The survey would be conducted in accordance with Appendix D of CDFW's Staff Report on Burrowing Owl Mitigation (CDFG 2012). • If burrowing owls are observed, coordination would occur with CDFW to determine the appropriate actions to take or any additional avoidance and minimization measures that may need to occur. These measures may include creating a protective buffer around occupied burrows during the duration of the breeding season and biological monitoring of			

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Listed Fish Species: Winter-Run Chinook Salmon Implementation of the bank erosion protection measures may result in adverse effects to juvenile and smolt winter-run Chinook salmon, their critical habitat, and EFH. Construction activities that increase noise, turbidity, and suspended sediment may disrupt feeding or temporarily displace fish from preferred habitat. Physical damage or harassment to listed fish species would be low during the months of construction. Winter-run Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River and American River SAM analysis reaches over the lifetime of the project when both IWM and planted benches are incorporated into the with-project conditions. Chinook	active burrows to ensure that construction activities do not result in adverse effects on nesting burrowing owls. • If potential burrows are present, all on-site construction personnel shall be instructed regarded the potential presence of burrowing owls, identification of these owls and their habitat, and the importance of minimizing impacts on burrowing owls and their habitat. Listed Fish Species USACE proposes to develop a green sturgeon habitat, mitigation, and monitoring plan (HMMP) (Appendix I) to address the long-term negative impacts to green sturgeon designated critical habitat with the specific elements that are described below: • The green sturgeon HMMP shall be developed in coordination with the Interagency Ecological Program (IEP) green sturgeon project work team and consulted on with NMFS prior to the construction of any work within the designated critical habitat of sDPS green sturgeon related to the ARCF GRR. • The USACE shall either refine the SAM or develop an alternative green sturgeon survival and growth response model based on using and updating the existing Hydrologic Engineering Center Ecosystem Function Model (HEC-EFM) that reflects			

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salmon should exhibit a positive response by year 5 in the winter-spring when most juvenile Chinook salmon are expected in the ARCF GRR project area. Spring-run Chinook Salmon Adult spring-run Chinook salmon migrate up the Sacramento River from March through September although most individuals have entered tributary streams by mid-June and will not be affected by construction activities. Therefore, potential for construction-related ARCF GRR project effects will be similar to that described for winter-run Chinook salmon. Central Valley Fall-/Late Fall–Run Chinook Salmon Fall-/Late Fall-Run Chinook salmon are expected to show a long term positive response to project actions in the Sacramento River and American River SAM analysis reaches over the lifetime of the project when both IWM and planted benches are incorporated into the with-project conditions. Chinook salmon should exhibit a positive response by year 5 in the winter-spring	green sturgeon's preference for benthic habitat. • The green sturgeon HMMP shall also be developed with measurable objectives for completely offsetting all adverse impacts to all life stages of sDPS green sturgeon (as modeled using refined approaches described above and considering design refinements that occur in the PED phase of project implementation. • The HMMP shall also, restore or compensate for the number of acres of soft bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. This mitigation shall be coordinated with the Interagency Working Group (IWG) or a Bank Protection Working Group (BPWG) and must be carried out within the lower Sacramento River/North Delta in order to offset the adverse modification to designated critical habitat. • Mitigation actions shall be initiated prior to the construction activities affecting sDPS green sturgeon and their critical habitat. • The sDPS green sturgeon HMMP will include measurable performance standards at agreed upon intervals and will be monitored for a period of at least ten years following construction. The following additional conservation measures would be implemented to reduce the adverse effects to listed Chinook, steelhead, delta smelt, and green sturgeon:			

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when most juvenile Chinook salmon are expected in the ARCF GRR project area. <u>Central Valley Steelhead</u> Steelhead are expected to show a long term positive response to project actions in the Sacramento River and American River SAM analysis reaches over the lifetime of the project. Steelhead should exhibit a positive response by year 4 in the winter-spring when most juvenile steelhead will be migrating and rearing through the project area. <u>Green Sturgeon</u> If larvae or juveniles are present during construction, in-water activities could result in localized displacement and possible injury or mortality to individuals that do not readily move away from the channel or nearshore areas. Project actions associated with bank protection measures may increase sediment, silt, and pollutants, which could adversely affect rearing habitat or reduce food production, such as aquatic invertebrates, for larval and juvenile green sturgeon.	• In-water construction activities (e.g., placement of rock revetment) will be limited to the work window of August 1 through November 30. If the USACE wants to work outside of this window they will consult with USFWS and NMFS. • The USACE will purchase delta smelt credits from a USFWS-approved conservation bank to off-set the loss of 14 acres of shallow water habitat, and 13 acres of spawning habitat. This mitigation is assumed to occur through the purchase of credits at a mitigation bank due to the lack of available real estate in the study area for on-site mitigation. Due to the spatial and temporal loss of habitat, the ecological value associated with doing all mitigation at an off site location was reduced to an overall 70% habitat value. This reduction is offset by the increase of mitigation credits at ratios specified by USFWS and NMFS in the Biological Opinions. The USACE proposes to purchase a total of 72 credits to ensure that impacts to Delta smelt are fully mitigated. • Erosion control measures will be implemented (BMPs), including Storm Water Pollution Prevention Program and Water Pollution Control Program, that minimize soil or sediment from entering the river. BMPs shall be followed, monitored for effectiveness, and maintained throughout construction operations to minimize effects to Federally listed fish and their designated			

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Due to these adverse effects to juvenile green sturgeon, USACE is proposing to adaptively manage the project in a number of ways in order to minimize impacts to this species. In particular, preconstruction physical modeling is proposed to assist in determining potential methods of implementing the proposed measures to minimize impacts to salmon. Additionally, new habitat modeling is proposed to better define what those impacts may be. Monitoring would be conducted during and post-construction in order to confirm the impacts estimated to result from the project, and to allow for improvement in minimizing impacts for future construction throughout the estimated 10 year construction period. <u>Delta Smelt</u> Potential spawning habitat includes shallow channel edge waters in the Delta and Sacramento River. Construction-related effects include disruption of spawning activities, disturbance or mortality of eggs and newly hatched larvae, and alteration of spawning and incubation habitat. As a result, potential construction-related effects to delta smelt physical habitat would include disruption of spawning activities, disturbance or mortality of	critical habitat. • Screen any water pump intakes, as specified by NMFS and USFWS screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt. • No grading or altering of the lands within the existing Sacramento Bypass will occur as part of the project. • The USACE shall participate in an existing IWG or work with other agencies to participate in a new BPWG to coordinate stakeholder input into future flood risk reduction actions associated with the ARCF GRR. • The USACE shall coordinate with NMFS during PED as future flood risk reduction actions are designed to ensure conservation measures are incorporated to the extent practicable and feasible and projects are designed to maximize ecological benefits. • The USACE shall include as part of the Project, a Riparian Corridor Improvement Plan with the overall goal of maximizing the ecological function and value of the existing levee system within the Sacramento Metropolitan Area. • The USACE shall develop a HMMP with an overall goal of ensuring the conservation measures achieve a high level of ecological function and value. The HMMP shall include:			

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eggs and newly hatched larvae, alteration of spawning and incubation habitat, and loss of shallow water habitat for spawning. Juvenile delta smelt may be subject to disturbance or displacement caused by construction activities that increase noise, turbidity, and suspended sediment. Delta smelt may not be readily able to move away from channel or nearshore areas that are directly affected by construction activities (i.e., placement of rock revetment). Larvae may be disrupted during summer months as they migrate downstream to rear in the Delta. Incidental take of delta smelt may occur from direct mortality or injury during a construction activity, or by the impairment of essential behavior patterns (i.e., feeding, escape from predators). In addition, physiological impairment could be caused by toxic substances (i.e., gasoline, lubricants, oil) entering the water. Construction related effects on delta smelt rearing and migration will be minimized by restricting in-water construction activities on the Sacramento River to a general estimated work window between August 1 and November 30. For the purpose of this study however, during PED, the work window will be adjusted on a site specific basis taking into account presence of juvenile and	▪ Specific goals and objectives and a clear strategy for maintaining all of the project conservation elements for the life of the project. ▪ Measures to be monitored by the USACE for 10 years following construction and shall update their O&M manual to ensure the HMMP is adopted by the local sponsor to ensure the goals and objectives of the conservation measures are met for the life of the project. ▪ Include specific goals and objectives and a clear strategy for achieving full compensation for all project-related impacts to listed fish species. ▪ The USACE shall continue to coordinate with NMFS during all phases of construction, implementation, and monitoring by hosting annual meetings and issuing annual reports throughout the construction period as described in the HMMP. ▪ The USACE shall host an annual meeting and issue annual reports for five years following completion of project construction. • The USACE shall ensure that, for salmon and			

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adult delta smelt as well as any other condition that could impact delta smelt rearing and migration. <u>Listed Fish Species continued</u>	steelhead, the maximum SAM WRI deficits for each seasonal water surface elevation as determined appropriate with input from the IWG or the BPWG are fully offset through the purchase of credits at a NMFS approved conservation bank (as described in this BA). • The USACE shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place or if not feasible, new IWM will be anchored in place. • The USACE shall ensure that the planting of native vegetation will occur as described in the HMMP. All plantings must be provided with the appropriate amount of water to ensure successful establishment. • The USACE shall provide a copy of the BO, or similar documentation, to the prime contractor, the prime contractor is responsible for implementing all requirements and obligations on behalf of USACE included in the documents and to educate and inform all other contractors involved in the project as to the requirements of the BO. • A NMFS-approved Worker Environmental Awareness Training Program for construction personnel shall be conducted by the NMFS-approved biologist for all construction workers prior to the commencement of construction activities. Written documentation of the training will be submitted to NMFS within 30 days of the			

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Listed Fish Species continued	completion of training. • The USACE shall consider installing IWM along future flood risk reduction projects associated with the ARCF GRR at 40 to 80 percent shoreline coverage at all seasonal water surface elevations in coordination with the IWG or the BPWG. The purpose is to maximize the refugia and rearing habitats for juvenile fish. • The USACE shall protect in place all riparian vegetation on the lower waterside slope of any levee unless removal is specifically approved by NMFS. • The USACE shall develop a Vegetation Variance for all elements of the ARCF GRR that are adjacent to habitat that is occupied by federally listed salmon, steelhead and green sturgeon, including the main channel of the Sacramento River (as proposed) and the Sacramento Bypass. • The USACE shall ensure the widening of the Sacramento Bypass is designed and constructed to minimize stranding of fish in the depressions wound within the bypass though grading or construction of drainage channels. • The USACE, in coordination with the local sponsor, shall ensure that the Habitat Mitigation and Monitoring Plan for the Sacramento Bypass includes baseline post-project monitoring of fish stranding. The monitoring plan shall be developed in coordination with NMFS.			

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Listed Fish Species continued	• The USACE shall update the O&M manual to incorporate without detrimental effects to flood operations 1) operations of the Sacramento Weir include a plan that allows for ramp down flows in a manner that minimize juvenile fish stranding in the Sacramento Bypass, (2) integration of Sacramento Weir operations with the Yolo Bypass. • During Preconstruction Engineering and Design, the USACE, in coordination with the local sponsor, shall coordinate with NMFS to provide an operation of the Sacramento Weir to allow without detrimental effects to flood management operations, for controlled ramp down rates of water into the Sacramento Bypass following peak flows. • Additional concerns about mitigation, not considered in a SAM analysis, will be included in the MMP (See Appendix I) along the Sacramento Bypass reach, including potential adult and juvenile passage issues, loss of shoreline riparian vs. gain in floodplain, and contradicting ESA species habitat requirements. These issues will be considered and appropriate actions will be taken where possible in coordination with other agencies. For SRA habitat impacted by construction, the following measures would be implemented to compensate for the habitat loss:			

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Listed Fish Species continued	• Compensation timing refers to the time between the initiation of construction at a particular site and the attainment of the habitat benefits to protected species from designated compensation sites. In general, compensation time is the time required for on-site plantings to provide significant amounts of shade or structural complexity from instream woody material recruitment. Significant long-term benefits have often been considered as appropriate to offset small short-term losses in habitat for listed species in the past, as long as the overall action contributes to recovery of the listed species. The authority to compensate prior to or concurrent with project construction is given under WRDA 1986 (33 United States Code [USC] §§ 2201–2330). • For identified designated critical habitat, where feasible all efforts will be made to compensate for impacts where they have occurred or in close proximity. Impacts to designated critical habitat, SRA and instream components combined and the compensation value of replacement habitat will be based on the interagency approved Standard Assessment Model (SAM) used throughout the Sacramento River basin and Delta flood control system. • Compensation sites would be monitored and vegetation would be replaced as necessary based on performance standards in the Mitigation Monitoring Plan (MMP) as detailed in Appendix I of the EIS/EIR.			

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                  Special Status Plant Species: Sanford's Arrowhead Sanford's arrowhead is known to occur in the Arcade Creek and NEMDC channels. Levee work in these reaches is proposed to remain within the levee prism and would not encroach into the channel; therefore, construction activities in this reach would not result in direct impacts to Sanford's arrowhead. Indirect effects to Sanford's arrowhead could occur during construction due to dust disturbance. However, the mitigation measures proposed in the air quality section.	Depending on the species of interest (e.g., delta smelt), the severity of the short-term habitat losses due to bank erosion repair actions may not be compensated by long-term gains, whereas longer lived species (e.g., steelhead, Chinook) have longer periods for compensation to be provided. The following compensation time periods (based loosely on life expectancy) should be considered as guidelines for compensation: • Green sturgeon, 15 years; • Chinook salmon, 5 years; • Central Valley steelhead, 4 years; and • Delta smelt, 1 year. Special Status Plant Species The following avoidance and minimization measures would be implemented during construction to reduce potentially significant effects to Sanford's arrowhead and wooly rose-mallow to less than significant. Additionally, the avoidance and minimization measures to address invasive plant species in Section 3.6.6 would also reduce potential impacts to special status plant species. • Preconstruction surveys would be conducted by a qualified botanist in suitable habitat to determine the presence of any special status plants. Surveys would be conducted at an			

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Wooly Rose-Mallow There are no known populations of wooly rose-mallow in the study area, however since they are known to occur on levee banks with riprap, they could potentially be adversely impacted by construction of the proposed project. Clearing and grubbing of the levee slopes, and some long-term O&M activities, such as mowing of the levees, could also remove populations of this plant, if present. **Alternative 2** A maximum of 15 acres of aquatic GGS habitat (drainage ditches and farm canals) would be permanently removed and incorporated into the Sacramento Bypass. To the east of the bypass, there are approximately 8 acres of riparian vegetation growing along the Sacramento River that would be removed to construct the new weir structure. The 8-acre area contains both the Old River Road and Union Pacific Railroad (UPRR) tracks. Prior to construction this area would be surveyed to determine if any avian species have nested in the area. If there is nesting Swainson's Hawks	appropriate time of year during which the species are likely to be detected, which would likely be during the blooming period. • If special status plant species are found during preconstruction surveys, the habitat would be marked or fenced as an avoidance area during construction. A buffer of 25 feet would be established. If a buffer of 25 feet is not possible, the next maximum possible distance would be fenced off as a buffer. • If special status plant species cannot be avoided during construction, the USACE would coordinate with the resource agencies to determine additional appropriate mitigation measures. **Alternative 2** Same mitigation ratios and BMPs as alternative 1			

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construction would be delayed until fledglings have left the nest. Fish in the area would likely disperse with the disturbance to the water. The expansion of the Sacramento Weir and Bypass could have a positive beneficial effect on special status wildlife such as the giant garter snake and its riparian vegetation once construction is complete and lands are converted from farming activities to open space where wetlands and shrubby riparian habitat is expected to naturally regenerate with the increased area that is periodically inundated from flooding during the rainy season. Widening of the weir and bypass will increase the entrainment and stranding exposure and rates of juvenile green sturgeon. When the weir is overtopping and water is flowing down the bypass, adult fish are attracted to the flow and follow it upstream in an attempt to reach their holding and spawning habitat. Widening the weir and bypass would increase the amount of water going over the weir and increase the attraction rate of sturgeon, salmon and steelhead.				
3.9 Cultural Resources The effects of the erosion repair on the	Avoidance of adverse effects to historic properties is the preferred treatment approach.	D, P, C	USACE	CVFPB

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American River, levee geometry measures, cutoff walls, and bank protection on the Sacramento River and construction of cutoff walls, correction of the levee geometry, installation of floodwalls, installation of a conduit or box culvert, raising of floodwalls and existing levees, construction of maintenance roads, installation of floodgates, and creation of a detention basin on the East Side Tributaries would likely result in an adverse effect to some historic properties located within the APE for the project. The records and literature search conducted for the project identified 69 known prehistoric and historic resources in the total project APE. For the purposes of this EIS/EIR, the USACE assumes that all of these resources would be impacted by the levee improvement alternatives. Site specific determinations of effect and impact cannot be made at this time because each site within the APE would need to be field checked, the previous recordation (included site boundary, associated features, integrity) verified, and each site would need to be considered for eligibility for listing in the NRHP. The process for field checking cultural resources sites and making determinations of eligibility for listing in	The USACE will consider design refinements of project elements in order to avoid historic properties and project effects that may be adverse. Avoidance of adverse effects to historic properties is a significant part of the USACE planning and cultural resources management for this project as described in the PA. The PA includes a framework to identify historic properties, evaluate NRHP eligibility, and assess effects. Although specific effects to historic properties cannot be determined at this time, effects could include, but is not limited to, the following: temporary visual and auditory effects caused by construction activities, temporary lack of access and/or privacy to areas traditionally used by Native American tribes for ceremonies, temporary and/or permanent effects to the viewshed of TCPs caused by construction activities and associated noise levels, vibration or compression effects caused by construction activities to historic properties located in proximity to construction activities, alteration or destruction of built environment resources, removal of trees and vegetation that may represent plants significant to Native American tribes and used in ceremonies or for other traditional uses.			Verify that the PA is in place

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the NRHP are outlined in the Programmatic Agreement (PA). Specific individual determinations of effect for historic properties that may be affected by Alternative 1 would be completed under the stipulations of the PA, which includes a framework to identify historic properties, evaluate NRHP eligibility, and assess effects. Although specific effects to historic properties cannot be determined at this time, effects could include, but is not limited to, the following: temporary visual and auditory effects caused by construction activities, temporary lack of access and/or privacy to areas traditionally used by Native American tribes for ceremonies, temporary and/or permanent effects to the viewshed of TCPs caused by construction activities and associated noise levels, vibration or compression effects caused by construction activities to historic properties located in proximity to construction activities, alteration or destruction of built environment resources, removal of trees and vegetation that may represent plants significant to Native American tribes and used in ceremonies or for other traditional uses. Alternative 2				

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Effects to cultural resources from the construction of levee improvements under Alternative 2 would be consistent with those analyzed for Alternative 1 with the addition of effects resulting from construction of the Sacramento Weir and Bypass widening. Effects to historic properties may also result from disturbance of cultural resources sites due to remediation of a hazardous, toxic, and radiological waste (HTRW) site near the existing north levee, which may consist of historic era debris.				
3.10 Transportation and Circulation Increased traffic on public roadways.	Preparation of a traffic control and Road Management Plan BMP's below will be implemented to reduce the impacts from traffic: • The contractor would be required to prepare a Traffic Control and Road Maintenance Plan. A traffic control plan describes the methods of traffic control to be used during construction. All on-street construction traffic would be required to comply with the local jurisdiction's standard construction specifications. The plan would reduce the effects of construction on the roadway system in the project area throughout the construction period.	P, C	USACE	CVFPB Verify traffic plan

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	• Construction contractors would follow the standard construction specifications of affected jurisdictions and obtain the appropriate encroachment permits, if required. The conditions of the encroachment permit would be incorporated into the construction contract and would be enforced by the agency that issues the encroachment permit. • If rock or other materials are transported by barge on the Sacramento River, appropriate water safety measures would be utilized in order to reduce impacts to recreational boaters. • The construction contractor would provide adequate parking for construction trucks, equipment, and construction workers within the designated staging areas throughout the construction period. If inadequate space for parking is available at a given work site, the construction contractor would provide an off-site staging area and, as needed, coordinate the daily transport of construction vehicles, equipment, and personnel to and from the work site. • Proposed lane closures would be coordinated with the appropriate jurisdiction and would be minimized to the extent possible during the morning and evening peak traffic periods. Standard construction specifications also typically limit lane closures during commuting hours. Lane closures will be kept as short as possible. If a road must be closed, detour routes and/or			Verify barge usage when appropriate.

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	temporary roads would be made to accommodate traffic flows. Detour signs would be provided to direct traffic through detours. Advance notice signs of upcoming construction activities would be posted at least 1 week in advance so that motorists are able to avoid traveling through the study area during these times. Within the Parkway, detours would be used to allow for continued use by bicycle commuters. • Safe pedestrian and bicyclist access would be maintained in or around the construction areas at all times. Construction areas would be secured as required by the applicable jurisdiction to prevent pedestrians and bicyclists from entering the work site, and all stationary equipment would be located as far away as possible from areas where bicyclists and pedestrians are present. • The construction contractor would notify and consult with emergency service providers to maintain emergency access and facilitate the passage of emergency vehicles on city streets. • Emergency vehicle access would be made available at all times. Coordination with local emergency responders by the contractor to inform them of the construction activities would be required by the contractor. • The construction contractor would assess damage to roadways used during construction and will repair all potholes, fractures, or other damages.			Verify pedestrian and cyclist detour routes.

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	• Trains utilizing the Yolo Shortline Railroad would be detoured to a different rail line during construction. If an alternative rail line is not available, railroad services would be continued by transporting goods on public roads using cargo trucks during the extent of closures required by the construction and realignment of the railroad on the new portion of the Sacramento Weir.			
<u>3.11 Air Quality</u> Emissions of criteria pollutants from construction equipment, haul trucks, and barges. Construction of the proposed project would result in short-term dust emissions from grading and earth moving activities at the project construction sites and the soil borrow sites. Construction of the proposed project would result in short-term diesel particulate emissions from onsite heavy duty equipment and on-road haul trucks. DPM, which is classified as a carcinogenic TAC by CARB, is the primary pollutant of concern with regard to indirect health risks to sensitive receptors. Nearby land uses, especially those residences and schools located downwind of the project sites could be exposed to DPM generated during construction activities, indirectly	SMAQMD's Basic Construction Emissions Control Practices The SMAQMD requires construction projects to implement basic construction emission control practices to control fugitive dust and diesel exhaust emissions (SMAQMD 2015). The USACE would comply with the following control measures for the project: • Water all exposed surfaces twice daily. Exposed surfaces include but are not limited to: soil piles, graded areas, unpaved parking areas, staging areas, and access roads. • Cover or maintain at least two feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Any haul trucks that would travel along freeways or major roadways should be covered. • Use wet power vacuum street sweepers to remove any visible trackout mud or dirt from adjacent public roads at least once a day.	D, P, C	USACE	CVFPB Verify that emissions control guidance is followed. Verify that dust control measures are in place.

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resulting in potential adverse health effects. The proposed project would not result in any major sources of odor, and the project would not involve operation of any of the common types of facilities that are known to produce odors (e.g., landfill, wastewater treatment facility). Odors associated with diesel exhaust emissions from the use of onsite construction equipment may be noticeable from time to time by adjacent receptors. Alternative 2 Construction of the Sacramento Weir and Bypass Widening would occur in YSAQMD and include clearing of trees and vegetation, construction of the new levee, construction of the new portion of the weir, construction of new sections of road and railroad on the top of the new portion of the weir and the new levee, relocation of utilities, degrading and excavating the existing levee, and delivery and installation of rip-rap on the waterside slope of the new levee. Materials for the construction of the new levee would be reused from the existing levee to the greatest extent possible.	Use of dry power sweeping is prohibited. • Complete all roadways, driveways, sidewalks, or parking lots to be paved as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used. • Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes [required by California Code of Regulations, Title 13, sections 2449(d)(3) and 2485]. Provide clear signage that posts this requirement for workers at the site entrances. • Maintain all construction equipment in proper working condition according to the manufacturer’s specifications. The equipment must be checked by a certified mechanic and determined to be running in proper condition before it is operated. <u>Fugitive Dust Emission Mitigation Measures</u> Fugitive dust mitigation would require the use of adequate measures during each construction activity and would include frequent water applications or application of soil additives, control of vehicle access, and vehicle speed restrictions. The USACE would implement the dust mitigation measures listed below. • Water exposed soil with adequate frequency for continued moist soil. • Suspend excavation, grading, and/or			

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	demolition activity when wind speeds exceed 20 mph. • Install wind breaks (e.g., plant trees, solid fencing) on windward side(s) of construction areas. • Plant vegetative ground cover (fast-germinating native grass seed) in disturbed areas as soon as possible. • Install wheel washers for all exiting trucks, or wash off all trucks and equipment leaving the site. • Treat site accesses to a distance of 100 feet from the paved road with a 6 to 12-inch layer of wood chips, mulch, or gravel to reduce generation of road dust and road dust carryout onto public roads. • Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The phone number of the District shall also be visible to ensure compliance. The project will ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40 percent opacity for more than three minutes in any one hour. The use of USEPA adopted Tier 3 and Tier 4 standards for newly-built marine engines in 2008 would be encouraged under the barge delivery scenario. The Tier 3 standards reflect the			

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	application of technologies to reduce engine PM and NO_X emission rates. Tier 4 standards reflect application of high-efficiency catalytic after-treatment technology enabled by the availability of ultra-low sulfur diesel. These Tier 4 standards would be phased in over time for marine engines beginning in 2014 (USEPA 2008). The USACE will require that all off-road construction equipment comply with SMAQMD's enhanced exhaust controls (20% NO_X and 45% PM reductions). The USACE will encourage their construction contractors to use off-road diesel-powered construction equipment greater than 50 horsepower that meets Tier-4 off-road emission standards under the barge delivery scenario. As of July 1, 2015, the mitigation fee rate is $18,030 per ton of emissions. The Contractor would provide payment of the appropriate SMAQMD-required NO_x mitigation fee to offset the project's NO_x emissions when they exceed SMAQMD's threshold of 85 lbs/day. The USACE would consult with the BAAQMD in good faith to enter into a mitigation contract for an emission reduction incentive program (e.g., TFCA or Carl Moyer Program). The current emissions limit is $17,080/weighted ton of criteria pollutants (NO_X + ROG + [20*PM]). An administrative fee of 5 percent would be paid to the BAAQMD to implement the program. The contractor would conduct daily and annual emissions monitoring to ensure onsite emissions			

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	reductions are achieved and no additional mitigation payments are required. The contractor would be required to ensure the requirement is met. This requirement would be incorporated into the construction contracts as part of the project's specifications.			
3.12 Climate Change Increased GHG emissions from construction equipment, haul trucks, and barges.	The following measures may be considered to lower GHG emissions during the construction: • Encourage and provide carpools, shuttle vans, transit passes and/or secure bicycle parking for construction worker commutes. • Recycle at least 75% of construction waste and demolition debris. • Purchase at least 20% of the building materials and imported soil from sources within 100 miles of the project site. • Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to no more than 3 minutes (5 minute limit is required by the state airborne toxics control measure [Title 13, sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the site. • Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified	P, C	USACE	CVFPB Verify mitigation measures are being implemented.

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	mechanic and determined to be running in proper condition before it is operated. • Use equipment with new technologies (repowered engines, electric drive trains). • Perform on-site material hauling with trucks equipped with on-road engines (if determined to be less emissive than the off-road engines). • Use a CARB approved low carbon fuel for construction equipment. (NO_x emissions from the use of low carbon fuel must be reviewed and increases mitigated.) • Purchase GHG offset for program-wide GHG emissions (direct emissions plus indirect emissions from on-road haul trucks plus commute vehicles) exceeding SMAQMD or CEQ's significance thresholds applicable at the time of construction. Carbon offset credits shall be purchased from programs that have been approved by SMAQMD.			
3.13 Noise Construction activities in the American River Parkway, Sacramento River, East Side Tributaries and Sacramento Bypass could result in temporary significant impacts on residents, recreationists, and other noise sensitive groups.	During construction, noise-reduction measures would be employed in order to ensure that construction noise complies with local ordinances. Prior to the start of construction, a noise control plan would be prepared that would identify feasible measures to reduce construction noise, when necessary. The following measures would apply to construction activities within 500 feet of a sensitive receptor, including, but not limited to, residences. These measures may include, but are not limited to, the following:	P, C	USACE	CVFPB Verify noise control plan. Verify that residents have been notified in writing. Verify signage.

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	• Provide written notice to residents within 1,000 feet of the construction zone, advising them of the estimated construction schedule. This written notice would be provided within one week to one month of the start of construction at that location. • Display notices with information including, but not limited to, contractor contact telephone number(s) and proposed construction dates and times in a conspicuous manner, such as on construction site fences. • Schedule the loudest and most intrusive construction activities during daytime hours (7:00 a.m. to 7:00 p.m.), when feasible. • Require that construction equipment be equipped with factory-installed muffling devices, and that all equipment be operated and maintained in good working order to minimize noise generation. • Locate stationary noise-generating equipment as far as practicable from sensitive receptors. • Limit unnecessary engine idling (i.e., more than 5 minutes) as required by State air quality regulations. • Employ equipment that is specifically designed for low noise emission levels, when feasible. • Employ equipment that is powered by electric or natural gas engines, as opposed to those powered by gasoline fuel or diesel, when feasible.			

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	• If the construction zone is within 500 feet of a sensitive receptor, place temporary barriers between stationary noise equipment and noise sensitive receptors to block noise transmission, when feasible, or take advantage of existing barrier features, such as existing terrain or structures, when feasible. • If the construction zone is within 500 feet of a sensitive receptor, prohibit use of backup alarms and provide an alternate warning system, such as a flagman or radar-based alarm that is compliant with State and Federal worker safety regulations. • Locate construction staging areas as far as practicable from sensitive receptors. • Design haul routes to avoid sensitive receptors, to the extent practical. • If there are any occupied buildings with plaster or wallboard construction within 40 feet of construction equipment, a vibration control plan would be prepared prior to construction.			
3.14 Recreation Site-specific designs have not been conducted to determine which erosion protection measure is appropriate along each reach of the Parkway, certain assumptions can be made: • Access to the American River for	The following measures would be implemented to keep the public informed of construction activities to mitigate for effects to bike trail/recreation trail access: • Coordination with recreation user groups would occur prior to and during construction for input into mitigation measures that would reduce affects to the maximum extent practicable.	P,C	USACE	CVFPB Verify that notice is given about recreational impacts prior to closure.

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the purposes of erosion control construction would require some temporary closures of portions of the recreation trail during construction activities. • Haul trucks would use portions of the recreational trail to bring materials to the construction sites, reducing accessibility to recreationists. • Some areas within the Parkway itself would be construction staging areas. • The presence of construction equipment and haul trucks would reduce the quality of recreational experiences. Alternative 2 Possible closure of the Sacramento Bypass during portions of the hunting season.	• Advance notice would be given to recreation users informing them of anticipated activities and detours to reduce the effects. To ensure public safety: • Flaggers, • Signs restricting access would be posted before and during construction • Detour routes would be clearly marked, • Fences would be erected in order to prevent access to the project area. • In areas where recreational traffic intersects with construction vehicles, traffic control will be utilized in order to maintain public safety. • The public will have continued access to the Parkway and recreation facilities during construction, but bike and running trail users would likely be required to detour onto public roads or alternative trails. • If any access point needs to be closed during construction, notices will be posted providing alternative access routes.			Verify use of flaggers. Verify use of detour signs.
3.15 Visual Resources Vegetation loss and construction activities would disrupt the existing visual conditions in the Parkway and along the Sacramento River.	American River Trees will be planted along the outer portion of the rock trench where there is sufficient space. Sacramento River Trees will remain on the waterside lower third of the levee. The understory vegetation will be removed in order to place rock.	P, C, M	USACE	CVFPB Verify replanting of trees. Verify that lower one third of trees are not removed.

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	Sacramento Weir and Bypass Native trees and shrubs within the existing bypass would be avoided during construction as much as practicable to help minimize visual impacts. The loss of ground cover in the existing and expanded bypass would be mitigated by planting native grasses and forbs in areas disturbed by construction, except within the footprint of the extended weir. The loss of existing native trees and shrubs within the existing bypass, along the bank of the Sacramento River, and within small portions of the agricultural lands directly impacted by the project would be mitigated by planting native trees and shrubs within certain portions of the expanded bypass.			Verify tree mitigation.
3.16 Public Utilities and Services Temporary disruptions to utility services are possible particularly during relocation of utilities that penetrate the levee.	Consultation with all known service providers would take place prior to construction to identify specific infrastructure locations and appropriate protection measures. Consultation would continue during construction to ensure avoidance/protection of facilities to minimize service disruptions. Where feasible, replacement utility structures would be completed before demolition of existing facilities. Mitigation measures would include the following: • Notification of any potential interruptions in service shall be provided to the appropriate agencies and affected landowners. • Before the start of construction, utility locations shall be verified through field surveys and the use of the Underground Service Alert services. Any buried utility lines	D, P, C	USACE	CVFPB Verify coordination with appropriate service providers.

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	shall be clearly marked in the area of construction on the construction specifications in advance of any earthmoving activities. • Before the start of construction, a response plan shall be prepared to address potential accidental damage to a utility line. The plan shall identify chain of command rules for notification of authorities and appropriate actions and responsibilities to ensure the safety of the public and workers. Worker education training in response to such situations shall be conducted by the contractor. The response plan shall be implemented by the project proponent(s) and its contractors during construction activities. • Utility relocations shall be staged to minimize interruptions in service. • Construction activities will be coordinated with first responders within the study area so plans can be implemented to avoid response delays due to construction detours.			
3.17 Hazardous, Toxic, and Radiological Wastes No effect from construction activities. HTRW sites encountered would be removed and properly disposed of prior to construction.	Borrow material would be tested prior to use to ensure that no contaminated soils are used in project.	P, C	USACE	CVFPB Verify that import soils are tested prior to use in project.
3.18 Socioeconomics, Population, and Environmental Justice Disruption to residents alongside	Mitigation for relocation of people and their homes would be compensated under the Federal Relocation Act.	D,P	USACE	CVFPB Verify that Federal

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construction sites from traffic, noise, and dust. Acquisition of properties for levee easements.				relocation process is followed.

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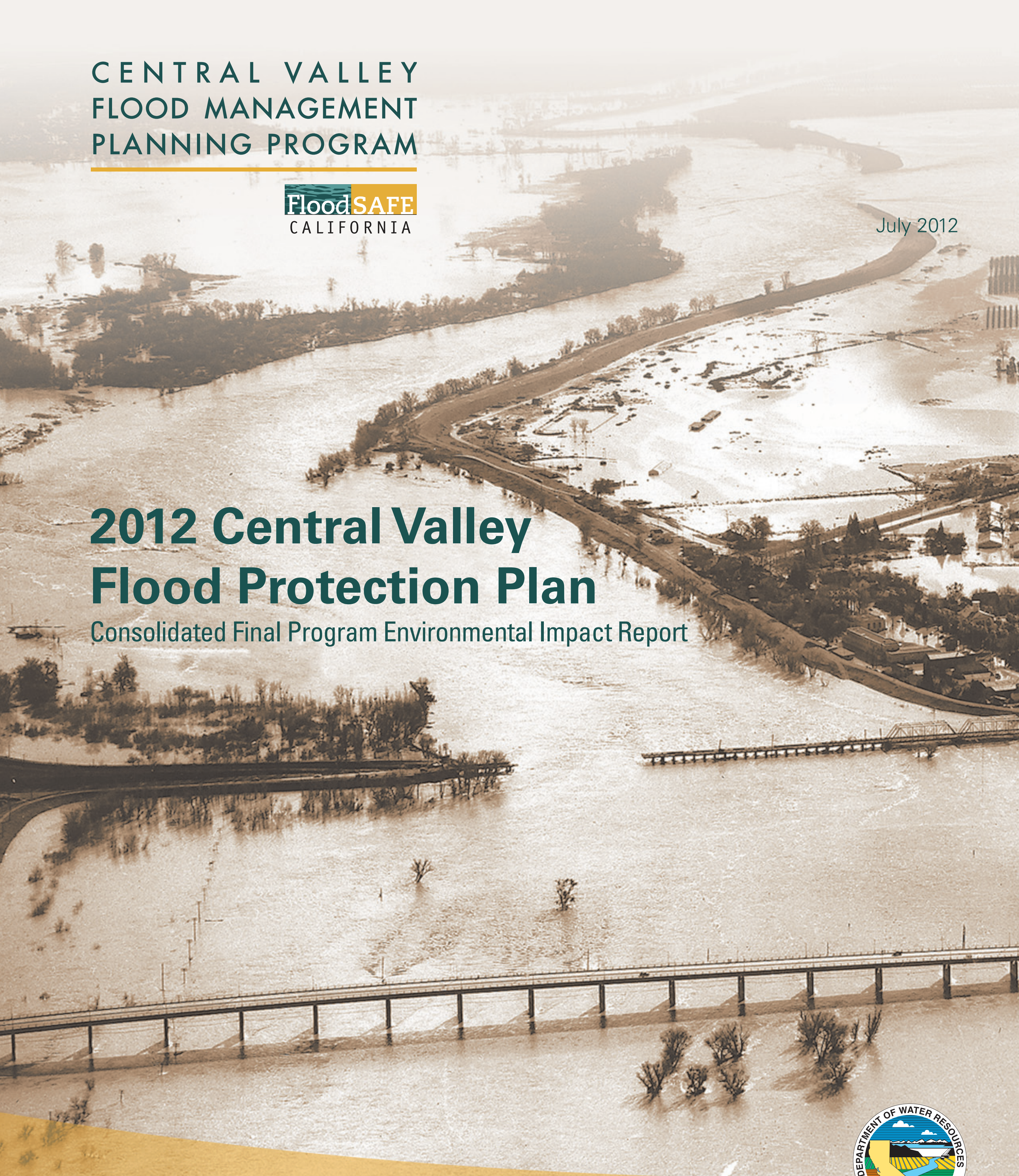


CENTRAL VALLEY
FLOOD MANAGEMENT
PLANNING PROGRAM

FloodSAFE
CALIFORNIA

July 2012

2012 Central Valley Flood Protection Plan

Consolidated Final Program Environmental Impact Report

PUBLIC SAFETY ENVIRONMENTAL STEWARDSHIP ECONOMIC STABILITY

Cover Photo: Feather River near Yuba City (December 1955)

The flood of December 1955 was one of the most widespread and destructive floods in Central Valley history. A levee break on the Feather River at Yuba City (shown) flooded about 6,000 homes and resulted in 38 confirmed deaths and millions in property damage.

Executive Summary

Table of Contents

Figures

Tables

EXECUTIVE SUMMARY

ES.1 Introduction

Historically, the Central Valley has experienced some of California's largest and most damaging floods. Floods have had devastating effects on life and property in the Central Valley and on the state's economic prosperity. The most recent large floods in the Central Valley, in 1986 and 1997, together caused more than $1 billion in damage (USACE 1997).

Despite the current flood management system in the Central Valley, the valley's residual flood risk remains among the highest in the country. Currently, even small flood events with a 5 percent chance of occurring annually can stress parts of the flood system.

"Residual Flood Risk" Residual risk is the portion of flood risk that remains after a flood control structure or works has been built. Risk remains because the likelihood exists for the design of the completed works to be surpassed by a flood event of sufficient intensity, resulting in structural failure.

Public awareness of flood risks was heightened by the catastrophic flooding in New Orleans associated with Hurricane Katrina in August 2005. That event caused estimated property damage exceeding $80 billion and took more than 1,800 lives.

In 2006, the California Department of Water Resources (DWR) launched FloodSAFE California, a multifaceted initiative to improve integrated flood management. In November of that year, the state's voters passed two important bond measures, Propositions 84 and 1E, which included approximately $3.3 billion in funds that could be used to support flood risk reduction efforts in the Central Valley.

In 2007, the California Legislature passed a package of several related flood bills, which included a requirement to prepare a Central Valley Flood Protection Plan (CVFPP). Additional requirements for the CVFPP were added in the Central Valley Flood Protection Act of 2008 (Senate Bill 5). That same year, DWR embarked on the Central Valley Flood Management Planning Program, which addresses flood management planning activities in the Central Valley that require leadership and participation by the State of California (State). The Central Valley Flood Management Planning Program is one of several programs managed by DWR under FloodSAFE California.

The CVFPP is a critical document intended to guide California's participation (and to influence federal and local participation) in managing flood risk along the Sacramento River and San Joaquin River systems. The CVFPP proposes a State Systemwide Investment Approach (SSIA) as its proposed program for sustainable, integrated flood management in areas currently protected by facilities of the State Plan of Flood Control (SPFC). The CVFPP is a program-level, rather than project-level, document. It articulates programs to further flood risk reduction in the Central Valley and suggests a range of potential future projects that could help meet that goal. The CVFPP will be updated every 5 years, with each update providing the opportunity to update existing policies, programs, and suggested projects, or to add new ones.

After extensive outreach to stakeholders and the public, a draft of the CVFPP was released to the public on December 30, 2011. Pursuant to Section 9612 of the California Water Code, the Central Valley Flood Protection Board (Board) shall adopt the CVFPP by July 1, 2012.

This CVFPP program environmental impact report (PEIR) was developed to inform DWR, which is developing the CVFPP, and the Board, which will consider adopting the CVFPP, about potential program-level environmental effects and mitigation measures related to the components of the CVFPP. The PEIR is written so that DWR and the Board will be able to rely on this PEIR for future planning and feasibility studies pertinent to implementation.

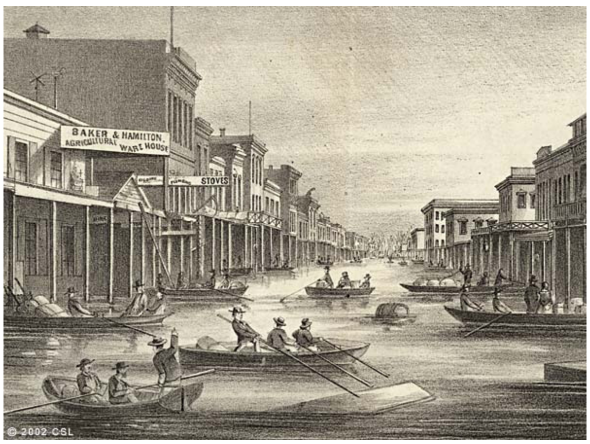
This executive summary provides an overview of the CVFPP PEIR consistent with Section 15123(a) of the California Environmental Quality Act Guidelines (CEQA Guidelines), which states that an EIR "shall contain a brief summary of the proposed action and its consequences." As explained in Section 15123(b), the summary shall identify (1) each significant impact, with proposed mitigation measures and alternatives; (2) areas of controversy known to the lead agency; and (3) issues to be resolved in the EIR.

This draft PEIR (DPEIR) is being circulated for public review. Comments received during the public review will be considered by DWR and the Board, and responses to comments will be included in the final PEIR. Continued public outreach, including public hearings, will be conducted before the final PEIR is completed. See Section ES.9, "Next Steps for the PEIR," below, for additional information.

ES.2 History and Background of Flood Protection in the Central Valley

Before settlement associated with the Gold Rush began, the Central Valley routinely flooded, forming a vast inland sea. Flood management efforts in the Central Valley began toward the middle of the 19th century, when major settlement and land reclamation and cultivation began in California's two largest valleys. The drainage and levee construction originally undertaken by individual farmers shifted in the 1880s to collective efforts and financing by newly authorized levee and reclamation districts in both the Sacramento and San Joaquin valleys. Because individual public levee and reclamation districts were formed by landowners, flood control efforts were fundamentally local and uncoordinated. The system proved inadequate, especially for the Sacramento River system.

In lieu of building river levees to make the Sacramento River a single, ever-wider flood channel, a weir and bypass system known as the "Jackson Plan" was conceived and formally adopted by the California Debris Commission in 1911. The Debris Commission was a federal body that had been created to address the effects of the deposition of mining debris on navigation. The bypass system proposed in the Jackson Plan consisted of weirs built to divert portions of the high Sacramento River flows from the river at different points into specially constructed, large-capacity flood channels to reduce flood stages in the river, and thereby to move floodwaters safely to the ocean. In 1911, the State authorized a means of funding the plan by creating a regional assessment district, the Sacramento–San Joaquin Drainage District, and a governing body for it, the State Reclamation Board. (The State Reclamation Board is now known as the Central Valley Flood Protection Board.) The plan, which became known as the Sacramento River Flood Control Project, was completed in 1960 by the U.S. Army Corps of Engineers (USACE).



1862 Flooding in Sacramento

The structures, such as levees and bypasses and other flood structures designed and primarily built by USACE in the watershed of the Sacramento and San Joaquin rivers, are known as the federal flood control facilities for the Central Valley. The levees that are part of federal flood control facilities are known as "project levees," which distinguishes them from levees that are not part of USACE's federal system of levees and other flood facilities in the Central Valley. These project levees are now called facilities of the SPFC. Construction of these facilities contributed to the loss of floodplain habitats and marshes over time.

About 45 percent of the levees in the Sacramento–San Joaquin Delta (Delta) are not project levees. The nonproject levees are maintained by local reclamation districts and are generally eligible for financial assistance from the State through the Delta Levees Subventions Program. The Delta Flood Protection Fund Act of 1988 substantially increased reimbursement opportunities for the local reclamation districts and added environmental mitigation and protection requirements for grant recipients. Multipurpose storage reservoirs on both the San Joaquin and Sacramento rivers that are not part of the federal flood control facilities also protect the valley from flooding.

Today, the Central Valley flood management system includes levees along the major rivers and streams of the valley floor and around the islands of the Delta, a major bypass system for the Sacramento River and its tributaries, several bypass segments along the San Joaquin River, and numerous reservoirs on almost all major rivers and streams draining to the Central Valley.

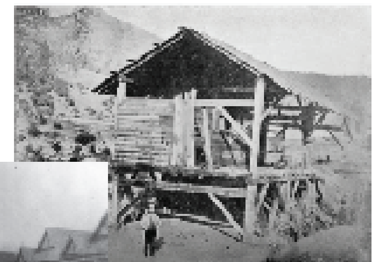
During major flood events, State, federal, and local agencies work together closely to forecast weather and runoff conditions, manage and coordinate flood releases from the reservoir system, patrol and conduct flood fights along the levee and bypass system, and operate the Sacramento Weir, drainage pumps, and other flood control structures.

Figure ES. 2-1 provides a chronology depicting the history of Central Valley flood management.

Figure ES. 2-1. Chronology of Flood Management–Related Actions in the Central Valley

Significant Flood Management Events

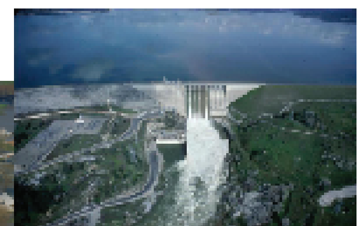
1849	California Gold Rush
1850	Federal Arkansas Act giving away "California Swamplands"
1850	California Statehood
1861	State Flood Control Act
	Reclamation District Act
1883	Federal Anti-Debris Act ends hydraulic mining
1911	State Reclamation Board Created
1933	Central Valley Project Authorized
2003	Paterno Decision
2005	DWR Flood Warning White Paper
2006	Propositions 1E and 84 Passed
2007	Flood Management Reform Legislation


1849 Sutter's Mill


1907 Flood in West Sacramento

Sacramento River Basin

1850	First Levee built in Sacramento
1917	Sacramento River Flood Control Project Authorized
1944	Shasta Dam was built
1955	Folsom Dam was built
1967	Oroville Dam was built
1969	New Bullards Bar Dam was built


1955 Folsom Dam was built


1997 Flood in Central Valley

San Joaquin River Basin

1944	Lower San Joaquin River and Tributaries Project
1949	Friant Dam Completed
1955	Bypasses and Levees authorized on the San Joaquin River above Merced River
1963	Camanche Dam was built
1964	New Hogan Dam was built
1967	New Exchequer Dam was built
1971	New Don Pedro Dam was built
1978	New Melones Dam was built
1993	Redbank/Fancher Creeks Project


1949 Friant Dam was built


1955 Flood in Visalia


1978 New Melones Dam was built

Over the past 150 years, funding levels for flood risk reduction activities in the Central Valley have varied considerably. Those funds have come from a variety of sources at the federal, State, and local levels, and have fluctuated as a result of factors such as competing priorities, changing levels of concern about flood risks, and economic concerns.

Geotechnical improvements to levees in the Pocket Area of Sacramento

As indicated above, in November 2006 California's voters passed two important general obligation bond measures, Propositions 84 and 1E, which provided approximately $3.3 billion for flood risk reduction activities in the Central Valley. Since the passage of Propositions 84 and 1E, DWR has been working with USACE and local agencies to improve flood management within areas protected by SPFC facilities. In the 5 years since these funds first became available, approximately $1.5 billion has been spent on a range of activities, the most important of which are summarized below.

A top priority was to repair portions of the levee system at critical risk of failure as a result of erosion or other factors. Since 2006, more than 120 critical levee erosion sites have been repaired, and a variety of conditions have been repaired at more than 220 other sites. DWR also undertook several major maintenance projects, including the removal of 3 million cubic yards of sediment from the bypasses, and rehabilitated seven flood system structures. More than 240,000 tons of rock have been stockpiled in the Delta to allow faster response to flood emergencies.

DWR also began extensive evaluations of the status of the flood system to provide the necessary factual support for flood planning efforts. To date, the department has collected topographic data and light detection and ranging (or LiDAR) data for 9,000 square miles along the flood system, conducted engineering and geotechnical evaluations for urban and nonurban levees, and developed a comprehensive medium-scale GIS data set of riparian vegetation for the Central Valley. DWR has also added about 50 flood forecasting and water supply gauging sites, developed the Flood Emergency Response Information System, developed a forecast coordinated operations program for the Yuba-Feather River system, and updated hydrology information for Central Valley streams. Major products of these efforts include the *State Plan of Flood Control Descriptive Document* in 2009 and the *Flood Control System Status Report in 2011.*

These activities have included an increased understanding of and emphasis on habitat and other environmental factors in the management of the flood risk reduction system. DWR has assessed major fish passage barriers within the flood protection system, evaluated potential floodplain restoration opportunity areas, catalogued and summarized conservation objectives from 30 conservation planning efforts, prepared a public draft Conservation Framework, and implemented 12 Flood Corridor Program projects in the Central Valley, providing habitat conservation on more than 4,000 acres and agricultural land conservation on more than 500 acres. There has been enhanced environmental integration of emergency response activities, including an emergency response exercise conducted with environmental resource and regulatory agencies.

DWR has also taken steps to improve its planning processes and coordinate those activities with other maintaining and regulatory agencies. In 2005, DWR initiated and coordinated the Interagency Flood Management Collaborative Program, a working group of federal, State, and local officials from key regulatory and maintaining agencies that meets monthly to address issues of mutual concern. The department is developing several integrated flood management and environmental initiatives in partnership with resource and regulatory agencies, including a Corridor Management Strategy and the Small Erosion Repair Program (SERP). SERP will streamline the permitting process for small erosion repair projects, so that the repairs can be undertaken before further erosion occurs and requires a larger, more costly repair with greater impacts on the riverine habitat and the environment. SERP will help avoid duplicative permitting efforts that can delay repairs and divert resources from more pressing environmental issues. DWR is taking the lead in developing a statewide policy framework and draft approach for Regional Advance Mitigation Planning.

To assist local planning entities, DWR has prepared voluntary flood-related Building Standards Code specifications (California Code of Regulations, Title 24, Parts 2 and 2.5) for single-family residential occupancy groups R-3 and R-3.1, for adoption by cities and counties. It has initiated mapping of the Central Valley Levee Flood Protection Zones and sent flood-risk notification letters to 300,000 affected property owners in the Central Valley in 2010 and 2011.

During the past 5 years, the State, USACE, and local agencies have also been working on major projects to upgrade the State-federal flood management system in the Central Valley. These projects include the American River Common Features Project, to provide improved flood protection to areas protected by levees along the following reaches: the American River downstream from Folsom Dam; the Sacramento River downstream from the American River; and the Natomas Basin. Other important projects include the following:

- Folsom Dam Modifications (as part of the Folsom Dam Joint Federal Project)
- Marysville Ring Levee Improvement Project
- Geotechnical improvements to levees in the Pocket Area of Sacramento
- Mid-Valley Area Levee Reconstruction Project
- South Sacramento Streams Project
- Three Rivers Levee Improvement Authority, Feather River Levee Improvement Project, Yuba County
- Three Rivers Levee Improvement Authority, Upper Yuba River Levee Improvement Project, Yuba County
- Levee District 1, Star Bend levee setback on the Feather River, Sutter County
- Reclamation District 2103, Bear River North Levee Rehabilitation Project, Sutter, Yuba, and Placer counties
- Reclamation District 17, 100-Year Seepage Area Project, San Joaquin River, San Joaquin County
- West Sacramento Area Flood Control Agency, Capital Outlay, City of West Sacramento
- West Sacramento Project, repair of two Yolo Bypass east bank levee slips in West Sacramento (under way)
- West Sacramento Setback Levee and Slurry Wall at River Mile 57.2 right bank constructed under the Sacramento River Bank Protection Project (under way)

These activities during the past 5 years have provided DWR with enhanced interagency relationships, improved planning and project implementation capabilities, and the information necessary to support the preparation of the CVFPP and this PEIR.

ES.3 Description of the Proposed Program

The SSIA is DWR's proposed program for sustainable, integrated flood management in areas currently protected by SPFC facilities. The SSIA described in the CVFPP is the proposed program evaluated in this PEIR. The proposed program includes broad management actions to improve the flood management system, policies, and institutions at a systemwide level, while enabling flexibility in addressing changing needs and funding scenarios. The program also integrates environmental conservation strategies and actions to improve the flood management system's long-term sustainability while improving ecosystem function. At the same time, it provides additional options for addressing compliance with environmental regulations related to long-term operation and maintenance.

"Sustainable" A project is considered sustainable when it is socially, environmentally, and financially feasible for an enduring period. For the CVFPP, a sustainable project will also have the flexibility to adapt to potential future changes such as climate change.

Flooding poses different threats to the people, critical infrastructure, and properties within the valley's varied land uses. Consequently, the proposed program provides different approaches to improve flood protection depending on the land use and its requirements. These land use areas have been delineated in the proposed program as urban areas, small communities, and rural-agricultural areas. Briefly, the key features of the proposed program can be characterized as follows:

- Improve levees that protect existing urban and urbanizing areas (populations greater than 10,000) to achieve an urban level of flood protection (protection against a 0.5-percent-chance event), at minimum.
- Reduce flood risk in existing small communities (with populations less than 10,000), where feasible.
- Improve rural-agricultural area levees included in the proposed program to reflect the lower levels of development within these floodplains.
- Improve the overall ability of the SPFC to convey large flood events through modified (or potentially new) weirs, bypass systems, hydraulic structures, and easements.
- Improve ecological conditions on a systemwide basis, using integrated policies, programs, and projects.

Implementation of the proposed program would depend on both the collaboration and independent decision-making of federal, State, and local cooperating and regulatory agencies. Follow-on feasibility studies and CVFPP updates are expected to refine the proposed program and assess the potential costs, benefits, and impacts of site-specific implementation projects.

ES.3.1 Near-Term and Long-Term Management Activities

For purposes of the PEIR, proposed activities that are part of the proposed program are divided into near-term management activities (NTMAs) and long-term management activities (LTMAs). NTMAs are those management activities that would be initiated during the first 5 years after approval of the CVFPP, with many having the potential to be completed during that initial period; LTMAs are management activities that would be initiated at any time beyond 5 years after adoption of the CVFPP. In the PEIR, NTMAs are evaluated at a greater level of specificity than LTMAs for the following reasons:

- NTMAs are better defined and less conceptual than LTMAs, are more likely to be implemented in the short term (within the first 5 years after approval of the CVFPP), and are generally less complex.
- NTMAs have more secure funding sources than LTMAs.
- Environmental impacts of NTMAs can generally be evaluated more accurately than impacts of LTMAs.

NTMAs can consist of any of the following types of activities:

- Conveyance management activities:
    - » Sediment removal
    - » Levee repair, reconstruction, and/or improvements:
        - ◦ Raise levees by adding earthen material or constructing floodwalls.
        - ◦ Strengthen levees to enhance their integrity by improving the properties and geometry of embankment soils to resist slope and seepage failures.
        - ◦ Address seepage with seepage berms, stability berms, impermeable barrier curtains (slurry cutoff walls) in the levee and/or its foundation, and relief wells and toe drains.
        - ◦ Armor the landside of the levees to improve levee resiliency during overtopping episodes.
        - ◦ Construct small setback levees (generally less than 0.75 mile long).

San Joaquin River at Friant Dam

- Storage management activities:
  - » Change reservoir operations criteria to alter the timing, magnitude, and frequency of flood releases to downstream channels, providing reductions in river flood stage and volume.
    - ◦ Coordinate operation among different reservoirs to increase objective releases from reservoirs.
    - ◦ More effectively use weather forecasting in conjunction with reservoir operations.
    - ◦ Use weather forecasting to support more flexibility in short-term allocations of available storage space between water supply and flood control.
- Other management activities:
  - » Implement a vegetation management strategy.
  - » Purchase floodplain easements and/or other interests in land.
  - » Integrate conservation strategies to improve the overall sustainability of and ecosystem benefits provided by the flood management system.
  - » Refine flood emergency response, improve flood system operations and maintenance, continue floodplain risk management, conduct feasibility studies, and implement flood risk reduction projects in coordination and partnership with local and federal agencies.

All other types of CVFPP activities fall within the LTMA category and consist of the following types of activities:


Construction of a new levee in the Natomas Basin of Sacramento

- Widening floodways (through setback levees and/or purchase of easements)
- Constructing or modifying weirs and bypasses
- Improving and remediating levees
- Constructing new levees
- Removing some facilities from the SPFC
- Using long-term forecasts to improve operation of existing reservoirs
- Achieving protection of urban areas from a flood event with 0.5 percent risk of occurrence in any given year
- Achieving protection of small communities from a flood event with 1 percent risk of occurrence in any given year
- Protecting rural-agricultural area against floods by facilitating inspection and flood fighting, improving levee performance, and purchasing agricultural easements
- Changing policies, guidance, standards, and institutional structures
- Implementing additional and ongoing conservation elements

However, because NTMA-type activities would continue to be implemented in the CVFPP study area into the longer term time frame of the LTMAs (e.g., remediation of existing levees), LTMAs include a continuation of activities described as part of the NTMAs.

ES.3.2 Purpose of the Proposed Program

The broad purpose of the proposed program is to respond to the California Legislature's direction in Senate Bill 5 to develop and implement a sustainable, integrated flood management plan for the Central Valley. In taking an integrated flood management approach, the proposed program recognizes that flood management is connected to water resource management; land use planning; environmental stewardship; and long-term economic, environmental, and social sustainability. Integrated flood management also recognizes the importance of evaluating opportunities and potential impacts from a systemwide perspective, and the importance of coordinating across geographic and agency boundaries to effectively manage flood flows in any given hydrologic unit.

Much of the legacy flood management system is characterized by aging infrastructure, making it increasingly difficult for DWR and local maintaining agencies to carry out maintenance programs. The proposed program reflects the State's vision for modernizing the SPFC to address current challenges and future trends and to meet the proposed program's objectives.

The proposed program would be implemented over time by the State, federal agencies, and local agencies such as reclamation districts, municipal and regional flood management agencies, and cities and counties.

The CVFPP is part of a long-term planning effort and is to be updated every 5 years. As the first edition of the plan, the 2012 CVFPP does the following:

- Describes a broadly supported vision for improving flood management in the Central Valley
- Recommends initial management actions to reduce flood risks
- Identifies potential modifications to the flood management system for further study
- Describes a framework for implementing future improvements
- Describes a framework for developing a conservation strategy for the flood system

ES.3.3 Objectives of the Proposed Program

Eight program objectives were formulated to guide development of this PEIR and a reasonable range of alternatives to be evaluated in the PEIR. Five of these objectives address the underlying goals of the proposed program: a primary objective to improve flood risk management and supporting objectives to improve operations and maintenance, promote ecosystem functions, improve institutional support, and promote multi-benefit projects. The remaining three program objectives guiding this PEIR reflect direction provided in the authorizing legislation: maximize flood-risk reduction benefits within the practical constraints of available funds; adopt the CVFPP by July 1, 2012; and promote as feasible the multiple objectives provided in Section 9616 of the California Water Code. These objectives are presented below.

Primary Objective

- **Improve Flood Risk Management**—Reduce the chance of flooding and damages, once flooding occurs, and improve public safety, preparedness, and emergency response through the following:
  - Identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC.
  - Formulating standards, criteria, and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin river basins and the Delta.

Supporting Objectives

- **Improve Operations and Maintenance**—Reduce systemwide maintenance and repair requirements by modifying the flood management systems in ways that are compatible with natural processes, and adjust, coordinate, and streamline regulatory and institutional standards, funding, and practices for operations and maintenance, including significant repairs.
- **Promote Ecosystem Functions**—Integrate the recovery and restoration of key physical processes, self-sustaining ecological functions, native habitats, and species into flood management system improvements.
- **Improve Institutional Support**—Develop stable institutional structures, coordination protocols, and financial frameworks that enable effective and adaptive integrated flood management (designs, operations and maintenance, permitting, preparedness, response, recovery, and land use and development planning).
- **Promote Multi-Benefit Projects**—Describe flood management projects and actions that also contribute to broader integrated water management objectives identified through other programs.

Statutory Objectives

- **Maximize Flood Risk Reduction Benefits within the Practical Constraints of Available Funds**—Ensure that technically feasible and cost-effective solutions are implemented to maximize the flood risk reduction benefits given the practical limitations of available funding, and provide a feasible, comprehensive, and long-term financing plan for implementing the plan.
- **Adopt the CVFPP by July 1, 2012**—Complete all steps necessary to develop and adopt the CVFPP by July 1, 2012, or such other date as may be provided by the Legislature.
- **Meet Multiple Objectives Established in Section 9616 of the California Water Code, Wherever Feasible:**
    - » *Reduce the risk to human life, health, and safety from flooding, including protection of public safety infrastructure.*
    - » *Expand the capacity of the flood management system in the Sacramento–San Joaquin Valley to either reduce flood flows or convey floodwaters away from urban areas.*
    - » *Link the flood protection system with the water supply system.*
    - » *Reduce flood risks in currently nonurbanized areas.*
    - » *Increase the engagement of local agencies willing to participate in improving flood protection, ensuring a better connection between State flood protection decisions and local land use decisions.*

- *Improve flood protection for urban areas to the urban level of flood protection.*
- *Promote natural dynamic hydrologic and geomorphic processes.*
- *Reduce damage from flooding.*
- *Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.*
- *Minimize flood management system operations and maintenance requirements.*
- *Promote the recovery and stability of native species' populations and overall biotic community diversity.*
- *Identify opportunities and incentives for expanding or increasing use of floodway corridors.*
- *Provide a feasible, comprehensive, and long-term financing plan for implementing the CVFPP.*
- *Identify opportunities for reservoir reoperation in conjunction with groundwater flood storage.*

ES.4 Study Area

The proposed program would be implemented primarily in the Systemwide Planning Area (SPA) of the CVFPP. The SPA includes lands that receive protection from the SPFC and are subject to flooding under the current facilities and operation of the Sacramento–San Joaquin River Flood Management System, including lands with facilities that provide substantial systemwide benefits or that protect urban areas in the Sacramento–San Joaquin Valley. The SPA also includes lands with facilities that are not part of the SPFC, including federal and local reservoirs that have allocated flood storage.

Effects of management actions implemented in the SPA may extend beyond this area. Therefore, the PEIR study area is divided into three regions for describing the environmental setting and potential environmental effects of implementing the CVFPP. These areas are described below and illustrated in Figure ES. 4-1.

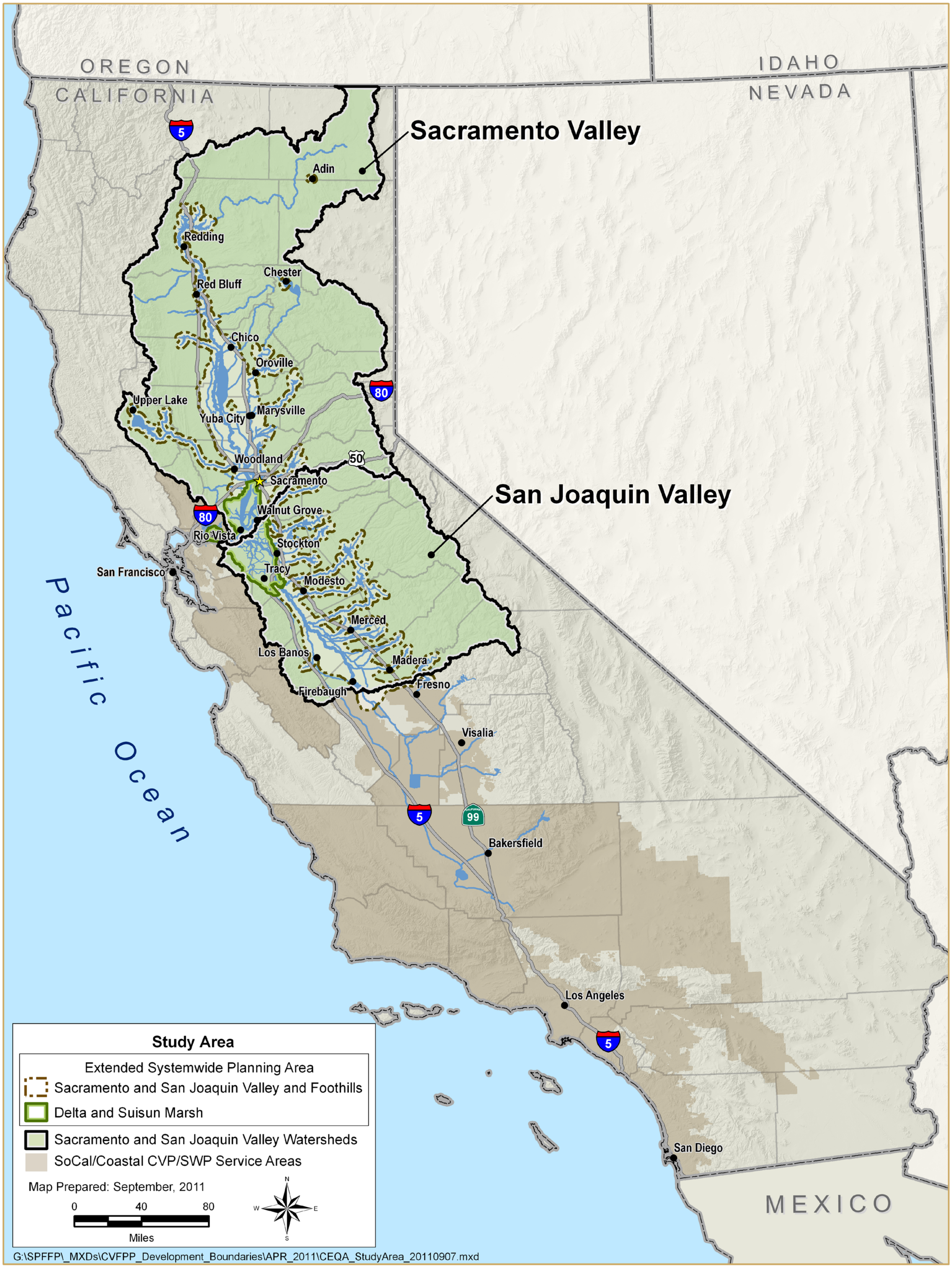


Figure ES. 4-1. PEIR Study Area

ES.4.1 Systemwide Planning Area Plus 2-Mile Buffer and Suisun Extension (Extended Systemwide Planning Area)

The Extended SPA includes a 2-mile-wide buffer around the SPA to provide the environmental context for direct and indirect impacts on areas adjacent to the SPA. Because of topographical and land use considerations, the buffer is 1 mile wide in urban areas and does not extend beyond the adjacent ridgeline along foothill waterways. The buffer is wider than 2 miles in the Suisun Marsh area so that the Extended SPA encompasses the hydrologically influenced areas. The Extended SPA is divided into two subregions:

- **Sacramento and San Joaquin Valley and Foothills**—This area consists of the Sacramento and San Joaquin valleys and the surrounding foothills along several major waterways. Most of the management actions would be implemented in this area.
- **Delta and Suisun Marsh**—This area encompasses the Delta and portions of Suisun Marsh where upstream management actions may affect water flows or quality. At Suisun Marsh, the boundary is at the west end of Montezuma Slough.

ES.4.2 Sacramento and San Joaquin Valley Watersheds

The Sacramento and San Joaquin Valley watersheds are the portions of the watershed upstream from the Extended SPA that may be affected by the management actions employed in these watersheds. These watersheds are discussed in less detail in this PEIR than the Extended SPA.

ES.4.3 SoCal/Coastal CVP/SWP Service Areas

The Southern California and coastal service areas of the Central Valley Project (CVP) and State Water Project (SWP) (referred to in this document as the "SoCal/coastal CVP/SWP service areas") consist of those portions of the CVP/SWP service areas that are not in the Extended SPA. These CVP/SWP service areas are located primarily in Southern California and the Central Coast areas and include CVP/SWP service areas in the Tulare Lake Basin. There are only limited mechanisms by which the SSIA might affect the environment in the SoCal/coastal CVP/SWP service areas, and these areas are discussed in less detail in this PEIR than are the Extended SPA and the Sacramento and San Joaquin Valley watersheds.

ES.5 Areas of Known Controversy and Issues To Be Resolved

Overcoming challenges to improving flood management in the Central Valley will require diligent collaboration, effective partnerships, and public outreach and participation. The CVFPP reflects the State's effort to take a balanced approach to achieving the objectives established in the Central Valley Flood Protection Act of 2008 and the primary and supporting goals defined in the initial phase of CVFPP formulation. Various areas of controversy and challenges associated with implementation of the CVFPP have been identified and are described briefly below.

- **Determining the appropriate level of public investment in flood protection.** Although $3.3 billion of funds were provided by Propositions 84 and 1E, substantial additional funds will be required to implement the proposed program. The State has a fundamental interest in promoting the safety of its people, sustainable economic growth, and a healthy ecosystem; however, all levels of government share the responsibility for managing flood risks. The allocation of finite public resources raises questions related to the level at which the State should invest in flood management and related activities, the degree to which such investments can and should maximize local and federal cost-sharing, and the extent to which State investments should accommodate local objectives. The amount of State funding available and the timing of the funding are also uncertain. Ultimately, although DWR has recommended a level of public investment reflected in the proposed program, the California Legislature and voters will make the final decisions regarding the amounts of State funds to be invested. Federal appropriations and local financial inputs will also be needed.
- **Relative level of expenditures in urban versus rural/agricultural areas.** Controversy exists regarding the focus and/or geographic distribution of flood management project expenditures within the program area. For example, if expenditures were to be allocated solely based on maximizing public safety, then a larger proportion of funding would be allocated to urban areas with concentrated populations. Similarly, if funding were to be allocated to multi-purpose projects that serve multiple needs (e.g., local flood protection, regional system improvements, ecosystem enhancement), then a wider variety of projects in geographically diverse areas would receive funding. Generally, local interests support investments in their local facilities. DWR, however, is required to take a broader statewide perspective and make difficult decisions to resolve these often-competing interests.
- **Financial responsibility for public investments.** Opinions differ regarding the financial responsibility for improving and maintaining the flood management system in the Central Valley. The "beneficiary pays" approach (i.e., only those with property in the specific flood protected area pay for system improvements) can be challenging, particu-

larly when the beneficiaries' capacity to fund improvements is limited. Debate continues regarding the responsibility of the State as a whole (including taxpayers residing outside the Central Valley) to contribute to improved flood management, when local areas primarily benefit from improved flood protection, which in turn supports the State and regional economy and infrastructure.

- **Requirements imposed on local planning entities by the 2007 California flood risk management legislation.** The 2007 flood legislation states that after the adoption of the CVFPP, local agencies within the Sacramento–San Joaquin Valley must amend their general plans and zoning ordinances, and must make certain findings related to the appropriate level of flood protection (200-year protection in urban and urbanizing areas and 100-year protection in nonurbanized areas) before making certain land use decisions. To make these findings, cities and counties will need information on floodplain extent (floodplain mapping) and frequency, which may not be readily available in all areas. Concern also has been raised about the financial burden placed on local cities and counties by these legislative requirements and the feasibility of the legislative timetable.
- **Issues raised by proposals to develop in floodplains.** There is controversy about the extent to which the State should discourage new development in floodplains, without infringing on the land use authority of local jurisdictions. Efforts by the State to effectively manage flood risks and associated liabilities in areas protected by the SPFC, especially in deep floodplains, may influence land uses and subsequently affect landowners, local governments, and developers.
- **Serving multiple benefits with flood system improvements.** Allocating investments to serve the State's interest in public safety while also accommodating other interests and needs, such as ecosystem sustainability and habitat enhancement, are not without challenges and controversy. Continued coordination with all affected stakeholders and agencies is necessary to implement flood management improvements that will serve multiple interests and achieve a balanced use of public funds, while meeting legislative requirements.
- **The appropriate level of vegetation management on levees.** In the wake of Hurricane Katrina, USACE has revisited its nationwide policies regarding vegetation management. USACE currently requires that all woody vegetation be removed from levees in the absence of a USACE-issued variance, if maintaining agencies such as DWR wish to retain eligibility for federal emergency repair funding under Public Law 84-99. This policy is memorialized in USACE's Engineering Technical Letter 1110-2-571 (ETL), *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures,* adopted April 10, 2009. (All references to the "ETL" in this chapter are specifically to ETL 1110-2-571.)

DWR does not believe that the science supports USACE's underlying assumption that all woody vegetation increases risks to public safety. In fact, in most circumstances, vegetation helps protect levees from erosion and other risk factors, while also providing important habitat values. Moreover, DWR has estimated that strict compliance with USACE's policy in the Central Valley could cost in excess of $10 billion, and would result in massive and likely unmitigable habitat losses. As a result, DWR has proposed a vegetation management strategy (VMS) that would retain all vegetation on the waterside slope of levees up to a line 20 feet below the levee crown (other than vegetation presenting a demonstrable risk, which would be removed); the VMS would limit vegetation management elsewhere to measures necessary for visibility and access. To further accommodate USACE's new policy, however, DWR is also proposing a life-cycle management (LCM) component of the VMS that would limit the recruitment of replacement trees on the upper waterside slope, crown, and landside of levees, which over time would reduce the amount of woody vegetation in those areas. Resource management agencies and environmental interests have expressed concerns about this LCM component.

- **Coordination with other collaborative processes and local planning efforts.** Multiple ongoing planning efforts in the Central Valley (e.g., the CALFED Bay-Delta Program, Bay Delta Conservation Plan, habitat conservation plans/natural communities conservation plans) overlap with the CVFPP in both geography and scope. Challenges exist when balancing the needs of these many efforts where jurisdictions and project timing overlap, and where the actions of one program may preclude (or limit) the actions of another.
- **Differing policies and guidance from permitting and implementing agencies.** Several agencies inform or oversee project permitting and implementation: DWR, the Board, USACE, local maintaining agencies, the California Department of Fish and Game, cities and counties, the State Water Resources Control Board, the regional water quality control boards, and the U.S. Fish and Wildlife Service and National Marine Fisheries Service. Each agency has its own requirements, guidance, and role in project implementation, and there are challenges associated with meeting the requirements of State and federal laws under the jurisdiction of these agencies.

ES.6 Alternatives to the Proposed Program

Development of the CVFPP involved formulating and evaluating substantially different preliminary alternatives to address CVFPP goals. The preliminary alternatives were used primarily to explore different potential physical changes to the existing flood management system and to assist in highlighting the need for policy changes or other management actions.

As described below, seven alternatives were considered for analysis in this PEIR:

- No-Project Alternative—Continued Operations Scenario
- No-Project Alternative—No Additional Activities Scenario
- Modified SSIA Alternative
- Achieve SPFC Design Flow Capacity Alternative
- Achieve SPFC Design Flow Capacity with Strict ETL Compliance Alternative
- Protect High-Risk Communities Alternative
- Enhance Flood System Capacity Alternative

ES.6.1 No Project Alternative—Continued Operations Scenario

Under the No-Project Alternative—Continued Operations Scenario, and without a systemwide flood management plan such as the CVFPP, current flood management trends in the Central Valley would likely continue. Projects that are planned or under way and supported by reasonably anticipated funds would commence and/or continue to completion. The Federal Emergency Management Agency would continue to remap the floodplains protected by the SPFC with less than 100-year flood protection. Existing partnerships among the federal government, the State, and local entities to implement flood risk reduction projects would continue. However, this alternative assumes that funding beyond that currently authorized under Propositions 84 and 1E would not be available, substantially constraining the scale of construction and other activities under this alternative. Local agencies' planning obligations that would be triggered by adoption of the CVFPP would not be triggered under this alternative, and system maintenance would still be challenged by the need to complete annual maintenance activities. The VMS, including the LCM component, would be implemented with or without the adoption of the CVFPP.

"100-Year Flood" is a shorthand expression for a flood that has a 1-in-100 chance of being exceeded in any given year. This may also be expressed as the 1-percent-annual-chance-of-exceedence flood, or "1-percent-annual-chance flood" for short. Similarly, a 200-year flood has a 1-in-200 (or 0.5-percent) chance of being exceeded in any given year.

ES.6.2 No-Project Alternative—No Additional Activities Scenario

The No-Project Alternative—No Additional Activities Scenario is similar to the No-Project Alternative—Continued Operations Scenario, except that this scenario does not assume that projects not already under way will be commenced, and further does not assume that funding will be forthcoming for projects other than those already commenced. This scenario also assumes that the component of the VMS reflected in *California's Central Valley Flood System Improvement Framework*, signed on February 27, 2009—vegetation management in the vegetation management zone for purposes of visibility and access—will continue to be implemented by maintaining agencies. However, it assumes that the LCM component—long-term elimination of trees in the vegetation management zone—will not be adopted or applied. Under this scenario, some recruitment of new trees on SPFC levees will incidentally be prevented by maintenance undertaken for purposes of visibility and access, but less thoroughly and at a slower rate than would be the case with LCM, so that some trees likely would remain.

ES.6.3 Modified State Systemwide Investment Approach Alternative

The Modified SSIA Alternative is similar to the proposed program in that it is based on the urban protection provided by the Protect High-Risk Communities Alternative and adds some small-community protection, but with more limited construction activities than for other alternatives. The alternative also includes expanding the Yolo Bypass and widening Fremont Weir, but does not include any of the other bypass expansions and related improvements contained in the proposed program. This alternative presents a less construction-intensive alternative that addresses only the most critical stressors on public safety, operations and maintenance, and ecosystem function, while minimizing potential adverse environmental effects. Work would focus on repairing and improving existing levees in urban areas with only limited work on expanding floodways.

ES.5.4 Achieve SPFC Design Flow Capacity Alternative

The Achieve SPFC Design Flow Capacity Alternative focuses on addressing the condition of existing SPFC levees so that the channels convey their design flows with a high degree of reliability based on current engineering criteria. The system was largely constructed based on geometric criteria using available soil materials without extensive investigation of foundation conditions. The majority of SPFC levees do not meet current engineering criteria. This alternative addresses an element of the authorizing legislation (California Water Code, Section 9614(g)), which requires that DWR evaluate structural projects that could be undertaken to reconstruct SPFC facilities to bring each of the facilities of the SPFC to within its design standard. This alternative involves addressing levee conditions primarily in place, without making major changes to the footprint or operation of those facilities. Levee improvements would be made regardless of the areas they protect or the level of protection they provide. This alternative would provide little opportunity to incorporate benefits beyond flood management.

ES.6.5 Achieve SPFC Design Flow Capacity with Strict ETL Compliance Alternative

The Achieve SPFC Design Flow Capacity with Strict ETL Compliance Alternative is the same as the Achieve SPFC Design Flow Capacity Alternative but presents a different method of addressing the issue of vegetation on levees. The Achieve SPFC Design Flow Capacity with Strict ETL Compliance Alternative involves meeting two goals simultaneously:

1. Improve existing SPFC levees so that they convey their design flow capacities.
2. Ensure the strictest compliance with USACE guidance provided in the ETL.

This alternative assumes that DWR would not use USACE's associated draft policy guidance letter, *Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls; Additional Findings* (77 *Federal Register* 9637–9650, February 17, 2012). The variance process allows for retention of some woody vegetation on or near levees under certain very specific circumstances.

ES.6.6 Protect High-Risk Communities Alternative

The Protect High-Risk Communities Alternative evaluates improvements to levees to protect life safety and property for high-risk population centers, including urban and small communities. Most levees in rural-agricultural areas would remain in their existing configurations; however, new training levees, ring levees, or floodwalls immediately adjacent to the communities may be constructed. This alternative would provide a minor opportunity to incorporate benefits beyond flood management.

ES.6.7 Enhance Flood System Capacity Alternative

The Enhance Flood System Capacity Alternative involves seeking opportunities to achieve multiple benefits by enhancing the flood system's storage and conveyance capacity, protecting high-risk communities, and fixing levees in place in rural-agricultural areas. This alternative combines the features of other alternatives and provides greater capacity within flood conveyance channels to lower flood stages in most of the system.

ES.6.8 Alternatives Carried Forward for Evaluation

Two alternatives described above—the Achieve SPFC Design Flow Capacity with Strict ETL Compliance and Protect High-Risk Communities alternatives—were considered for further evaluation in the PEIR but were rejected. These alternatives were rejected because they failed to meet most of the basic program objectives, were determined to be infeasible, would not avoid or substantially lessen significant environmental impacts, and/or would be so similar to another alternative that they would not add to expand the range of alternatives evaluated in this PEIR.

The other five alternatives were carried forward for further analysis and evaluation in this PEIR. These alternatives were determined to meet most of the program objectives, were found to be feasible, would avoid or substantially lessen significant environmental impacts, would collectively provide a reasonable range of feasible alternatives to evaluate in this PEIR, and/or were specifically included in the CVFPP planning process by the California Legislature. These alternatives carried forward are the No-Project Alternative—Continued Operations Scenario, No-Project Alternative—No Additional Activities Scenario, Modified SSIA Alternative, Achieve SPFC Design Flow Capacities Alternative, and Enhance Flood System Capacity Alternative. See Section ES.8, "Comparison of Environmental Impacts of the Proposed Program and Alternatives," below.

ES.7 Summary of Environmental Impacts of the Proposed Program

The PEIR impact analysis examines all potentially significant impacts that would occur with implementation of the CVFPP. Impacts and mitigation measures are described for NTMAs and LTMAs.

The impact analysis addresses construction, operations and maintenance, and policy actions for both activity categories. Construction-related, operational, and maintenance-related impacts would result in direct and indirect impacts, while policy actions would result only in indirect impacts.

Potential environmental impacts of the proposed program and associated mitigation measures are summarized in Table ES-1 at the end of this Executive Summary.

ES.8 Comparison of Environmental Impacts of the Proposed Program and Alternatives

This section compares the environmental impacts of each of the five retained alternatives (described above) with the impacts of the proposed program.

The CEQA Guidelines (Section 15126.6(d)) permit evaluation of the alternatives in less detail than for a proposed project. Consistent with Section 15126.6(d) of the CEQA Guidelines, the analysis below generally compares the environmental effects of the alternatives against the effects of the proposed program, focusing on whether the alternative would result in effects greater than, less than, or similar to those identified for the proposed program.

Table ES.8-1 provides a summary comparison of the impact levels of the proposed program, and alternatives when compared to the proposed program. The impact levels listed for the proposed program in Table ES.8-1 reflect the most substantial environmental effects identified for each environmental resource area.

Table ES. 8-1. Comparison of Impact Levels of the Proposed Program and the Alternatives

ENVIRONMENTAL RESOURCE	PROPOSED PROGRAM[1]	NO-PROJECT—CONTINUED OPERATIONS SCENARIO	NO-PROJECT—NO ADDITIONAL ACTIVITIES SCENARIO	MODIFIED SSIA	ACHIEVE SPFC DESIGN FLOW CAPACITIES	ENHANCE FLOOD SYSTEM CAPACITY
Aesthetics	Less than significant after mitigation	Similar	Similar	Lesser	Lesser	Greater
Agriculture and Forestry Resources	Potentially significant and unavoidable	Lesser	Lesser	Lesser	Lesser	Greater
Air Quality	Potentially significant and unavoidable	Similar	Lesser	Lesser	Lesser	Greater
Biological Resources—Aquatic	Potentially significant and unavoidable	Greater	Greater	Greater	Greater	Greater
Biological Resources—Terrestrial	Potentially significant and unavoidable	Greater	Greater	Greater	Greater	Greater
Climate Change and Greenhouse Gas Emissions	Less than significant	Greater	Greater	Similar	Greater	Unknown
Cultural and Historic Resources	Potentially significant and unavoidable	Lesser	Lesser	Lesser	Lesser	Greater
Energy	Less than significant	Lesser	Lesser	Lesser	Lesser	Similar
Geology, Soils, and Seismicity (Including Mineral and Paleontological Resources)	Potentially significant and unavoidable	Lesser	Lesser	Lesser	Lesser	Greater
Groundwater Resources	Less than significant after mitigation	Greater	Greater	Greater	Greater	Lesser
Hazards and Hazardous Materials	Less than significant after mitigation	Greater	Greater	Greater	Greater	Lesser
Hydrology	Less than significant after mitigation	Greater	Greater	Lesser	Greater	Lesser
Land Use and Planning	Significant and unavoidable	Lesser	Lesser	Lesser	Lesser	Greater

Table ES. 8-1. Comparison of Impact Levels of the Proposed Program and the Alternatives (contd.)

ENVIRONMENTAL RESOURCE	PROPOSED PROGRAM[1]	NO-PROJECT—CONTINUED OPERATIONS SCENARIO	NO-PROJECT—NO ADDITIONAL ACTIVITIES SCENARIO	MODIFIED SSIA	ACHIEVE SPFC DESIGN FLOW CAPACITIES	ENHANCE FLOOD SYSTEM CAPACITY
Noise	Less than significant after mitigation	Lesser	Lesser	Lesser	Similar	Similar
Population, Employment, and Housing	Less than significant	Greater	Greater	Greater	Greater	Lesser
Public Services	Less than significant	Greater	Greater	Similar	Greater	Greater
Recreation	Less than significant after mitigation	Lesser	Lesser	Similar	Lesser	Similar
Transportation and Traffic	Potentially significant and unavoidable	Lesser	Lesser	Similar	Similar	Greater
Utilities and Service Systems	Less than significant after mitigation	Greater	Greater	Similar	Greater	Similar
Water Quality	Less than significant after mitigation	Greater	Greater	Greater	Greater	Lesser

Source: Data compiled by AECOM in 2012

Notes:
[1] Impact categories listed for the proposed program provide the most severe impact category identified for the environmental issue area. If there are one or more significant and unavoidable impacts, then "Significant and unavoidable" or "Potentially significant and unavoidable" is placed in the column. If the most severe impact within the environmental issue area is "Less than significant after mitigation," then this designation is placed in the column. If every impact for the environmental issue area is less than significant, then "Less than significant" is placed in the column.

Key:
SPFC = State Plan of Flood Control
SSIA = State Systemwide Investment Approach

ES.9 Next Steps for the PEIR

The DPEIR is available for public review and comment for 45 days. Written comments must be received at the physical or e-mail address below no later than the close of business (5 p.m. Pacific time) on Friday, April 20, 2012:

Mary Ann Hadden, Staff Environmental Scientist
DWR, DFM
c/o MWH
3321 Power Inn Road, Suite 300
Sacramento, CA 95826
(916) 574-1431
DPEIRcomments@water.ca.gov

Please include "Comments on the March 2012 CVFPP DPEIR" in the subject line of e-mail or paper comments submitted.

All documents referenced in the DPEIR are available at MWH, 3321 Power Inn Road, Suite 300, Sacramento, California. The DPEIR is available on the following Web site where it may be viewed or downloaded: http://www.water.ca.gov/cvfmp/documents.cfm.

The DPEIR schedule is presented below, with public hearings indicated in italics.

Public Release Date of DPEIR	March 6, 2012
Public Hearing—Sacramento, Resources Building, Auditorium, 1416 Ninth Street	April 5, 2012 – 2 p.m.
Public Hearing—Marysville, Yuba County Government Office, Board of Supervisors Boardroom, 915 8th Street	April 6, 2012 – 2 p.m.
Public Hearing—Stockton, San Joaquin County Robert J. Cabral Agricultural Center, 2101 E. Earhart Avenue	April 9, 2012 – 2 p.m.
Public Hearing—Woodland, Yolo County Board of Supervisors Building, 625 Court Street	April 11, 2012 – 2 p.m.
End of 45-day DPEIR Public Comment Period	April 20, 2012 – 5 p.m.

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
3.2 Aesthetics					
Impact VIS-1 (NTMA & LTMA): *Temporary, Short-Term Construction-Related Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character*	LTS		N/A	LTS	
Impact VIS-2 (NTMA & LTMA): *Degradation of Scenic Vistas, Scenic Resources, and Existing Visual Character Resulting from Conveyance-Related Management Activities*	LTS		N/A	LTS	
Impact VIS-3 (NTMA & LTMA): *Degradation of Scenic Vistas, Scenic Resources, and Existing Visual Character Resulting from Storage-Related Management Activities*	LTS		N/A	LTS	
Impact VIS-4 (NTMA & LTMA): *New Sources of Substantial Light and Glare*	PS		Mitigation Measure VIS-4 (NTMA & LTMA): *Establish and Require Conformance to Lighting Standards, and Prepare and Implement a Lighting Plan* Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The project proponent will ensure that the following measures are implemented where project activities occur in the vicinity of sensitive light receptors to reduce potentially significant adverse effects associated with light and glare: • If construction lighting is needed, contractors will be required to shield or screen lighting fixtures and direct lights downward onto the work site and prevent significant light spill onto adjacent properties. • Contractors will place and direct flood or area lighting needed for construction activities or for security so as not to significantly disturb adjacent residential areas, passing motorists, or other light-sensitive receptors. • The use of harsh mercury vapor, low-pressure sodium, or fluorescent bulbs or light fixtures that are of unusually high intensity or brightness will be prohibited unless there is no practicable alternative. • Where applicable and practicable, lighting fixtures will meet lighting standards of the local jurisdiction. Design features that will reduce the effects of nighttime lighting, namely directional shielding for all substantial light sources, will be included in the project designs. In addition, the use of automatic shutoffs or motion sensors for lighting features will be considered in the project designs to further reduce excess nighttime lighting. All nighttime lighting will be shielded to prevent the light from shining off the surface intended to be illuminated. • Materials with natural colors and low-reflection materials will be used on all new or replacement structures to the extent feasible so that the facilities appear more consistent with the existing character of the area and do not generate excessive glare.	LTS	
Impact VIS-5 (NTMA & LTMA): *Effects of Other NTMAs and LTMAs on Aesthetic Resources*	LTS		N/A	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
3.3 Agriculture and Forestland Resources					

Impact AG-1 (NTMA & LTMA): *Conversion of Substantial Amounts of Important Farmland to Nonagricultural Uses and Conversion of Land under Williamson Act Contracts to an Inconsistent Use Resulting from Conveyance-Related Management Activities*	PS		Mitigation Measure AG-1a (NTMA & LTMA): *Preserve Agricultural Productivity of Important Farmland to the Extent Feasible*
			
			In a May 4, 2005, memorandum to California Resources Agency departments, boards, and commissions, the Secretary stated that "in selecting and developing resource-related projects, departments under the Resources Agency should consider ways to reduce effects on productive agricultural lands" and encouraged departments to incorporate, where appropriate, the strategies identified in the CALFED Bay-Delta Program (CALFED) EIR to reduce the impact of the CALFED Ecosystem Restoration Program on agricultural land and water use.
			
			The measures listed below include the applicable strategies identified in the CALFED EIR and some additional measures. Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.
			
			The project proponent will ensure that the following measures are implemented as applicable to reduce effects and preserve agricultural productivity on Important Farmland:
			• Site projects and project footprints to minimize the permanent conversion of Important Farmland to nonagricultural uses.
			• Identify and implement project design features that will benefit flood management, agriculture, and natural resources.
			• When selecting sites and methods for repair, reconstruction, and improvement of flood control facilities, minimize the splitting or fragmentation of parcels that are to remain in agricultural use.
			• Maximize contiguous parcels of agricultural land of a size sufficient to support their efficient use for continued agricultural production.
			• Where the construction or operation of a facility could limit access to ongoing agricultural operations, maintain a means of reasonably convenient access to these agricultural properties as part of project design, construction, and implementation.
			• At borrow sites to be returned to agricultural production, remove and stockpile, at a minimum, the upper 2 feet of topsoil and replace the topsoil after project completion as part of borrow site reclamation. Borrow site reclamation for agricultural production will also take into account the potential unique characteristics of soils for production of certain crops (e.g. clay pan soils for rice).
			• In areas permanently disturbed by program activities, and where topsoil is removed as part of project construction (e.g., stripping topsoil under a levee foundation) and not reused as part of the project, make the topsoil available to less productive agricultural lands that could benefit from the introduction of good-quality soil. By agreement between the project proponent or landowners of affected properties and the recipient(s) of the topsoil, the recipient(s) would use the topsoil for agricultural purposes.
			• Relocate and/or replace wells, pipelines, power lines, drainage systems, and other infrastructure that are needed for ongoing agricultural uses and would be affected by project construction or operation.
			• Minimize disturbance of Important Farmland and continuing agricultural operations during construction by implementing the following measures:
			   ◆ To the extent possible, locate construction laydown and staging areas on sites that are fallow, already developed or disturbed, or to be discontinued for use as agricultural land.
			   ◆ Use existing roads to access construction areas to the extent possible.
			• Coordinate with growers to develop appropriate construction practices to minimize construction-related impairment of agricultural productivity. Practices may include coordinating the movement of heavy equipment and implementing traffic control measures.
			• Support the testing and application of alternative crops (i.e., agroforestry or energy crops) on idle farmland.
			• Before an NTMA [or LTMA] is implemented, search the CNDDB to determine whether sensitive communities, habitats, and species observation records may be present in or near the project area. These communities, habitats, and species occurrences will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that implementation of NTMAs [or LTMAs] minimizes direct and indirect disturbance of sensitive communities, habitats, and species to the extent feasible. In consultation with USFWS and DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for construction-related effects on sensitive communities, habitats, and species.
				PSU	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs

			Mitigation Measure AG-1b (NTMA & LTMA): *Minimize Impacts on Williamson Act–Contracted Lands, Comply with Government Code Sections 51290–51293, and Coordinate with Landowners and Agricultural Operators*
			
			The project proponent will consider the following mitigation measures and implement them, as applicable, to reduce effects on lands under Williamson Act contracts:
			• The project proponent will comply with applicable provisions of California Government Code Sections 51290–51295 with regard to acquiring lands under Williamson Act contract. Sections 51290(a) and 51290(b) specify that State policy, consistent with the purpose of the Williamson Act to preserve and protect agricultural land, is to avoid locating public improvements and any public utilities improvements in agricultural preserves, whenever practicable. If such improvements must be located within a preserve, they will be located on land that is not under contract, if practicable.
			• More specifically, the project proponent will comply with the following basic requirements stated in the California Government Code:
			  ◆ Whenever it appears that land within a preserve or under contract may be required for a public improvement, DOC and the city or county responsible for administering the preserve must be notified (Section 51291(b)).
			  ◆ Within 30 days of being notified, DOC and the city or county must forward comments, which will be considered by the proponent of the public improvement (Section 51291(b)).
			  ◆ A public improvement may not be located within an agricultural preserve unless findings are made that (1) the location is not based primarily on the lower cost of acquiring land in an agricultural preserve and (2) for agricultural land covered under a contract for any public improvement, no other land exists within or outside the preserve where it is reasonably feasible to locate the public improvement (Sections 51291(a) and 51291(b)). If the land is acquired for the purpose of flood damage reduction measures, the project proponent(s) is exempt from the findings required in California Government Code Section 51292 (Section 51293(e)(1)).
			  ◆ The contract is normally terminated for lands acquired by eminent domain or in lieu of eminent domain (Section 51295).
			  ◆ DOC must be notified within 10 working days upon completion of the acquisition (Section 51291(c)).
			  ◆ DOC and the city or county must be notified before completion of any proposed work of any significant changes related to the public improvement (Section 51291(d)).
			  ◆ If, after acquisition, the acquiring public agency determines that the property would not be used for the proposed public improvement, DOC and the city or county administering the involved preserve must be notified before the land is returned to private ownership. The land will be reenrolled in a new contract or encumbered by an enforceable restriction at least as restrictive as that provided by the Williamson Act (Section 51295).
			• The project proponent will coordinate with landowners and agricultural operators to sustain existing agricultural operations, at the landowners' discretion, until the individual agricultural parcels are needed for project construction.		

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
			Mitigation Measure AG-1c (NTMA & LTMA): *Establish Conservation Easements Where Potentially Significant Agricultural Land Use Impacts Remain after Implementation of Mitigation Measures AG-1a (NTMA) and AG-1b (NTMA)* As discussed in Mitigation Measures AG-1a (NTMA) and AG-1b (NTMA), in general, where there is a reduction or termination of agricultural activities to undertake flood protection, environmental protection, or other conservation measures, project proponents should consider other measures before considering purchasing easements or other measures of compensation (collectively referred to as "easements" below). If after implementing all other applicable measures, the proposed project could still result in a potentially significant environmental impact, easements should be considered. Easements are most likely appropriate where there would be serious degradation or elimination of the physical conditions or natural processes that provide the land's resource qualities for agriculture. In this situation, there would normally also be other impacts on the environment. Where easements are applicable, the following factors will be considered: • Where easements are considered for other resources such as terrestrial biological resources, purchase of easements should be coordinated where possible so that agricultural resources are also addressed. For example, if it were determined that a project would permanently terminate agricultural activities on a piece of land that served as Swainson's hawk foraging habitat, if an easement on another property were determined appropriate to address losses of Swainson's hawk foraging habitat, the replacement land could also support the same kind of agricultural activity as the original converted property. • Applicable methods established in the area of the specific project activity will be considered. Methods for compensation may include but are not limited to establishing agricultural conservation easements, paying in-lieu fees toward agricultural conservation easements, supporting agricultural land trusts, and participating in habitat conservation plans or natural communities conservation plans that include conservation of agricultural lands. The appropriate ratio of purchase or establishment of agricultural conservation easements relative to conversion of Important Farmland will be established on a case-by-case basis for each project. Depending on the specifics of the impact, available agricultural conservation programs in various locations, and local or regional regulatory standards, there are some circumstances where less than a 1-to-1 compensation ratio may be appropriate, and other circumstances where greater ratios may be required. Where conservation easements are established by the project proponent, they may be held by land trusts, local governments, or other appropriate agencies that are responsible for ensuring that these lands are maintained in agricultural use. When determining whether effects on agricultural land warrant purchase of an easement, the following factors should be considered: • Whether the change would affect the use of the land for agricultural purposes (i.e., ceasing agricultural activities and allowing land to be fallowed or be used for resource restoration in such a way that land could be returned to agricultural production) • Whether the change would permanently take land out of production (i.e., depositing sediment on agricultural lands) • Whether the land could be used for agricultural production but has not been or is not likely to be able to be used for such purposes because of flooding, bad soils, lack of dependable water supplies, or other reasons • Whether the land is currently being used for agricultural production and would not be able to be used for similar purposes in the future because of the project, but the project would provide benefits to nearby or other land that could be or is being used for agricultural purposes • Whether the land is currently being used for agricultural production and would not be able to be used for similar purposes in the future because of the project, but the land is not Prime Farmland, Unique Farmland, or Farmland of Statewide Importance • Whether the land is currently being used for agricultural production and would not be able to be used for similar purposes in the future because of physical changes brought about by the project, and the land is Prime Farmland, Unique Farmland, or Farmland of Statewide Importance • Whether thse land would be converted to a use that would reduce ancillary environmental benefits		
Impact AG-2 (NTMA & LTMA): *Conversion of Important Farmland to Nonagricultural Uses and Conversion of Land under Williamson Act Contracts to an Inconsistent Use Resulting from Storage-Related Management Activities*	LTS		N/A	LTS	
Impact AG-3 (NTMA &LTMA): *Effects of Other NTMAs [& LTMAs] on Important Farmland and Williamson Act Contract Land*	PS		Mitigation Measure AG-3 (NTMA & LTMA): *Implement Mitigation Measures AG-1a (NTMA), AG-1b (NTMA), and AG-1c (NTMA)*	PSU	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact AG-4 (NTMA & LTMA): *Conversion of Forest Land to Nonforest Uses Resulting from Conveyance-Related Management Activities*	S		Mitigation Measure AG-4 (NTMA & LTMA): *Implement Mitigation Measure BIO-T-1a (NTMA), "Conduct Biological Resources Surveys to Quantify Sensitive Natural Communities in Project Areas, and Avoid, Minimize, and, Where Appropriate, Compensate for Construction-Related Effects"*	LTS	
Impact AG-5 (NTMA & LTMA): *Conversion of Forest Land to Nonforest Uses Resulting from Storage-Related Management Activities*	LTS		N/A	LTS	
Impact AG-6 (NTMA & LTMA): *Effects of Other NTMAs [& LTMAs] on Forest Land*	PS		Mitigation Measure AG-6 (NTMA & LTMA): *Implement Mitigation Measure BIO-A-2b (NTMA), "Ensure Full Compensation for Losses of Riparian Habitat Functions and Values Caused by Implementing the Vegetation Management Strategy Along Levees"*	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
3.4 Air Quality					

Impact AQ-1 (NTMA & LTMA): *Construction-Related Emissions of Criteria Air Pollutants and Ozone Precursors Resulting from Conveyance and Other Components that Could Exceed Local CEQA Thresholds of Significance*	PS		Mitigation Measure AQ-1 (NTMA & LTMA): *Implement Measures to Reduce Construction-Related Emissions*
			
			The following measures will be considered during project-level evaluation of specific management actions. Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.
			
			The mitigation measures described below are grouped according to whether they address construction in general, fugitive dust emissions, or exhaust emissions.
			
			GENERAL CONSTRUCTION MITIGATION
			The following measures are designed to reduce all construction-related emissions:
			• Comply with and implement applicable air district rules and regulations that pertain to construction activities (e.g., asphalt ROG requirements, administrative requirements, fugitive dust management practices). As applicable, implement construction-related requirements from air districts or local governments with authority over the project at the commencement of and during each construction activity.
			• Do not use open burning to dispose of any excess materials generated during site preparation or other project activities.
			
			FUGITIVE DUST EMISSIONS
			The following measures may be used to reduce fugitive dust emissions:
			• Submit a dust control plan to the local air district, and obtain approval of the plan before the grading permit is issued. Implement the plan during construction. The dust control plan will specifically identify measures that would demonstrate that earth-moving activities in areas of the site would comply with applicable requirements of the local air district.
			• Phase long-duration construction activities to reduce the size of the disturbed area at any given time.
			• Water all exposed surfaces three times a day or sufficiently to prevent visible dust emissions from exceeding 20 percent opacity beyond the construction boundaries.
			• Apply water, nontoxic chemical stabilizers, or dust suppressants or use tarps or other suitable material (e.g., vegetative ground cover) in all disturbed areas that will not be used for 10 days or more.
			• Suspend excavation and grading activities when winds exceed 15 mph.
			• Restrict the speed of construction vehicles to 15 mph on any unpaved surface.
			• Prevent carryout and trackout of fugitive dust on construction vehicles. Methods to limit carryout and trackout include using wheel washers; sweeping any trackout on adjacent public streets at the end of each workday; and lining access points with gravel, mulch, or wood chips.
			• Cover access roads within 100 feet of paved roads with a 6- to 12-inch layer of wood chips or mulch or a 6-inch layer of gravel to reduce the generation of road dust and road dust carryout onto public roads.
			• Clean up carryout and trackout using any of the following methods:
			  ◆ Manually sweeping and picking up
			  ◆ Operating a rotary brush or broom accompanied or preceded by sufficient wetting to limit visible dust emissions to 20 percent opacity
			  ◆ Operating a PM_{10}-efficient street sweeper that has a pickup efficiency of at least 80 percent
			  ◆ Flushing with water if curbs or gutters are not present and if using water would not either result in a source of trackout material, result in adverse impacts on stormwater drainage systems, or violate any National Pollutant Discharge Elimination System permit program
			• Cover or wet the filled cargo compartment of material transport trucks to limit visible dust emissions during transport, and maintain at least 2 feet of freeboard from the top of the container.
			• Clean or cover the cargo compartment of empty material transport trucks before they leave the site.
			• Install sandbags or other erosion control measures on sites with a slope greater than 1 percent to prevent runoff of silt to public roadways.
			• Limit the number of areas subject to excavation, grading, and other ground-disturbing activities at any given time.
				PSU	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
			EXHAUST EMISSIONS The following measures may be used to reduce exhaust emissions: • Develop a comprehensive construction-activity management plan to minimize the amount of large construction equipment operating at any given time. • Implement a shuttle service to and from retail services and food establishments during lunch hours, or employ a catering service to bring lunch to the project site. • Use diesel-powered construction equipment that meets CARB's 1996 or newer certification standard for off-road heavy-duty diesel engines. • Schedule construction truck trips during nonpeak traffic hours to reduce peak-hour emissions and traffic congestion to the extent feasible. • Use alternative-fueled (e.g., compressed natural gas (CNG), liquefied natural gas (LNG), propane, biodiesel) or electricity-powered construction equipment, where feasible. Project-specific analysis should confirm that using any alternative fuel would not increase NO_x emissions. • Install diesel oxidation catalysts, catalyzed diesel particulate filters, or other applicable air district–approved emission reduction retrofit devices where feasible. • Use the newest equipment available to try to maintain a Tier 1 fleet equipment average. The following measures from Mitigation Measure CLM-1a (NTMA) in Section 3.7, "Climate Change and Greenhouse Gas Emissions," could help to further reduce exhaust emissions of criteria air pollutants and ozone precursors: • *BMP 6.* Minimize idling time by requiring that equipment be shut off after 5 minutes when not in use (as required by the State airborne toxics control measure (Title 13, Section 2485 of the California Code of Regulations)). Provide clear signage that posts this requirement for workers at the entrances to the site and provide a plan for the enforcement of this requirement. • *BMP 7.* Maintain all construction equipment in proper working condition and perform all preventative maintenance. Required maintenance includes compliance with all manufacturer's recommendations, proper upkeep and replacement of filters and mufflers, and maintenance of all engine and emissions systems in proper operating condition. Maintenance schedules shall be detailed in an air quality control plan prior to commencement of construction. • *BMP 8.* Implement a tire inflation program on jobsite to ensure that equipment tires are correctly inflated. Check tire inflation when equipment arrives on-site and every 2 weeks for equipment that remains on-site. Check vehicles used for hauling materials off-site weekly for correct tire inflation. Procedures for the tire inflation program shall be documented in an air quality management plan prior to commencement of construction. • *BMP 9.* Develop a project-specific ride share program to encourage carpools, shuttle vans, transit passes, and/or secure bicycle parking for construction worker commutes.		
Impact AQ-2 (NTMA & LTMA): *Potential for Construction-Related Emissions of Criteria Air Pollutants and Ozone Precursors Resulting from Storage-Related NTMAs [& LTMAs] to Exceed Local CEQA Thresholds of Significance*	LTS		N/A	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact AQ-3 (NTMA & LTMA): *Potential for Long-Term Operational and Maintenance-Related Emissions of Criteria Air Pollutants and Ozone Precursors to Exceed Local CEQA Thresholds of Significance*	LTS	PS	**Mitigation Measure AQ-3 (LTMA):** *Implement Measures to Reduce Operational Emissions* The following measures will be considered during project-level evaluation of specific management actions. Not all measures would be applicable to each management activity. Rather, these measures serve as an overlying mitigation framework to be used when individual projects are evaluated. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The following measures may be implemented to reduce exhaust emissions from vehicles and equipment where operations and maintenance activities for specific projects exceed applicable emissions thresholds: • Develop and implement a comprehensive maintenance-activity management plan to miniize the amount of vehicle travel associated with maintenance actions. • Develop and implement a worker trip reduction plan to achieve average vehicle ridership of 1.5 persons or greater where applicable. • Maintain all equipment (including maintenance trucks) to the manufacturers' specifications. The equipment should be checked by a certified mechanic on a regular basis. • Minimize idling time either by shutting off equipment when it is not in use or by reducing the time of idling to no more than 5 minutes. Provide clear signage regarding idling at locations visible to maintenance staff. • Schedule maintenance trips during nonpeak traffic hours to reduce peak-hour emissions and traffic congestion to the extent feasible. • Use alternative-fueled (e.g., CNG, LNG, propane), electricity-powered, or catalyst-equipped diesel vehicles where feasible. The following measures from Mitigation Measure CLM-1b (NTMA) in Section 3.7, "Climate Change and Greenhouse Gas Emissions," could help to further reduce operational emissions of criteria air pollutants and ozone precursors: • Implement all current standards and/or requirements as part of any DWR sustainability plan or guidelines. • Use renewable energy generated on site (i.e., solar, wind, hydroelectric) where feasible. • Use alternative fuels for maintenance vehicles and equipment. • Use energy-efficient equipment for operation and maintenance of proposed facilities (e.g., pumps, hydraulic equipment, maintenance equipment). Equipment and operation of equipment will conform to U.S. Department of Energy best practices, Consortium for Energy Efficiency initiatives and guidance, and National Electrical Manufacturers Association standards where feasible. • Require proposed buildings to exceed California Building Standards Code Title 24 energy efficiency standards by 20 percent or more.	N/A	PSU
Impact AQ-4 (NTMA & LTMA): *Construction-Related and Operational Emissions from Conveyance and Other NTMAs [or LTMAs] that Could Result in Cumulatively Considerable Net Increases in Criteria Air Pollutants for Which the Project Region is Nonattainment under Applicable Federal or State Ambient Air Quality Standards*	PS		**Mitigation Measure AQ-4 (NTMA & LTMA):** *Implement Mitigation Measure AQ-1 (NTMA)*	PSU	
Impact AQ-5 (NTMA & LTMA): *Potential for Construction-Related and Operational Emissions from Storage-Related NTMAs [& LTMAs] to Result in Cumulatively Considerable Net Increases in Criteria Air Pollutants for Which the Project Region is Nonattainment under Applicable Federal or State Ambient Air Quality Standards*	LTS		N/A	LTS	

<table>
<tr><th rowspan="2">EIR SECTION AND IMPACT(S)</th><th colspan="2">LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]</th><th rowspan="2">MITIGATION MEASURE</th><th colspan="2">LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]</th></tr>
<tr><th>NTMAs</th><th>LTMAs</th><th>NTMAs</th><th>LTMAs</th></tr>
<tr><td>Impact AQ-6 (NTMA & LTMA): Potential Construction-Related Exposure of Sensitive Receptors to Substantial Pollutant Concentrations through Diesel PM and Naturally Occurring Asbestos or Potential Generation of Substantial Concentrations of TACs during Operations</td><td colspan="2">PS</td><td>Mitigation Measure AQ-6 (NTMA & LTMA): Implement Strategies to Protect Sensitive Receptors from Substantial Construction-Related Emissions of Naturally Occurring Asbestos

Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.

It will be assumed that any construction within one-half mile of State-identified NOA areas is operating in serpentine or ultramafic rock and will comply with all requirements outlined in CARB's Asbestos Air Toxic Control Measures for Construction, Grading, Quarrying, and Surface Mining Operations. These requirements include all of the following:
Prepare and implement an asbestos dust mitigation plan, which must be approved by the local air district before construction begins and must be implemented at the commencement and maintained throughout the duration of construction and grading activities in known NOA areas.
Prepare and implement an asbestos health and safety program in known NOA areas, if required under California Code of Regulations Title 8, Section 1529(4), Asbestos.
The asbestos dust mitigation plan, as required by Title 17, Sections 93105(e)(2) and 93105(e)(4) of the California Code of Regulations, will identify dust mitigation practices that are sufficient to ensure that no equipment or operations emit dust that is visible and crossing property lines. The plan will also identify trackout prevention and control measures, control measures for disturbed surface areas and storage piles that would remain inactive for more than 7 days, postconstruction stabilization measures, and asbestos monitoring measures, if required. Examples of these measures include wetting, covering, or crusting the surface; applying chemical dust suppressants or stabilizers; installing wind barriers; enforcing speed limits in construction areas; controlling truck spillage; and establishing vegetative covers. In addition, the asbestos dust mitigation plan will include recordkeeping and reporting requirements that will be used to document the results of any air monitoring, geologic evaluation, and asbestos bulk sampling.

The asbestos health and safety program will be implemented if permissible exposure limits for airborne asbestos are found to be exceeded within the study area. Implementation will include applicable measures to protect construction employees as defined under Title 8, Section 1529(g) of the California Code of Regulations, and any additional measures required by the California Occupational Safety and Health Administration to reduce exposure of construction employees to airborne asbestos.</td><td colspan="2">LTS</td></tr>
<tr><td>Impact AQ-7 (NTMA & LTMA): Potential for Construction-Related and Operational Generation of Odors that Could Affect a Substantial Number of People</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
<tr><td colspan="6">3.5 Biological Resources–Aquatic</td></tr>
<tr><td>Impact BIO-A-1 (NTMA & LTMA): Potential Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Riparian Habitat, Designated Critical Habitat, and Essential Fish Habitat Caused by Siltation and Degradation of Water Quality during Construction or Operations and Maintenance Activities</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
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EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact BIO-A-2 (NTMA & LTMA): *Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Riparian Habitat, Designated Critical Habitat, and Essential Fish Habitat Caused by Loss of Overhead Cover and Instream Woody Material as Part of the Vegetation Management Strategy*	PS		**Mitigation Measure BIO-A-2a (NTMA & LTMA):** *Secure Applicable State and/or Federal Permits and Implement Permit Requirements* Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The project proponent will ensure that the following measures are implemented to reduce the effects of repairing, reconstructing, and improving levees on trees within stream zones, shaded riverine aquatic habitat, IWM, listed fish species, and designated critical habitat: • A Section 1602 streambed alteration agreement will be obtained from DFG before any trees are removed from a stream zone that is under DFG jurisdiction unless the activity is implemented by USACE. The project proponent will comply with all terms and conditions of the streambed alteration agreement, including measures to protect habitat or to restore, replace, or rehabilitate any habitat. • The project proponent will consult or coordinate with USFWS and NMFS as required under the federal ESA, and with DFG as required under the CESA, regarding potential impacts on listed fish species, including the loss of habitat. The project proponent will implement any additional measures developed through the ESA and CESA consultation processes, including the conditions of Section 7 biological opinions, Section 10 HCPs, and Section 2081 permits. Where an existing approved HCP, NCCP, or similar plan covers an NTMA [or LTMA] and provides for compliance with applicable State or federal regulations, the project proponent may participate in and comply with the terms of such a plan to achieve the permit compliance measures listed above. Any mitigation plantings in the floodway will not be permitted if they would result in substantial increases in flood stage elevations, or alter flows in a manner that would have a substantial adverse effect on the opposite bank. **Mitigation Measure BIO-A-2b (NTMA & LTMA):** *Ensure Full Compensation for Losses of Riparian Habitat Functions and Values Caused by Implementing the Vegetation Management Strategy Along Levees* DWR will coordinate with the Board and levee maintenance agencies tasked with implementing the vegetation management strategy to develop and implement a plan to record data on riparian vegetation lost or removed due to implementation of the vegetation management strategy, and to ensure adequate compensation for losses of riparian habitat functions and values. Although this mitigation measure is written as if a single plan is prepared, multiple plans addressing individual regions, watersheds, river corridors, or other geographic subdivisions are also acceptable. The plan will be completed and suitable for implementation before the start of riparian habitat removal under the vegetation management strategy. The plan will include mechanisms to, at a minimum, record and track the acreage, type, and location of riparian habitat to be removed through implementation of the vegetation management strategy or lost over time through LCM. The plan will also address compensation for the loss and degradation of riparian habitat through the enhancement, restoration, or creation of riparian habitat in other locations. Assessment of the value of lost or degraded habitat and of compensation habitat will take into account issues such as the differing functions of waterside and landside riparian habitat, continuity and connectivity of habitat, types of riparian habitat removed vs. type of compensation habitat (e.g., riparian scrub vs. cottonwood riparian forest), and ability of habitat to support special-status species. DWR will track habitat compensation efforts and only authorize implementation of vegetation removal under the vegetation management strategy at a rate and in locations consistent with the volume and type of compensation habitat that has been established. This habitat compensation tracking program will be included in the program MMRP prepared to support this PEIR. The plan must, at a minimum, meet the following basic performance standard: • Authorized losses of habitat do not exceed the function and value of available compensation habitat. DWR will coordinate with USFWS, NMFS, and DFG during preparation and implementation of the plan to incorporate into the plan appropriate compensation for effects on special-status species from vegetation management along the levee system. Various mechanisms may be employed to provide compensation habitat under the plan, as long as the performance standard identified above is met. The mechanisms include but are not limited to the following: • Implementation of the CVFPP Conservation Strategy Framework • Participation in existing NCCPs, HCPs, or other conservation plans • Purchase of habitat credits at an established mitigation bank • Habitat restoration implemented by a levee maintenance agency or other entity Any mitigation plantings in the floodway will not be permitted if they would result in substantial increases in flood stage elevations, or alter flows in a manner that would have a substantial adverse effect on the opposite bank	PSU	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact BIO-A-3 (NTMA & LTMA): *Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Riparian Habitat, Designated Critical Habitat, and Essential Fish Habitat Caused by Loss of Overhead Cover and Instream Woody Material during Construction*	S		**Mitigation Measure BIO-A-3 (NTMA & LTMA):** *Inventory and Replace Shaded Riverine Aquatic Habitat* The project proponent will require that the following measures be implemented to reduce the effects of program construction activities on special-status fish, fish movement, nursery sites, riparian habitat, designated critical habitat, and EFH. These measures may already be incorporated into the conditions of permits identified above in Mitigation Measure BIO-A-2a. • An inventory of shaded riverine aquatic habitat will be conducted before construction activities begin. Any shaded riverine aquatic habitat that is removed will be replaced, with replacement to occur on site when feasible. This includes IWM and other instream structures, overhead shade, and shallow-water habitat. • Mitigation credits may be purchased from a public or private mitigation bank approved by DFG, USFWS, and/or NMFS. The final number of credits to be purchased will be determined by agency staff. • A mitigation and monitoring plan will be developed and implemented to ensure that the proposed bank treatments and any off-site mitigation treatments fully compensate for losses of shaded riverine aquatic habitat. On-site revegetation is the preferred method of compensation, and could reduce the impact to a less-than-significant level, and even potentially to a beneficial level. If on-site compensation is not feasible, off-site mitigation will be established either before or as soon as feasible after existing vegetation is removed, or mitigation bank credits will be purchased before existing vegetation is removed. As much of the mitigation habitat as feasible will be created at or near the project site. If off-site mitigation is necessary, a location that does not currently support riparian vegetation and is capable of supporting riparian habitats will be preferred. Revegetation requirements may be accomplished as part of implementation of the CVFPP Conservation Framework. Any mitigation plantings in the floodway will not be permitted if they would result in substantial increases in flood stage elevations, or alter flows in a manner that would have a substantial adverse effect on the opposite bank.	LTS	SU
Impact BIO-A-4 (NTMA & LTMA): *Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Designated Critical Habitat, and Essential Fish Habitat Caused by an Increase in Hydrostatic Pressure, Underwater Noise, and Vibrations during Construction*	PS		**Mitigation Measure BIO-A-4 (NTMA & LTMA):** *Conform to NMFS Guidelines for Pile-Driving Activities* Several measures may be effective in reducing potential impacts on listed fish species, either by decreasing the level of underwater sound or by decreasing the number of fish exposed to the sound. The project proponent and construction contractors will implement the following measures to the extent feasible, as construction activities and site-specific conditions allow: • Use fewer piles, smaller piles, or a different type of pile to minimize the number and/or intensity of pile hammer impacts. • Drive piles when species of concern are not present, as determined either from surveys or by known migration and use patterns for species occurring in the project area. • Use a vibratory hammer rather than an impact hammer. • Use a cushioning block between the hammer and pile. • Use a confined or unconfined air bubble curtain. • Drive piles during periods of reduced currents. Pile-driving activities at project sites will be monitored to ensure that the effects of pile driving on listed fish species are minimized. If any injury or mortality to fish is observed, DFG, NMFS and/or USFWS will be immediately notified and in-water pile driving will cease.	LTS	
Impact BIO-A-5 (NTMA & LTMA): *Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Riparian Habitat, Designated Critical Habitat, and Essential Fish Habitat Caused by Rock Placement*	PS		**Mitigation Measure BIO-A-5 (NTMA & LTMA):** *Implement Mitigation Measures BIO-A-2a (NTMA) and BIO-A-2b (NTMA)*	PSU	
Impact BIO-A-6 (NTMA & LTMA): *Effects on Special-Status Fish, Fish Movement, Nursery Ground Usage, Riparian Habitat, Designated Critical Habitat, and Essential Fish Habitat Caused by the Increased Availability of Floodplain Habitat Generated by Setback Levees*	PS		**Mitigation Measure BIO-A-6 (NTMA & LTMA):** *Design and Implement Floodplain Habitat to Minimize Stranding* To avoid or minimize the potential for fish stranding associated with the creation of new floodplain habitat, the existing topographic and hydrologic characteristics of the floodplain will be examined to define the flooding regime, drainage patterns, water depths, and potential risks of fish stranding. Potential floodplain habitat will slope to a main channel or slough to facilitate complete drainage and avoid depressions or other low-lying floodplain features that may strand fish. Periodic recontouring (e.g., filling and excavation) of floodplain surfaces may be required to avoid stranding fish.	LTS	
Impact BIO-A-7 (LTMA): *Effects on Passage by Special-Status Fish and Fish Movement*	N/A	B	N/A	N/A	B

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	NTMAs	LTMAs		NTMAs	LTMAs
3.6 Biological Resources–Terrestrial					
Impact BIO-T-1 (NTMA & LTMA): *Construction-Related Effects on Sensitive Natural Communities and Habitats*	S		Mitigation Measure BIO-T-1a (NTMA & LTMA): *Conduct Biological Resources Surveys to Quantify Sensitive Natural Communities in Project Areas, and Avoid, Minimize, and, Where Appropriate, Compensate for Construction-Related Effects* Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The project proponent will ensure that applicable elements of the following measures are implemented to reduce construction-related effects of proposed NTMAs [or LTMAs] on sensitive natural communities. Where measures below call for field surveys, the project proponent may be able to rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines. • Before an NTMA [or LTMA] is implemented, the CNDDB will be searched and other sources (which may include species experts, species recovery plans, and other monitoring or research studies) will be consulted to determine whether sensitive communities, habitats, and species observation records may be present in or near the project area. These communities, habitats, and species occurrences will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that implementation of NTMAs [or LTMAs minimizes direct and indirect disturbance of sensitive communities, habitats, and species to the extent feasible. In consultation with USFWS and DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for construction-related effects on sensitive communities, habitats, and species. • Before an NTMA [or LTMA] is implemented and if the project so warrants, waters of the United States will be delineated according to methods established in the USACE wetlands delineation manual and Arid West Supplement (Environmental Laboratory 1987, 2008). The delineation will map and quantify the acreage of wetland habitats in the area, and will be submitted to USACE for verification. Not all projects involving construction activities may require a delineation of waters. • If wetlands are found within the proposed construction site or any other area to be disturbed, a wetland delineation report will be prepared and submitted to USACE. After USACE verifies the acreage of waters and wetlands, the project proponent will determine how many acres of waters of the United States and waters of the State would be affected by the NTMA [or LTMA]. The verified wetland delineation, field observation, and as needed, hydraulic modeling will be used to make this determination. Where feasible, impacts will be avoided and minimized by establishing a buffer around wetlands and waterways. • The project proponent will replace, restore, or enhance the acreage of all wetlands, other waters of the United States, and waters of the State that cannot be avoided and will be removed and/or degraded. Thus, the project will achieve "no net loss" of wetland functions and values, in accordance with the requirements of USACE and the Central Valley RWQCB. Wetland habitat will be restored, enhanced, and/or replaced at an acreage and location agreed upon by the project proponent, USACE, and the Central Valley RWQCB, as appropriate. The acreage, location, and methods will be determined during the Section 401 and Section 404 permitting processes, and will be based on a USACE-verified wetland delineation. Methods to be used will be approved by the agency with jurisdiction over the area. • In consultation with the appropriate resource agency (typically DFG), native woodland areas will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that construction activities of NTMAs [& LTMAs] minimize disturbance of native woodlands, including riparian habitats, to the extent feasible. Temporary fencing will be installed during construction to prevent avoidable disturbance of native trees that are located adjacent to construction areas. In consultation with DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for effects on native woodlands. • Protected areas that are managed by federal, State, and local governments or agencies and private entities will be identified, mapped, and quantified as deemed appropriate. The project proponent will coordinate with the appropriate government or agency manager to minimize disturbance of the protected habitats, to the extent feasible.	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
			Mitigation Measure BIO-T-1b (NTMA & LTMA): *Minimize Construction-Related Effects on Critical Habitat and Compensate for Unavoidable Adverse Effects* Before an NTMA [or LTMA] is implemented, USFWS-designated critical habitat in the project area will be identified, mapped, and quantified by a qualified biologist. The project proponent will consult with USFWS to develop and implement measures to avoid, minimize, and, where necessary, compensate for construction-related effects on primary constituent elements and potential adverse modification of critical habitat. Compensation would likely consist of enhancement, restoration, and/or creation of habitat types and vegetation communities that serve as primary constituent elements for the critical habitat affected. Compensation habitat would be enhanced/restored/created within the geographic range of critical habitat for the species in question.		
Impact BIO-T-2 (NTMA & LTMA): *Construction-Related Effects on Water Quality in Sensitive Natural Communities and Special-Status Species' Habitats*	LTS		N/A	LTS	
Impact BIO-T-3 (NTMA & LTMA): *Construction-Related Effects on Special-Status Plants and Wildlife*	S		**Mitigation Measure BIO-T-3a (NTMA & LTMA):** *Conduct Focused Surveys for Special-Status Plants and Wildlife, and Avoid Impacts* Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The project proponent will verify whether species survey and avoidance protocols have been established for species that might be affected by the specific project, or will coordinate with the appropriate regulatory agency (e.g., USFWS or DFG) to determine an acceptable alternative method for surveying and avoiding effects on a species. To avoid effects of proposed construction activities on special-status plants and wildlife, the project proponent will ensure that the following measures are implemented before commencement of ground-disturbing activities. Where measures below call for field surveys, the project proponent may rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines. If avoidance consistent with these measures cannot be achieved, the project proponent will implement the minimization and compensation measures included in Mitigation Measure BIO-T-3b described below. Where surveys for special-status species may be necessary, the project proponent may be able to rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines. • The CNNDB will be searched to determine whether any records describe species observations and indicate the presence of habitat for those species in or near the project area. These habitats and species occurrences will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that disturbance of sensitive communities, habitats, and species is minimized during construction to the extent feasible. In consultation with USFWS and DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for construction-related effects on sensitive habitats and special-status species. • A qualified botanist will conduct surveys for special-status plants (as listed in Table 3.6-3) with potential to occur in appropriate habitat within the project area. The surveys will follow applicable guidelines established by USFWS and/or DFG, and will be conducted at the appropriate time of year when the target species would be clearly identifiable. If no special-status plants have the potential to occur in the project area or none are found during focused surveys, no further action is required. If special-status plants are found, areas of occupied habitat will be identified. The construction contractor will avoid these areas where feasible. Temporary fencing will be installed to protect all occupied habitat that is located adjacent to construction areas but can be avoided. • A qualified biologist will conduct a survey in areas where elderberry shrubs could occur within 100 feet of construction and inundation areas. Surveys and stem counts will follow the USFWS conservation guidelines for the valley elderberry longhorn beetle (USFWS 1999). If elderberry shrubs are found, the project proponent will implement avoidance measures that are consistent with the USFWS conservation guidelines for this species (USFWS 1999). Where feasible, effects will be avoided by establishing and maintaining a 100-foot-wide buffer around elderberry plants. Where a 100-foot buffer is not feasible, effects may be minimized by providing a minimum setback, with a buffer around elderberry plants measuring at least 20 feet wide.	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
			• Protocol surveys of all potential nesting trees and habitat in the area will be completed during the raptor nesting season (generally February 15–September 15 but may be adjusted for individual species), particularly if any construction activity is to occur during that season. Potential nesting trees and other nesting habitats (e.g., grasslands for northern harriers and burrowing owls) that are within one-half mile of proposed activity will be surveyed. To avoid the loss of active raptor nests, if the project proponent elects to remove trees suitable for nesting, the trees will be removed during the non-nesting season (generally between September 15 and February 15), to the extent practicable. Where feasible and depending on the species (particularly for Swainson's hawk), construction activities within one-quarter mile of active nests will be avoided during the raptor nesting season. Other nesting raptors may tolerate a much smaller buffer (e.g., one-tenth mile). • Surveys for other special-status wildlife listed in Table 3.6-4 with potential to occur in the project area will be conducted by a qualified biologist at the appropriate time of year when the target species would be clearly identifiable. Not all wildlife species require surveys, because their presence may be assumed based on habitat components and known locality records or they clearly will not be present in the area. USFWS and DFG will be consulted to determine for which species surveys should be conducted; appropriate species protocols will be followed. Occupied and potentially suitable habitat will be avoided where feasible by installing temporary exclusionary fencing. • If potentially suitable aquatic habitat for giant garter snake is identified, a buffer area of 200 feet will be established around the aquatic habitat, where feasible. These buffers will be indicated by temporary fencing, high-visibility flagging, or other equally effective means. • If nesting areas for pond turtles are identified, a buffer area of 300 feet will be established between the nesting site and nearby wetlands, where feasible. (The nesting site may be adjacent to wetlands or extend up to 400 feet away from wetland areas in uplands.) These buffers will be indicated by temporary fencing if construction has begun or will be established before nesting periods are ended (the period from egg laying to emergence of hatchlings is normally April to November). • Preconstruction surveys for special-status bat species will be conducted to determine the presence of roosts. When colonial roosting sites located in trees or structures must be removed, removal will occur outside of the nursery and/or hibernation seasons. Unless otherwise approved by DFG, such removal will occur during dusk and/or evening hours after bats have left the roosting site. When hibernation sites are identified on the project site, nursery and hibernation sites will be sealed before the hibernation season (November–March). Additional measures, such as monitoring and on-site mitigation roosts, will be implemented, as feasible (see H.T. Harvey & Associates 2004). • Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA [or LTMA] may replace the specific survey and avoidance actions listed above if all of the following conditions are met: • The existing approved HCP, NCCP, or similar plan is applicable to the NTMA [or LTMA]. • The NTMA [or LTMA] is within the permit area. • The NTMA [or LTMA] is a covered activity under the existing plan. • The plan addresses methods to identify, avoid, minimize, and compensate for effects on special-status species. Mitigation Measure BIO-T-3b (NTMA & LTMA): *If Avoiding Construction-Related Effects on Special-Status Plants and Wildlife is Infeasible, Minimize and, Where Appropriate, Compensate for Effects on Special-Status Species and Loss of Habitat* If the focused surveys described above in Mitigation Measure BIO-T-3a have been completed and avoiding effects on special-status species is infeasible, the project proponent will coordinate with the appropriate regulatory agency (e.g., USFWS or DFG) to determine acceptable methods for minimizing or compensating for effects on a species. Various minimization and compensation measures are described below. The CVFPP Conservation Strategy Framework may be a suitable source of compensation habitat. The project proponent will ensure that the following measures are implemented to minimize and compensate for effects of proposed levee improvements on special-status plants and wildlife: • If special-status plants cannot be avoided, the project proponent will coordinate with USFWS and/or DFG (depending on which agency has jurisdiction over the particular species) to determine appropriate minimization and compensation measures. Some local plans and policies, if applicable to the project being implemented, may require that the project proponent completely avoid effects on a special-status plant species or pay a fee to mitigate impacts. Where feasible and applicable, the project proponent will consult and/or coordinate with local agencies on these plans and policies. In some instances, sensitive plants may be relocated to an area approved by DFG or USFWS.		

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
			• If ground-disturbing activities are to occur within 20 feet of the dripline of an elderberry shrub, minimization and compensation measures consistent with the USFWS conservation guidelines (USFWS 1999) will be implemented. These measures include transplanting elderberry shrubs and planting compensatory elderberry seedlings and associated native plantings. • If an active raptor nest is found, a biologist, in coordination with DFG, will determine an appropriate buffer that minimizes the potential for disturbing the nest. Setbacks will be marked by brightly colored temporary fencing. Based on the coordination with DFG, no construction activities will begin in the buffer area until a qualified biologist has confirmed that the nest is no longer active or that the birds are not dependent on it. A qualified biologist will monitor construction to ensure that project activities will not substantially adversely affect the nesting pair or their young. The size of the buffer may vary, depending on the nest location, nest stage, construction activity, and monitoring results. If establishing the buffer becomes infeasible or construction activities result in an unanticipated nest disturbance, DFG will be consulted to determine the appropriate course of action. • Minimization and compensation measures for other special-status wildlife species will be developed in consultation with DFG and/or USFWS. DFG and USFWS provide standardized minimization measures for several species; for example, the giant garter snake has specific minimization measures, such as restrictions on the construction season and a requirement for biological surveys and monitoring. Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA [or LTMA] may replace the specific minimization and compensation actions listed above if all of the following conditions are met: • The existing approved HCP, NCCP, or similar plan is applicable to the NTMA [or LTMA]. • The NTMA [or LTMA] is within the permit area. • The NTMA [or LTMA] is a covered activity under the existing plan. • The plan addresses methods to identify, avoid, minimize, and compensate for effects on special-status species. All construction-related activities will be subject to all applicable permitting requirements. The mitigation measures described above, when combined with applicable permit requirements, must, at a minimum, meet the following basic performance standard: • Authorized losses of habitat will not exceed the function and value of available compensation habitat. DWR will also track these habitat compensation efforts as part of the MMRP for this PEIR. These measures will be designed to ensure that construction activities will not result in a substantial reduction in the population size or range of any special-status plants or wildlife. Mitigation Measure BIO-T-3c (NTMA & LTMA): *Secure Applicable State and/or Federal Permits and Implement Permit Requirements* The project proponent will ensure that the following measures are implemented to reduce construction-related effects of proposed levee or other repairs, remediation, and improvements on trees and shrubs within stream zones, listed plant and wildlife species, and wetlands: • A streambed alteration agreement, as required under Section 1602 of the California Fish and Game Code, will be obtained from DFG before any vegetation is removed from a stream zone under DFG jurisdiction unless the activity is being implemented by USACE. The project proponent will comply with all terms and conditions of the streambed alteration agreement, including measures to protect habitat or to restore, replace, or rehabilitate any habitat. • The project proponent will consult or coordinate with USFWS under the federal ESA and DFG under the CESA regarding potential impacts on listed plant and wildlife species and associated critical habitat. The project proponent will implement any additional measures developed through the ESA and CESA consultation processes, including conditions of Section 7 biological opinions and Section 2081 permits. • Before ground-disturbing activities begin on a project reach that contains waters of the United States, authorization for fill of such waters will be secured from USACE through the Section 404 permitting process. This permitting process will include providing compensatory mitigation for affected wetlands to ensure no net loss of wetland functions and values. Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA [or LTMA] may be used to achieve the permit compliance measures listed above if all of the following conditions are met: • The existing approved HCP, NCCP, or similar plan is applicable to the NTMA [or LTMA]. • The NTMA [or LTMA] is within the permit area. • The NTMA [or LTMA] is a covered activity under the existing plan. • The plan provides for compliance with applicable State or federal regulations.		
Impact BIO-T-4 (NTMA & LTMA): *Construction-Related Effects on Wildlife Movement*	PS		Mitigation Measure BIO-T-4 (NTMA & LTMA): *Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)*	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact BIO-T-5 (NTMA & LTMA): *Potential for Construction-Related Effects to Conflict with Local Plans and Policies*	PS		Mitigation Measure BIO-T-5a (NTMA & LTMA): *Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)* Mitigation Measure BIO-T-5b (NTMA & LTMA): *Identify Local Plans and Policies and Develop Strategy to Maintain Plan Consistency, Minimize Effects, or Compensate for Construction-Related Effects on Local Plans* Before an NTMA [or LTMA] is implemented, the project proponent will identify applicable local conservation plans in the area and evaluate the plans to determine whether the NTMA [or LTMA] is within the plan area. As feasible, the project proponent will consider developing a strategy to maintain plan consistency and will consult and/or coordinate with the appropriate entity or plan administrator to develop and implement measures to avoid, minimize, and where necessary, compensate for effects on local plans. In some instances, the NTMA [or LTMA] may be a covered activity under the plan.	LTS	
Impact BIO-T-6 (NTMA & LTMA): *Effects of Reservoir Operational Criteria Changes on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies*	LTS		N/A	LTS	
Impact BIO-T-7 (NTMA & LTMA): *Effects of the Vegetation Management Strategy on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, and Wildlife Movement*	PS		Mitigation Measure BIO-T-7a (NTMA & LTMA): *Implement Applicable Elements of Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA) to Minimize Impacts during Vegetation Removal* Mitigation Measure BIO-T-7b (NTMA & LTMA): *Implement Mitigation Measure BIO-A-2b (NTMA), "Ensure Full Compensation for Losses of Riparian Habitat Functions and Values Caused by Implementing the Vegetation Management Strategy Along Levees"*	PSU	
Impact BIO-T-8 (NTMA & LTMA): *Effects of Other Management Activities on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies*	B		N/A	B	
3.7 Climate Change and Greenhouse Gas Emissions					
Impact CLM-1 (NTMA & LTMA): *Net Construction-Related and Operational Greenhouse Gas Emissions*	LTS		Mitigation Measure CLM-1a (NTMA & LTMA): *Implement Greenhouse Gas–Reducing Construction BMPs* DWR has developed preconstruction, construction, and final design BMPs for reduction of GHG emissions. These preconstruction and final design and construction BMPs are designed to ensure that individual projects are evaluated and their unique characteristics taken into consideration when determining if specific equipment, procedures, and or material requirements are feasible and efficacious for reducing GHG emissions from the project. As applicable and appropriate, the following BMPs would be applied: • *BMP 1*. Evaluate project characteristics, including location, project work flow, site locations, and equipment performance requirements, to determine whether specifications of the use of equipment with repowered engines, electric drive trains, or other high-efficiency technologies are appropriate and feasible for the project or specific elements of the project. • *BMP 2*. Evaluate the feasibility and efficacy of performing on-site material hauling with trucks equipped with on-road engines. • *BMP 3*. Ensure that all feasible avenues have been explored for providing an electrical server drop to the construction site for temporary construction power. When generators must be used, use alternative fuels, such as propane or solar, to power generators to the maximum extent feasible. • *BMP 4*. Evaluate the feasibility and efficacy of producing concrete on-site and specify that batch plants be set up on-site or as close to the site as possible. • *BMP 5*. Evaluate the performance requirements for concrete used on the project, and specify concrete mix designs that minimize GHG emissions from cement production and curing while preserving all required performance characteristics. • *BMP 6*. Minimize idling time by requiring that equipment be shut off after 5 minutes when not in use (as required by the State airborne toxics control measure, Title 13, Section 2485 of the California Code of Regulations). Provide clear signage that posts this requirement for workers at the entrances to the site and provide a plan for the enforcement of this requirement. • *BMP 7*. Maintain all construction equipment in proper working condition and perform all preventative maintenance. Required maintenance includes compliance with all manufacturer's recommendations, proper upkeep and replacement of filters and mufflers, and maintenance of all engine and emissions systems in proper operating condition. Maintenance schedules shall be detailed in an air quality control plan prior to commencement of construction.	LTS	N/A/TS

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
			• *BMP 8.* Implement a tire inflation program on jobsite to ensure that equipment tires are correctly inflated. Check tire inflation when equipment arrives on-site and every 2 weeks for equipment that remains on-site. Check vehicles used for hauling materials off-site weekly for correct tire inflation. Procedures for the tire inflation program shall be documented in an air quality management plan prior to commencement of construction. • *BMP 9.* Develop a project-specific rideshare program to encourage carpools, shuttle vans, transit passes, and/or secure bicycle parking for construction worker commutes. • *BMP 10.* Reduce electricity use in temporary construction offices by using high-efficiency lighting and requiring that heating and cooling units be Energy Star compliant. Require that all contractors develop and implement procedures for turning off computers, lights, air conditioners, heaters, and other equipment each day at close of business. • *BMP 11.* For deliveries to project sites where the haul distance exceeds 100 miles and a heavy-duty class 7 or class 8 semi-truck or 53-foot or longer box-type trailer is used for hauling, a SmartWay certified truck will be used to the maximum extent feasible. • *BMP 12.* Minimize the amount of cement in concrete by specifying higher levels of cementitious material alternatives, larger aggregate, longer final set times, or lower maximum strength where appropriate and while preserving all required performance characteristics. • *BMP 13.* Develop a project-specific construction debris recycling and diversion program to achieve a documented 50 percent diversion of construction waste. Mitigation Measure CLM-1b (NTMA & LTMA): *Implement Greenhouse Gas–Reducing Operational Practices* Incremental operational GHG emissions would likely be reduced in the near term relative to existing conditions through the replacement of older equipment, buildings, and vehicles. Even so, although Impact CLM-1 (NTMA [or LTMA]) would be less than significant, the project proponent will implement the measures listed below—where needed, feasible, and appropriate—to minimize operational GHG emissions for replacement and new CVFPP facilities associated with NTMAs [or LTMAs]. Not all mitigation measures listed below may be applicable to each management action. Rather, these mitigation measures serve as an overlying mitigation framework to be utilized for specific management actions. The applicability of mitigation measures would vary based on the lead agency, location, timing, and nature of each management action. • Implement all current standards and/or requirements as part of any DWR sustainability plan or guidelines. • Use renewable energy generated on site (i.e., solar, wind, hydroelectric). • Use alternative fuels for maintenance vehicles and equipment. • Use energy-efficient equipment for operation and maintenance of proposed facilities (e.g., pumps, hydraulic equipment, maintenance equipment). Equipment and operation of equipment will conform to U.S. Department of Energy best practices, Consortium for Energy Efficiency initiatives and guidance, and National Electrical Manufacturers Association standards where possible. • Require proposed buildings to exceed California Building Standards Code Title 24 energy efficiency standards by 20 percent or more.		
3.8 Cultural and Historic Resources					
Impact CUL-1 (NTMA & LTMA): *Potential Damage to or Destruction of Known Archaeological Resources from Ground Disturbance or Other Construction-Related Activities*	PS		Mitigation Measure CUL-1a (NTMA & LTMA): *Conduct Cultural Resource Studies and Avoid Effects on Known Archaeological Resources* To minimize potential adverse effects on prehistoric and historic-era archaeological resources, the project proponent will conduct cultural resource studies before project approval (where feasible and appropriate) to identify the presence of such resources at all project sites. Where field surveys cannot be completed before project approval, such as in locations where access permission has not been received, field surveys will be completed before ground disturbance begins. These archaeological studies and surveys will be conducted by professionals who meet the Secretary of the Interior's standards for archaeology professionals. Should resources eligible for listing in the NRHP and CRHR be identified within the study area, effects on those resources resulting from any NTMA [or LTMA] will be avoided, if feasible. Methods of avoidance may include redesigning or relocating the project, such as moving an access road around an archaeological site instead of through it. Where avoidance is not feasible, see Mitigation Measure CUL-1b (NTMA [& LTMA]) below.	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
			Mitigation Measure CUL-1b (NTMA & LTMA): *Conduct Additional Evaluations and Recover Sufficient Data to Compensate for Damage to or Destruction of Known Archaeological Sites* If a substantial adverse change to an archaeological resource that has been determined as eligible for listing in the NRHP or the CRHR cannot be avoided, the project proponent will deploy a qualified archaeologist to conduct additional research and other tasks. These tasks will include preparing a research design; conducting additional archival and historical research, when appropriate; conducting an archaeological excavation; analyzing artifacts, features, and other attributes of the resource; and preparing a technical report documenting the methods and results of the investigation in accordance with the California Office of Historic Preservation's Guidelines for Archaeological Research Design (1991). The purpose of this work will be to recover a sufficient quantity of data to compensate for damage to or destruction of the resource. The procedures to be employed in this data recovery program will be determined in consultation with responsible agencies and interested parties, such as Native American tribes, as identified by the Native American Heritage Commission, as appropriate. The approved measures must be implemented before construction activities occur at the archaeological site. An alternative method to mitigate impacts on archaeological sites considered eligible for listing in the NRHP and CRHR is to have the primary construction contractor for the project proponent cap the site with soil, gravels, rock, or appropriate vegetation to protect the deposit. For example, sites subject to inundation and water-level fluctuations may be protected from erosion by application of a layer of gravel/rock or soil, or both. A layer of soil (i.e., sterile fill) may also be placed over a site where construction of a building is planned, such that all construction activities will occur in the fill material. For sites located in areas subject to looting, vegetation such as blackberry brambles or wild rose may be planted over the site as a useful deterrent, but only in areas where operations and maintenance of facilities would not be impaired by the deterrent vegetation. If capping an archaeological site proves necessary, the project proponent will provide the materials and labor, regularly monitor and evaluate the efficacy of the mitigation, and refresh the protection, when necessary.		
Impact CUL-2 (NTMA & LTMA): *Potential Damage to or Destruction of Previously Undiscovered Buried Archaeological Resources from Ground Disturbance or Other Construction-Related Activities*	PS		Mitigation Measure CUL-2 (NTMA & LTMA): *If Cultural Resources Are Discovered, Immediately Halt Construction and Implement an Accidental-Discovery Plan* Should cultural resources such as structural features, unusual amounts of bone or shell, artifacts, human remains, or architectural remains be encountered during construction activities, work will be suspended immediately at the location of the find and within a 50-foot radius. A qualified archaeologist will conduct a field investigation of the specific site and recommend mitigation necessary to protect or recover any cultural resource determined by the archaeologist to represent a historical resource or unique archaeological resource. Based on the archaeologist's recommendations, the project proponent will develop measures in consultation with responsible agencies and, as appropriate, interested parties such as Native American tribes. The approved mitigation must be implemented before construction activities resume at the archaeological site, as identified by the Native American Heritage Commission. All of the steps identified above will be detailed in an accidental-discovery plan developed before construction so that all parties are aware of the process that must be implemented should buried archaeological resources be uncovered during construction. Construction monitoring by a qualified archaeologist in areas determined particularly sensitive for buried archaeological remains will be implemented by project proponents when warranted, as recommended by the archaeological professional. Reasons for providing an archaeological monitor may include but are not limited to the previous identification of buried cultural deposits in the project vicinity or the previous recordation of an archaeological site that could not be recently identified on the ground surface. Furthermore, some landforms, such as mounded areas in floodplains adjacent to water courses, are more likely to be sensitive for buried resources. Large-scale projects involving a great deal of ground disturbance (e.g., lengthy levee construction) could benefit from geoarchaeological studies to determine those areas most likely to contain buried cultural deposits. Discoveries of human remains will be treated as described in Mitigation Measure CUL-5c (NTMA [& LTMA]), below.	LTS	
Impact CUL-3 (NTMA & LTMA): *Potential Damage or Disturbance to or Change in Significance of Built-Environment Resources*	PS		Mitigation Measure CUL-3a (NTMA & LTMA): *Conduct Cultural Resources Studies and Avoid Effects on Built-Environment Resources* In areas potentially containing historic resources, the project proponent will ensure that architectural history studies and surveys will be conducted by professionals who meet the Secretary of the Interior's professional standards, to identify the presence of built-environment resources within a particular project location. Should buildings or structures that are eligible for listing in the NRHP or CRHR be identified within the study area, impacts on those resources resulting from any NTMA [or LTMA] will be avoided, if feasible. Project relocation and redesign are appropriate avoidance measures. For example, should constructing a new levee require removal of a historic farmhouse, realigning the levee away from the structure would avoid a significant adverse change to the structure. If avoidance is not feasible, see Mitigation Measure CUL-3b (NTMA [& LTMA]) below.	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
			Mitigation Measure CUL-3b (NTMA & LTMA): *Follow the Secretary of the Interior's Standards for the Treatment of Historic Properties* In some cases, completely avoiding an element of the built environment that qualifies as a historical resource or historic property may not be feasible, and the feature must be altered as part of project implementation. In such a scenario, any program-related alterations to historic-era buildings or structures, including relocations, will conform to the Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings (1995). The project proponent will develop and implement any plans necessary to mitigate alterations to historic properties in accordance with these standards. The plans will be submitted to the SHPO for approval before project implementation. If these standards cannot be met, see Mitigation Measure CUL-3c (NTMA) below.		
	PS		Mitigation Measure CUL-3c (NTMA & NTMA): *Record Built-Environment Resources to Historic American Buildings Survey and Historic American Engineering Record Standards* In some cases, avoiding or relocating a building or structure considered eligible for the NRHP or CRHR may not be feasible, and that resource must be demolished. These situations are expected to be rare occurrences. However, in such a scenario, the project proponent will retain a qualified architectural historian to document the affected historical built-environment resource according to Historic American Buildings Survey (HABS) or Historic American Engineering Record (HAER) standards, as appropriate. HABS and HAER documentation packages will be entered into the Library of Congress, as well as the appropriate Information Center of the California Historical Resources Information System.	PSU	
Impact CUL-4 (NTMA & LTMA): *Potential Damage or Disturbance to Traditional Cultural Properties during Ground Disturbance or Other Construction-Related Activities*	PS		Mitigation Measure CUL-4a (NTMA & LTMA): *Conduct Cultural Resources Studies and Avoid Effects on TCPs* In areas potentially containing traditional cultural properties, an ethnographer or archaeologist who meets the Secretary of the Interior's standards as a professional cultural resource specialist will consult with appropriate populations (Native Americans or otherwise) before approval of any project and identify the presence of any TCPs at the project location. Native American TCPs may be identified by an ethnographer who has worked intensively with community members (often, but not always, elders) possessed of considerable knowledge about places important to the community. Should TCPs be identified in the project area, they will be avoided by project redesign or relocation, if feasible. As an example, the proposed location of a water-monitoring device may be moved to another, still appropriate, place along a stream bed to avoid a section of the creek bank that is a TCP for medicinal plants, thereby avoiding a substantial adverse change to the resource. If avoidance is not feasible, see Mitigation Measure CUL-4b (NTMA [& LTMA]) below.	LTS	
			Mitigation Measure CUL-4b (NTMA & LTMA): *Consult with Native American Communities and Implement Appropriate Measures to Mitigate Effects on TCPs* Effects to TCPs are expected to be rare occurrences. However, where an identified TCP cannot be fully avoided by a proposed project, the project proponent will engage in early, meaningful consultation with Native American communities, as identified by the Native American Heritage Commission, to identify ways to mitigate impacts on TCPs. For example, if TCP locations that presently support plant species cultivated and harvested by Native American communities for traditional medicines and foods, or for uses such as basketry, are slated for destruction to make way for planned construction, the project proponent may work with the Native American community associated with the TCP to identify other nearby locations that can support these same plants. The project proponent can then take steps to enhance existing plant populations at those locations or provide materials and labor to cultivate new plants, with assistance from the Native American community. Working with local Native American communities to develop interpretive programs is another measure to mitigate impacts on TCPs. Programs may include developing signage, constructing visitor centers describing locations that have sacred or other special meaning to Native Americans, developing and implementing management plans for important cultural resources, or establishing conservation easements to protect culturally important places.	PSU	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact CUL-5 (NTMA & LTMA): *Potential Damage or Disturbance to Human Remains, Including Those Interred Outside of Formal Cemeteries, during Ground Disturbance or Other Construction-Related Activities*	PS		**Mitigation Measure CUL-5a (NTMA & LTMA):** *Conduct Cultural Resources Studies and Avoid Effects on Human Remains* The project proponent will ensure that archaeological and historical studies and surveys will be conducted by professionals who meet the Secretary of the Interior's standards, to identify the presence of human remains within a particular project location. Should human remains be identified within the study area, impacts on those remains resulting from any NTMA [or LTMA] will be avoided, if feasible. Project relocation and redesign are appropriate avoidance measures. For example, should construction of a new maintenance facility be proposed at a place known to contain human remains, relocation of the facility would avoid disturbing the burials. However, if avoidance is not feasible, see Mitigation Measures CUL-5b (NTMA [& LTMA]) and/or CUL-5c (NTMA [& LTMA]) below, as applicable. **Mitigation Measure CUL-5b (NTMA & LTMA):** *Relocate Known Cemeteries* The project proponent will consult with the entity (county, city, or private) that has jurisdiction over the cemetery, and with interested parties as appropriate, to identify a satisfactory place to relocate human remains that would provide protection from future disturbance. Similarly, if Native American burials are known to exist in an archaeological site, the project proponent will work with the appropriate tribe, as identified by the Native American Heritage Commission, to identify a satisfactory location for reinterment of burials in a protected location. **Mitigation Measure CUL-5c (NTMA & LTMA):** *Immediately Halt Construction If Human Remains Are Discovered and Implement a Burial Treatment Plan* Construction activities have the potential to result in unanticipated effects on buried human remains where there is no surface indication of their presence. Under these circumstances, the project proponent will adhere to the requirements described in Section 7050.5 of the California Health and Safety Code and PRC Section 5097.98: • If human remains are uncovered during ground-disturbing activities, potentially damaging excavation must halt in the area of the remains and the local county coroner must be notified. The coroner is required to examine all discoveries of human remains within 48 hours of receiving notice of a discovery on private or state lands (Health and Safety Code, Section 7050.5(b)). • If the coroner determines that the remains are those of a Native American, he or she must contact the NAHC by phone within 24 hours of making that determination (Health and Safety Code, Section 7050(c)). • In turn, under the provisions of PRC Section 5097.98, NAHC will identify a Most Likely Descendant (MLD). The MLD designated by the NAHC will have at least 48 hours to inspect the site and propose treatment and disposition of the remains and any associated grave goods. For large projects (e.g., new levee construction) or projects where a high probability of encountering human remains exists, a burial treatment plan will be developed by the project proponent in consultation with local Native American tribes before construction. During this process, all parties will be made aware of the actions required should buried Native American human remains be uncovered during construction. The plan will detail all of the activities identified above and include treatment preferences identified by the MLD. Smaller, localized projects do not require a burial treatment plan. Examples of such projects are modifications of existing facilities and projects that do not involve ground disturbance (e.g., purchases of easements, structure modifications). However, should human remains be uncovered during these project activities, treatment of the remains will strictly follow the requirements in Section 7050.5 of the California Health and Safety Code and PRC Section 5097.98.	LTS	
3.9 Energy					
Impact ENRG-1 (NTMA & LTMA): *Inefficient, Wasteful, or Unnecessary Consumption of Energy during Construction-Related Activities*	LTS		N/A	LTS	
Impact ENRG-2 (NTMA & LTMA): *Inefficient, Wasteful, or Unnecessary Consumption of Energy during Operational and Maintenance-Related Activities*	LTS		N/A	LTS	
Impact ENRG-3 (NTMA & LTMA): *Reduced Generation of Renewable Energy as a Result of Altered Flow Releases at Hydropower Facilities Caused by Changes in Reservoir Operations*	LTS		N/A	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
3.10 Geology, Soils, and Seismicity (Including Mineral and Paleontological Resources)					
Impact GEO-1 (NTMA & LTMA): *Exposure of People or Structures to Risks Related to Fault Rupture, Ground Shaking, Liquefaction, or Landslides*	B		N/A	B	
Impact GEO-2 (NTMA & LTMA): *Potential Localized Soil Erosion and Inadvertent Permanent Soil Loss as a Result of Construction or Operation and Maintenance Activities*	LTS		N/A	LTS	
Impact GEO-3 (NTMA & LTMA): *Potential risks of Damage to Infrastructure Associated with Expansive Soils*	LTS		N/A	LTS	
Impact GEO-4 (NTMA & LTMA): *Potential Use of Septic Tanks or Alternative Wastewater Disposal Systems in Areas with Unfavorable Soils*	NI		N/A	LTS	
Impact GEO-5 (NTMA & LTMA): *Potential Loss of Availability of a Known Mineral Resource of Value*	LTS		Mitigation Measure GEO-5 (LTMA): *Minimize Loss of Mineral Resources through Siting and Design* When designing bypasses or setback levees or purchasing easements, the project proponent will consider a range of locations and configurations to minimize the potential to eliminate access to locally valuable mineral resources.	LTS	PSU
Impact GEO-6 (NTMA & LTMA): *Possible Damage to or Destruction of Unique Paleontological Resources*	PS		Mitigation Measure GEO-6 (NTMA & LTMA): *Prepare a Paleontological Resources Assessment and, If Necessary, Conduct Construction Worker Personnel Education, Stop Work If Paleontological Resources Are Encountered during Earthmoving Activities, and Implement Recovery Plan* If an NTMA [or LTMA] involves excavation in native soil (e.g., not imported fill) that has the potential to contain fossils (e.g., greater than 11,000 years old), an assessment of the paleontological sensitivity of rock formations in the excavation area will be conducted. The project proponent will retain the services of a paleontologist to perform an evaluation that includes all of the following: • A determination of the specific rock formations present at the project site • A records search of the applicable paleontological resources database to identify past fossil finds in the area • A field visit (if necessary as determined by the paleontologist) • A determination as to the paleontological sensitivity of the rock formations in areas proposed for excavation using SVP (1995) guidelines Studies conducted for past projects in the same area that meet these criteria may be used to fulfill this requirement. No further mitigation will be required for excavation activities in rock formations that are determined to be of low paleontological sensitivity. Before earthmoving activities begin for any project phase in rock units that have moderate to high paleontological sensitivity, the project proponent will retain a qualified paleontologist or archaeologist to train all construction personnel involved in earthmoving activities, including the site superintendent, regarding the following: • The possibility of encountering fossils • The appearance and types of fossils likely to be seen during construction • The proper notification procedures to follow if fossils are encountered In addition, as determined by the paleontologist in consultation with the project proponent, full-time monitoring during earthmoving activities may be required in areas of high paleontological sensitivity. If a paleontological resource potentially qualifying as unique or significant (as defined above in "Thresholds of Significance") is discovered during earthmoving activities, the construction crew will immediately cease work in the vicinity of the find and notify the project proponent. The project proponent will retain a qualified paleontologist to evaluate the resource, and if it is confirmed to qualify as a unique or significant resource, a qualified paleontologist will prepare a recovery plan in accordance with SVP guidelines (1995). The recovery plan may include but will not be limited to further field surveys in the vicinity of the find, sampling and data recovery procedures, museum storage coordination for any specimen recovered, further monitoring of earthmoving activities, and a report of findings. The project proponent will ensure implementation of the recovery plan. Construction activities can resume at locations where unique or significant paleontological resource are discovered after the resource has been recovered and moved from the work site.	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
3.11 Groundwater Resources					
Impact GRW-1 (NTMA & LTMA): *Potential Localized Degradation of Groundwater Quality Related to Construction, Operation, and Maintenance Activities*	LTS		N/A	LTS	
Impact GRW-2 (NTMA & LTMA): *Degradation of Groundwater Quality Resulting from Decreased Natural Recharge or Increased Pumping due to Reduced Water Supplies from Changes to Reservoir Operational Criteria*	LTS		N/A	LTS	
Impact GRW-3 (NTMA & LTMA): *Depletion of Groundwater Levels Resulting from Decreased Natural Recharge or Increased Pumping due to Reduced Water Supplies from Changes to Reservoir Operational Criteria*	LTS		N/A	LTS	
Impact GRW-4 (NTMA & LTMA): *Modification of Groundwater Flows Resulting in Decreased Natural Recharge to Regional or Local Groundwater Supplies or Reduced or Delayed Local Drainage*	LTS		N/A	LTS	
Impact GRW-5 (LTMA): *Degradation of Water Quality or Adverse Rise in Groundwater Elevation as a Result of Groundwater Banking*	N/A	PS	Mitigation Measure GRW-5a (LTMA): *Develop and Implement Groundwater Management Plans or Expand Existing Groundwater Management Plans, Including Defining Basin Management Objectives, Groundwater Monitoring Plans, and Conditions under Which Corrective Actions Are Taken* Formalized groundwater management plans will be developed or expanded by the project proponent to guide management of groundwater basins where managed groundwater recharge and/or groundwater banking projects are to occur. These plans will include quantifiable basin-management objectives and groundwater monitoring plans to allow for management of the basin in a manner that minimizes adverse effects on groundwater. The plans will identify conditions to be evaluated using groundwater monitoring data and will describe corrective actions that may be taken, such as modifications to groundwater banking operations. Mitigation Measure GRW-5b (LTMA): *Conduct Phase I Environmental Site Assessments* Phase I Environmental Site Assessments will be conducted by the project proponent at all sites before groundwater banking activities begin to prevent the degradation of water quality associated with recharging water in a potentially contaminated aquifer or exposing rising groundwater to contaminated soils.	N/A	LTS
3.12 Hazards and Hazardous Materials					
Impact HHM-1 (NTMA & LTMA): *Hazards from Routine Transport, Use, or Disposal and Reasonably Foreseeable Accidental Release of Hazardous Materials*	LTS		N/A	LTS	
Impact HHM-2 (NTMA & LTMA): *Accidental Release and Use of Hazardous Materials within One-Quarter Mile of an Existing or Proposed School*	PS		Mitigation Measure HHM-2 (NTMA & LTMA): *Conduct a Site-Specific Analysis to Determine the Proximity of School Sites, Notify and Consult with Affected Schools, and Implement Storm Water Pollution Prevention Plan and Best Management Practices as Required* The project proponent will determine whether the site of any existing or proposed school is located within one-quarter mile of each site-specific NTMA or LTMA that would require construction activities. If no school sites are located within this distance, no further mitigation is required. If existing or proposed schools are located within one-quarter mile, the project proponent will notify each affected school (or the school district in which the school is located) in writing, and will consult with appropriate school or district personnel about the types of activities that would occur and their estimated timing. The project proponent will provide examples of the types of hazardous materials that could be used during proposed activities. The written notification will be provided at least 30 days before the commencement of any construction activities within one-quarter mile of the school or at least 30 days before any future project-specific CEQA document is certified or adopted, whichever is earlier. The project proponent will also be required by law to design and implement spill prevention and cleanup measures (i.e., best management practices (BMPs)) as part of the storm water pollution prevention plan (SWPPP) prepared for each site-specific NTMA or LTMA (see Section 3.13, "Hydrology," for a discussion of relevant BMPs and the SWPPP process), which would help to reduce the potential for adverse impacts during project construction.	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact HHM-3 (NTMA & LTMA): *Exposure of People and the Environment to Existing Hazardous Materials, Including Sites on the Cortese List*	PS		Mitigation Measure HHM-3a (NTMA & LTMA): *Search for Contaminated Sites Potentially Affected by Site-Specific Projects and Avoid Contact with or Clean Up Contaminated Areas* Before construction begins on any site-specific project that involves earth-moving activities, a Phase I Environmental Site Assessment (ESA) will be completed. An existing Phase I ESA can be used to complete this requirement if it covers the project area and has been completed within 5 years of initiation of the project's environmental analysis, and land uses on the project site have not changed since completion of the Phase I ESA that would alter the potential for contamination to be present. The Phase I ESA will include a database search to determine whether site-specific work would take place within the boundary of any facilities included on the Cortese List or other recorded contaminated or potentially contaminated sites. If so, the project proponent will do one of the following: 1. Coordinate with the appropriate federal, State, or local agency to determine whether the contamination issue has been resolved by the responsible party. OR 2. Determine whether a qualified hazardous materials specialist has found, through soil and groundwater testing, that previously documented contamination would be sufficiently distant from project construction areas to ensure that the site's known hazardous materials would not be encountered or threaten the safety of construction workers, the public, or the environment. However, if evidence of existing contamination is found on the site, the nature of this contamination will be evaluated in the Phase I ESA and appropriate action will be recommended. Such action may involve further study through completion of a Phase II ESA. If the contamination is sufficient to exceed applicable regulatory thresholds, then the project proponent will ensure cleanup of the site, consistent with regulatory requirement. Cleanup of contaminated sites will be completed before construction is initiated in the contaminated location. In the case of projects that could put the contaminated site in contact with surface waters, cleanup will be completed before levees or other features are modified in a manner that would allow surface waters to reach the contaminated site. Mitigation Measure HHM-3b (NTMA & LTMA): *Locate Oil and Gas Wells and Transmission Lines Potentially Affected by Site-Specific Projects, and Coordinate with Owner/Operators to Avoid Disturbance* Before construction begins on any site-specific project, the project proponent will search appropriate State and local databases to determine whether any oil or natural gas wells or transmission pipelines are located within the specific project site. If any wells or pipelines are found, the project proponent will notify and coordinate with the owner/operators of the wells and pipelines to ensure that such facilities are properly flagged in the field and avoided during construction. Mitigation Measure HHM-3c (NTMA & LTMA): *Train Construction Workers on Hazardous Materials, Stop Work Near Contaminated Soils, and Determine and Implement an Avoidance or Cleanup Strategy* Before construction begins on any site-specific project, the project proponent will train construction workers on the potential to encounter hazardous materials and proper notification procedures. Such training will specify that work in the vicinity must cease and a qualified hazardous materials specialist must be consulted if stained or odorous soils; underground storage tanks; or abandoned or closed wells, mines, or septic systems are encountered. The project proponent will also notify the appropriate federal, State, and/or local agencies. A variety of steps may be taken at the discretion of the project proponent. Among those steps are the following: • Avoid the area containing the stained/odorous soils or infrastructure. • Perform a Phase I ESA to determine the nature, extent, and level of hazard to the public and construction workers if construction needs to occur in the exact location of the soils or infrastructure. • Clean up the area or coordinate with the owner of the affected parcel to perform cleanup activities. Should the project proponent elect to clean up activities on its own, all hazardous substances encountered will be removed and properly disposed of by a licensed contractor in accordance with federal and State regulations.	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
Impact HHM-4 (NTMA & LTMA): *Creation of Safety Hazards, Including Bird Strike, in the Vicinity of a Public or Private Airstrip*	PS		Mitigation Measure HHM-4 (NTMA & LTMA): *Prepare Site-Specific Impact Assessments and, If Necessary, Coordinate with Affected Airport(s) to Prepare and Implement Wildlife Hazard Management Plan(s)* Future CEQA documents related to the proposed program will include analyses of bird strike hazards in those situations where NTMAs or LTMAs would increase the amount of bird habitat or the amount of inundated floodplain within the following distances: • 5,000 feet from airports serving piston-powered aircraft • 10,000 feet from airports serving turbine-powered aircraft • 5 statute miles from airports where the wildlife attractant may cause hazardous wildlife movement into or across the approach or departure airspace Each analysis will consider the size of the airport, the species of birds likely to be present near the proposed improvements, the proximity to any known migratory bird corridors (e.g., the Pacific Flyway), and the number of previously documented bird-strike incidents at the airport (if any). The analysis will determine whether the project-related increase in bird habitat would be substantial compared to existing bird habitat that is already present in the airport vicinity. If the results of the site-specific analysis determine that the impact would be significant, the project proponent will consult and coordinate with the affected airport operator to determine whether a wildlife hazard management plan is required. If required, the project proponent will coordinate with the affected airport to prepare and implement such a plan pursuant to 14 CFR Part 139. The wildlife hazard management plan will identify the hazardous wildlife attractants on or near the airport, the appropriate damage management techniques to minimize the wildlife hazard, and prioritize the management measures. The plan will be prepared in consultation with a wildlife biologist. Bird control techniques may include but are not limited to maintaining grass at a height of less than 8 inches, preventing growth of large emergent plants (e.g., cattails), installing barriers between water features and nearby vegetated areas, installing signs prohibiting feeding of birds, removing nesting materials, and hazing birds to discourage them from using water features.	LTS	
Impact HHM-5 (NTMA & LTMA): *Exposure to Substantial Hazard from Wildland Fires*	LTS		N/A	LTS	
Impact HHM-6 (NTMA & LTMA): *Increased Human Health Hazards Associated with Vector-Borne Diseases*	PS		Mitigation Measure HHM-6 (NTMA & LTMA): *Implement Workplace Precautions against Vector-Borne Diseases and Coordinate with and Support Local Vector Control District Programs* The project proponent will implement the following workplace precautions against vector-borne diseases at the construction sites of future site-specific projects: • Conduct construction worker personnel training that covers the potential hazards and risks associated with exposure to and protection from vector-borne diseases such as West Nile virus. Instruct personnel in the use of proper construction apparel and warn them against handling any dead animals (particularly birds) with bare hands. • Inspect work areas and eliminate sources of standing water that could provide breeding habitat for mosquitoes. For example, eliminate uncovered, upright containers that could accumulate water, and fill or drain potholes or other areas where water is likely to accumulate. • Provide insect repellent for worker use at construction sites. As recommended by the Centers for Disease Control and Prevention (CDC), the insect repellent should contain active ingredients that have been registered with EPA for use as insect repellents on skin or clothing such as diethyl(meta)toluamide (DEET) or picaridin (KBR 3023) (CDC 2010). • Notify the appropriate city or county health department about dead birds found at any project site. In addition, the project proponent will coordinate with and support local vector control districts in implementing their vector control activities at the time of future site-specific projects, as appropriate and feasible. Support will include but will not be limited to the following actions: • Inform the appropriate vector control district about implementation of site-specific projects. Provide information requested to support vector control activities along waterways affected by those site-specific projects in a manner that could increase exposure to vector-borne diseases. • Implement applicable BMPs from the DPH publication entitled *Best Management Practices for Mosquito Control on California State Properties* (DPH 2008).	LTS	

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	NTMAs	LTMAs		NTMAs	LTMAs
3.13 Hydrology					
Impact HYD-1 (NTMA & LTMA): *Increased Erosion and Siltation from Modifying the Flood Conveyance System*	LTS		Mitigation Measure HYD-1 (LTMA): *Identify and Implement Measures to Minimize Downstream Erosion and Siltation* Before a project is approved and implemented, the project proponent will perform an analysis of the new facilities to determine whether the facility will experience or cause elsewhere an erosion or siltation problem. To the extent possible, the facility will be designed to avoid or minimize these effects. Where avoidance is not feasible, the project proponent will address any erosion or siltation impacts through bank protection measures on- or off-site depending on where the increase erosion or siltation may occur. Measures could include moving levee foundations landward away from the eroding bank, maintaining waterside vegetation, dredging to remove siltation, or installing rock revetments, riprap, or other engineered structures along the eroding banks to reduce further erosion and protect the foundation of the levee. These measures will be implemented or funded by the project proponent.	LTS	
Impact HYD-2 (NTMA & LTMA): *Increased Flooding from Modifying the Flood Conveyance System*	LTS		N/A	LTS	
Impact HYD-3 (NTMA & LTMA): *Placement of Housing within a 100-Year Flood Hazard Area*	B		N/A	LTS	
Impact HYD-4 (NTMA & LTMA): *Modification of the Flood Conveyance System in a Way that Would Redirect Flood Flows and Increase Flood Risk or Exposure of People or Structures to a Risk of Loss, Injury, or Death Involving Flooding*	LTS		N/A	LTS	
Impact HYD-5 (NTMA & LTMA): *Increased Risk of Inundation by Seiche*	LTS		N/A	LTS	
Impact HYD-6 (NTMA & LTMA): *Reduced Long-Term Water Supplies from Reservoir Operational Criteria Changes*	LTS		N/A	LTS	
3.14 Land Use and Planning					
Impact LU-1 (NTMA & LTMA): *Physical Division of an Established Community as a Result of Conveyance-Related Management Activities*	LTS		N/A	LTS	
Impact LU-2 (NTMA & LTMA): *Physical Division of an Established Community as a Result of Storage-Related Management Activities*	NI		N/A	NI	
Impact LU-3 (NTMA & LTMA): *Physical Division of an Established Community as a Result of Policies Associated with the Required Level of Flood Protection*	LTS		N/A	LTS	
Impact LU-4 (NTMA & LTMA): *Physical Division of an Established Community as a Result of Other NTMAs [& LTMAs]*	LTS		N/A	LTS	
Impact LU-5 (NTMA & LTMA): *Alterations of Land Uses or Patterns of Land Use as a Result of Conveyance-Related Management Activities that Could Cause a Substantial Adverse Physical Environmental Effect*	S		Mitigation Measure LU-5a (NTMA &LTMA): *Provide Financial Compensation for Property Loss and Relocation Assistance to Compensate for the Removal and Displacement of Residential Land Uses* The project proponent will provide financial compensation for property loss and relocation expenses to any person displaced because of the acquisition of real property, as required by the State of California Relocation Assistance Act (Chapter 16, Section 7260 et seq. of the California Government Code). Before an offer is made to each property owner, all real property to be acquired will be appraised to determine its fair market value. The project proponent will assist eligible property occupants in finding comparable replacement housing and will pay for actual, reasonable moving costs consistent with applicable State and federal law.	LTS (removal of residences)	SU

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	NTMAs	LTMAs		NTMAs	LTMAs
			Mitigation Measure LU-5b (NTMA & LTMA): *Implement Mitigation Measure AG-1a (NTMA), "Preserve Agricultural Productivity of Important Farmland to the Extent Possible"* Mitigation Measure LU-5c (NTMA & LTMA): *Implement Mitigation Measure AG-1c (NTMA), "Establish Conservation Easements Where Potentially Significant Agricultural Land Use Impacts Still Occur after Implementation of Mitigation Measures AG-1a and AG-1b"*	SU (agri-cultural land use pattern changes)	
			Mitigation Measure LU-5d (NTMA & LTMA): *Implement Mitigation Measure REC-1 (NTMA), "Replace Displaced Recreational Facilities and Access"* Mitigation Measure LU-5e (NTMA & LTMA): *Implement Mitigation Measure REC-2 (NTMA), "Avoid Construction Activities and Staging near Recreational Facilities and Time Such Activities to Avoid the High-Use Recreation Season"* Mitigation Measure LU-5f (LTMA): *Implement Mitigation Measure REC-7 (LTMA), "Replace Displaced Recreational Facilities"*	LTS (recre-ational land use changes)	
Impact LU-6 (NTMA & LTMA): *Alterations of Land Uses or Patterns of Land Use as a Result of Storage-Related Management Activities that Could Cause an Adverse Physical Environmental Effect*	LTS		N/A	LTS	
Impact LU-7 (NTMA & LTMA): *Alterations of Land Uses or Patterns of Land Use as a Result of Policies Related to the Required Level of Flood Protection that Would Cause a Substantial Adverse Physical Environmental Effect*	TS		N/A	TS	
Impact LU-8 (NTMA & LTMA): *Alterations of Land Uses or Patterns of Land Use as a Result of Other NTMAs [& LTMAs] that Would Cause a Substantial Adverse Physical Environmental Effect*	S		Mitigation Measure LU-8 (NTMA & LTMA): *Implement Mitigation Measure LU-5b (NTMA)*	SU	

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<tr><th rowspan="2">EIR SECTION AND IMPACT(S)</th><th colspan="2">LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]</th><th rowspan="2">MITIGATION MEASURE</th><th colspan="2">LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]</th></tr>
<tr><th>NTMAs</th><th>LTMAs</th><th>NTMAs</th><th>LTMAs</th></tr>
<tr><td colspan="6">3.15 Noise</td></tr>
<tr><td rowspan="2">Impact NOI-1 (NTMA & LTMA): Exposure of Sensitive Receptors to Temporary and Short-Term Construction-Related Noise</td><td colspan="2">PS

(construction noise)</td><td>Mitigation Measure NOI-1 (NTMA & LTMA): Implement Noise-Reducing Construction Practices

Not all measures listed below may be applicable to each management action. Instead, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.

The project proponent will implement the following measures during construction activities when noise-sensitive receptors are located nearby and could be subject to substantial construction noise in excess of applicable standards or substantially greater than existing conditions.
• Equipment will be operated, stored, and/or maintained as far away as practical from sensitive noise receptors.
• Construction equipment will be properly maintained per manufacturers' specifications and fitted with the best available noise suppression devices (e.g., mufflers, silencers, wraps). All impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.
• Equipment that is quieter than standard equipment will be used in the vicinity of sensitive noise receptors. For example, electrically powered equipment will be used instead of internal combustion equipment where use of such equipment is a readily available substitute that accomplishes program tasks in the same manner as internal combustion equipment.
• Construction equipment operating in the vicinity of sensitive noise receptors will not be left idling for extended periods between construction activities.
• To the greatest extent feasible, construction activities will limit the use of "alarms" (e.g., backup indicators) on construction equipment in the vicinity of sensitive noise receptors. One mechanism to achieve this objective is by providing adequate turning movement distance such that construction and delivery vehicles can turn around without having to operate in reverse.
• Construction equipment will be inspected before first use at a project site located near sensitive noise receptors and at least once during construction for compliance with noise reduction measures.
• To the greatest extent feasible, construction outside of normal construction hours will be minimized or avoided completely when located in the vicinity of sensitive noise receptors. Except under extreme circumstances (as in the case of construction of a slurry cutoff wall, which must be in continuous operation), construction activities will be limited to normal construction hours or hours identified in applicable local noise regulations.
• Where stationary construction equipment would result in exceedence of noise standards at a nearby sensitive receptor, temporary noise barriers will be installed where feasible between the stationary construction operation and the sensitive receptor.
• Speed limits will be established and enforced for construction traffic.</td><td colspan="2" rowspan="2">LTS</td></tr>
<tr><td colspan="2">LTS
(construction traffic noise)</td><td>Mitigation Measure NOI-1b (LTMA): Minimize Construction-Related Traffic Noise

Where the project-specific noise analysis conducted as part of CEQA review for a project indicates that noise from construction traffic could exceed applicable standards at a sensitive receptor, an additional individual traffic noise analysis will be prepared. The individual traffic noise analysis will be conducted as haul routes are determined to establish existing average noise conditions and model the noise contribution from project construction. The traffic noise analysis will take into account daily traffic volumes, fleet mixes (percentages of automobiles, medium-duty trucks, and heavy-duty trucks during daytime, evening, and nighttime hours), and vehicle speeds along designated haul-route roadways. If the individual traffic noise analysis also concludes that applicable noise standards are exceeded at a sensitive receptor, the analysis will identify additional measures to reduce noise levels at sensitive receptors and these measures will be implemented by the project proponent. Measures could include (but would not be limited to) using alternative traffic routes, splitting trips among multiple routes, or directing noisier vehicles to use less noisesensitive routes.</td></tr>
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EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact NOI-2 (NTMA & LTMA): *Exposure of Sensitive Receptors to, or Generation of, Excessive Groundborne Vibration*	PS		Mitigation Measure NOI-2 (NTMA & LTMA): *Implement Vibration-Reducing Construction Practices* Not all measures listed below may be applicable to each management action. Instead, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action. The project proponent will implement the following measures before and during construction activities that occur within 300 feet of a receptor sensitive to vibration disturbance: • A disturbance coordinator will be designated, and this person's contact information will be posted in a location near the construction site that is clearly visible to the nearby receptors most likely to be disturbed. The disturbance coordinator will manage complaints and concerns resulting from activities that cause vibrations. The severity of the vibration concern will be assessed by the disturbance coordinator and, if necessary, evaluated by a qualified noise and vibration control consultant. • Vibration monitoring will be conducted before and during construction-generated vibration activities occurring within 100 feet of historic structures. Every attempt will be made to limit construction-generated vibration levels in accordance with Caltrans's recommendations during pile driving and other groundborne noise- and vibration-generating activities in the vicinity of historic structures. • If estimated or recorded vibration levels meet or exceed levels that could damage an adjacent historic feature, the adjacent historic features will be covered or temporarily shored, as necessary, to protect them from vibrations. • For pile driving required within 100 feet of residences or other occupied structures, alternative installation methods (e.g., pile cushioning, jetting, predrilling, cast-in-place systems, resonance-free vibratory pile drivers) will be used where feasible to reduce the number and amplitude of blows required to seat the pile. If the estimated vibration levels exceed levels that could damage the structures, they will be covered or temporarily shored, as necessary, to protect them from vibrations. • Pile-driving activities conducted within 300 feet of sensitive receptors will occur during daytime hours to avoid causing sleep disturbance during evening and nighttime hours.	LTS	

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<tr><th rowspan="2">EIR SECTION AND IMPACT(S)</th><th colspan="2">LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]</th><th rowspan="2">MITIGATION MEASURE</th><th colspan="2">LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]</th></tr>
<tr><th>NTMAs</th><th>LTMAs</th><th>NTMAs</th><th>LTMAs</th></tr>
<tr><td>Impact NOI-3 (NTMA & LTMA): Exposure of Sensitive Receptors to Operational Noise</td><td colspan="2">PS</td><td>Mitigation Measure NOI-3 (NTMA & LTMA): Implement Design Techniques to Reduce Operational Noise

The project proponent will implement the following measures during operation:
• Stationary noise sources (e.g., water pumps) will be located as far away from sensitive receptors as feasible.
• Design techniques to reduce noise (e.g., structure encasing, installation below grade) will be implemented for stationary noise sources (e.g., water pumps) in the vicinity of sensitive receptors. If noise modeling indicates that noise reduction techniques are sufficient to allow the stationary noise source to be located closer to sensitive noise receptors and still not violate applicable noise standards, then the facility may be located closer to the receptor.</td><td colspan="2">LTS</td></tr>
<tr><td colspan="6">3.16 Population, Employment, and Housing</td></tr>
<tr><td>Impact PEH-1 (NTMA & LTMA): Inducement of Population Growth, Either Directly or Indirectly, through an Increase in Regional Economic Output Resulting from Construction or Operations Activities</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
<tr><td>Impact PEH-2 (NTMA & LTMA): Displacement of Existing Housing or People through Changes in Land Use or Policy Changes</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
<tr><td>Impact PEH-3 (NTMA & LTMA): Changes in Employment, Either Directly or Indirectly, through Changes in Land Use or Policy Changes</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
<tr><td colspan="6">3.17 Public Services</td></tr>
<tr><td>Impact PS-1 (NTMA & LTMA): Physical Effects Resulting from the Need for New or Altered Law Enforcement or Fire Protection Facilities and Services</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
<tr><td colspan="6">3.18 Recreation</td></tr>
<tr><td>Impact REC-1 (NTMA & LTMA): Substantial Permanent Displacement of or Decreased Access to Recreational Facilities Caused by Levee Reconstruction, Improvements, or Setbacks</td><td colspan="2">PS</td><td>Mitigation Measure REC-1 (NTMA & LTMA): Replace Displaced Recreational Facilities and Access

Where recreational facilities or access must be displaced by levee reconstruction or improvements, facilities and access will be restored on site as part of the project design. If the facilities or access cannot be replaced at the project site, they will be replaced as close as possible to the original project site. Alternatively, existing facilities could be expanded to meet the demand for recreational opportunities lost with the removal of the facility at the project site, or to compensate for the loss of access resulting from project implementation. Where new facilities must be constructed or existing facilities are expanded, these actions will undergo necessary environmental review and mitigation will be implemented as appropriate. Please also see Impact Rec-6 (NTMA) below regarding environmental effects of new facilities.</td><td colspan="2">LTS</td></tr>
<tr><td>Impact REC-2 (NTMA & LTMA): Temporary Decrease in Opportunities for Recreation or Access to Recreational Facilities during Construction of Conveyance or Storage Improvements</td><td colspan="2">LTS</td><td>Mitigation Measure REC-2 (NTMA & LTMA): Minimize Construction Activities and Staging near Recreational Facilities and Time Such Activities to Avoid the High-Use Recreation Season

Where feasible, the project proponent will avoid placing construction staging areas or borrow areas near recreational facilities or popular use areas, and will avoid using key recreation access routes as access and haul routes for construction. Where avoiding facilities is not possible, construction will be scheduled to minimize temporary closure or access restrictions or other temporary adverse effects on recreation facilities. Numerous factors must be considered in the siting and timing of construction activities and selection of access and haul routes; for some projects, however, opportunities may exist to select from among several options those that would have the smallest effect on recreation
Where feasible, the project proponent will schedule construction activities to avoid the high-use recreation season for the potentially affected areas. This frequently will not be possible for major repairs or upgrades because those major construction activities typically occur during the dry season (May through October). However, in some cases it may be possible to focus construction activity during the months when recreational activity would be least affected. In addition, the project proponent will avoid scheduling construction activities on weekend days, where feasible, to help minimize effects on recreational activities.</td><td colspan="2">LTS</td></tr>
<tr><td>Impact REC-3 (NTMA & LTMA): Reduced Functionality of Recreational Facilities and Decreased Opportunities for Recreation at Reservoirs as a Result of Changes in Reservoir Operational Criteria</td><td colspan="2">LTS</td><td>N/A</td><td colspan="2">LTS</td></tr>
</table>

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact REC-4 (NTMA & LTMA): *Boat Navigation Hazards and Passage Restrictions for Recreational Boat Traffic Resulting from Construction Activities Conducted from Barges in Waterways*	PS		Mitigation Measure REC-4 (NTMA & LTMA): *Maintain Safe Boat Passage and Provide Appropriate Safety Measures to Minimize Navigation Hazards Associated with Construction Equipment and Activity in Waterways* The project proponent will establish construction exclusion zones around barges and other equipment in waterways to keep boats from approaching too closely. The project proponent will follow all standard U.S. Coast Guard practices for navigation safety and communications, and will ensure that barges and other construction equipment are lit at night to avoid potential boat collisions. The objectives of this mitigation measure are to maintain safe boat passage in affected waterways to the maximum extent possible, and to minimize boat traffic delays, particularly in high-traffic areas. Stopping boat traffic may be necessary for brief periods (for example, while material or equipment is being transferred to or from a barge); however, the expectation is that with appropriate caution, boat traffic will be able to navigate past construction sites at most times. Boats may be required to reduce speeds in the vicinity of the barge for safe passage. The period of time when boat traffic must be restricted will be minimized to the extent feasible.	LTS	
Impact REC-5 (NTMA & LTMA): *Decrease in Quality of Terrestrial and Water-Based Recreation as a Result of Removal of Woody Vegetation from Levees*	LTS		N/A	LTS	
Impact REC-6 (NTMA & LTMA): *Environmental Effects Associated with Construction of Recreational Facilities and Access to Replace Facilities Displaced by Management Activities*	LTS		N/A	LTS	
Impact REC-7 (LTMA): *Substantial Displacement of or Decreased Access to Recreational Facilities Caused by Conveyance-Related and Other Management Activities*	N/A	PS	Mitigation Measure REC-7 (LTMA): *Replace Displaced Recreational Facilities* This mitigation measure would be similar to Measure REC-1 (NTMA) as described above, but mitigation would be required at a broader range of recreational facilities and sites, beyond those associated with levees. Specifically, mitigation would be required at reservoirs, within bypasses, and at areas outside the present flood control system (for example, where a new bypass is constructed).	N/A	LTS
3.19 Transportation and Traffic					
Impact TRN-1 (NTMA & LTMA): *Temporary Increases in Traffic from Construction Activities*	PS		Mitigation Measure TRN-1 (NTMA & LTMA): *Implement Measures to Reduce Construction Traffic* To minimize impacts on traffic circulation and roadway capacity, including emergency vehicle access, the project proponent will implement the following measures: • Require construction contractors to limit truck trips to less than 50 trips per hour on any affected roadway during the morning and afternoon or evening peak-hour periods, if feasible. • Before construction of major projects that could exceed this threshold, prepare a traffic management plan that identifies the number of truck trips, time of day for truck arrivals and departures, limits on the number of truck trips, and traffic circulation control measures. Control measures typically include advertising planned lane closures, installing warning signage, providing a flagperson to direct traffic flows when needed, and implementing methods to maintain continued access by emergency vehicles. During project construction, access to existing land uses will be maintained at all times where feasible, with detours used as necessary during road closures. • Submit the traffic management plan to the appropriate city or county public works, fire, police, and sheriff's departments for comments. • Implement the traffic management plan and feasible recommendations by the appropriate departments.	LTS	PSU
Impact TRN-2 (NTMA & LTMA): *Removal or Temporary Disruption of Current Transportation Infrastructure*	PS		Mitigation Measure TRN-2 (NTMA & LTMA): *Provide Detours for Closed or Disrupted Routes* If the effects of a project on roadways will be temporary, the project proponent will provide easily recognizable detour signs and prepare and implement a traffic management plan to minimize traffic, including bicycle, impacts, in consultation with the local transportation agency. If management actions require removal of transportation infrastructure, efforts will be undertaken to make sure that a convenient transportation alternative option is available for travel. For effects on rail lines, the project proponent will work with the respective rail owner to maintain maximum use of the line.	LTS	PSU
Impact TRN-3 (NTMA & LTMA): *Increased Hazards due to Construction and Temporary Design Feature*	LTS		N/A	LTS	

EIR SECTION AND IMPACT(S)	LEVELS OF SIGNIFICANCE BEFORE MITIGATION[a]		MITIGATION MEASURE	LEVELS OF SIGNIFICANCE AFTER MITIGATION[b]	
	NTMAs	LTMAs		NTMAs	LTMAs
Impact TRN-4 (NTMA & LTMA): *Closure or Reduction in Capacity of an Emergency Response or Evacuation Route*	PS		Mitigation Measure TRN-4 (NTMA & LTMA): *Minimize Effects of Reduction or Closure of an Emergency Response or Evacuation Route* Before the start of construction, all emergency response agencies will be consulted to determine the impacts of the project on their emergency response and evacuation routes. If routes cannot be maintained, then the passage blockage will occur during periods of minimum demand, such as by working at night or maintaining emergency evacuation routes during periods of most likely use (flood season).	LTS	
Impact TRN-5 (NTMA & LTMA): *Conflict with Adopted Policies, Plans, or Programs regarding Public Transit, Bicycle, or Pedestrian Facilities*	LTS		N/A	LTS	
3.20 Utilities and Service Systems					
Impact UTL-1 (NTMA & LTMA): *Potential Disruption of Utility Service and Modification or Relocation of Utility Infrastructure from Project Construction Activities*	PS		Mitigation Measure UTL-1 (NTMA & LTMA): *Verify Utility Locations, Coordinate with Utility Providers, Prepare and Implement a Response Plan, and Conduct Worker Training with Respect to Accidental Utility Damage* Before construction begins, the project proponent and its primary contractors will coordinate with applicable regulatory agencies and utility providers to implement orderly relocation of utilities that need to be removed or relocated. The project proponent and its primary contractors will implement all of the following measures: • The appropriate agencies and affected landowners will be notified of any potential interruptions in service. • Before the start of construction, the locations of utilities will be verified through field surveys and the use of Underground Service Alert services. Any buried utility lines will be clearly marked in areas where construction activities would take place and on the construction specifications before any earth-moving activities begin. • Many of the Board's encroachment permits for utility facilities contain clauses requiring the owner to remove and/or relocate the facility at the owner's expense. If necessary, infrastructure will be removed, relocated to safer locations, or made flood resistant in coordination with all potential service providers known to have, or potentially having, utility infrastructure in the project area. • If necessary, infrastructure will be flood-proofed (e.g., raised on piers) in coordination with all transmission providers known to have infrastructure in the project area. • Before the start of construction, a response plan will be prepared to address the potential for accidental damage to a utility. The plan will identify chain-of-command rules for notifying authorities and appropriate actions and responsibilities to ensure the safety of the public and workers. The construction contractor will conduct worker education training on responding to situations when utility lines are accidentally damaged. The project proponent and its contractors will implement the response plan during construction activities. • Utility relocations will be staged to minimize interruptions in service.	LTS	
Impact UTL-2 (NTMA & LTMA): *Potential Disruption of Utility Service and Modification or Relocation of Utility Infrastructure from Project Operation*	B		N/A	B	
Impact UTL-3 (NTMA & LTMA): *Increased Generation of Solid Waste during Project Construction*	LTS		N/A	LTS	
3.21 Water Quality					
Impact SWQ-1 (NTMA & LTMA): *Temporary Construction-Related Effects on Water Quality that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality*	LTS		N/A	LTS	
Impact SWQ-2 (NTMA & LTMA): *Modification of Reservoir Operations that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality*	LTS		N/A	LTS	
Impact SWQ-3 (NTMA & LTMA): *Alteration of Floodplain Inundation Patterns that Could Result in Substantial Erosion and Adversely Affect Water Quality*	PS		Mitigation Measure SWQ-3 (NTMA & LTMA): *Conduct and Comply with Phase I Environmental Site Assessments* The project proponent will conduct a Phase I Environmental Site Assessment to determine the presence of any hazardous materials at all sites where new floodplain would be exposed to inundation. Project proponents of subsequent site-specific projects will implement all the recommended actions and measures identified in the Phase I Environmental Site Assessment. In addition, the project proponent will be required to comply with the federal and California endangered species acts and incorporate associated measures into the project design/planning features.	LTS	

Notes:

N/A Either impact mechanism, need for mitigation, and/or determination of significance after mitigation is not applicable

[a] Impact Significance before Mitigation
B Beneficial
NI No impact
LTS Less than significant
PS Potentially significant
S Significant
TS The impact is too speculative to make a significance determination

[b] Impact Significance after Mitigation
B The impact would be beneficial and no mitigation is required; therefore, the impact would remain beneficial.
LTS The impact would be less than significant and no mitigation is required; therefore, the impact would remain less than significant, whether or not mitigation has been provided to further reduce the impact.
SU Significant and unavoidable
PSU Potentially significant and unavoidable
TS The impact is too speculative to make a significance determination

Although some impacts are identified as significant and unavoidable or potentially significant and unavoidable in Table ES-1, these impact conclusions may or may not apply to any given project, as most projects would result in less-than-significant impacts after mitigation, but some projects may not, as described in Chapter 3.0 and summarized in Section 6.3 "Significant and Unavoidable Impacts."

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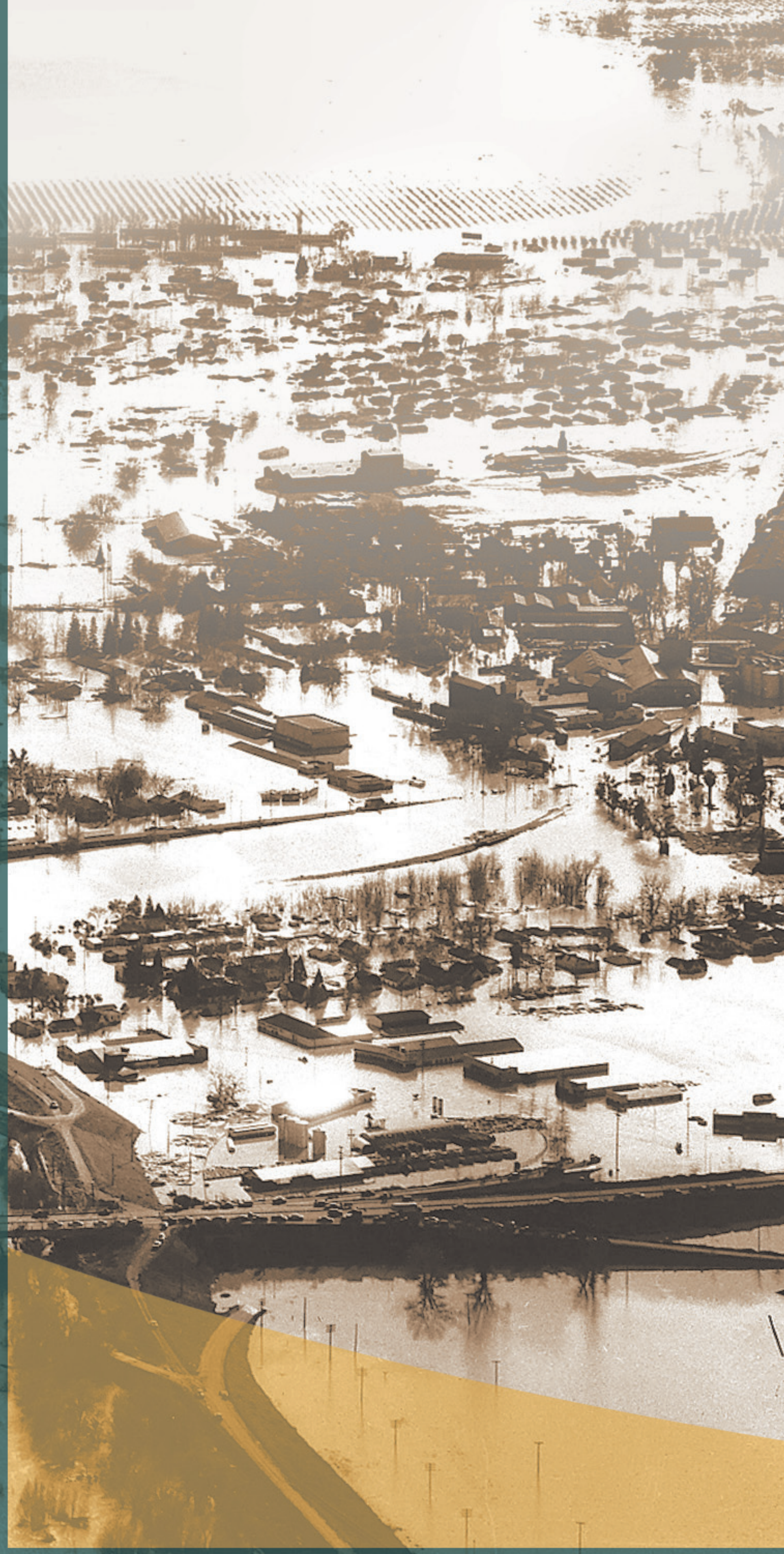

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