United States Department of the Interior

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Cons. # 02ENNM00-2015-F-0103

Memorandum

To: Acting Jennifer Area Manager, Albuquerque Area Office, Bureau of Reclamation, Albuquerque, New Mexico

From: Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

Subject: U.S. Fish and Wildlife Service's Biological Opinion on the Effects of the Bureau of Reclamation's Delta Channel Maintenance Project

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the action described in the Biological Assessment (BA) provided November 26, 2014 for the Bureau of Reclamation's (Reclamation) Delta Channel Maintenance Project (Delta Channel Project) in the Rio Grande, conducted as part of Reclamation's River Maintenance Program. This BO analyzes the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow), the endangered southwestern willow flycatcher, *Empidonax traillii extimus* (flycatcher), and the threatened yellow-billed cuckoo, *Coccyzus americanus* (cuckoo). Reclamation has determined the proposed action will have no effect on designated critical habitat for the flycatcher or proposed critical habitat for the cuckoo. Critical habitat for the silvery minnow is not present within the action area, and Reclamation has determined the proposed action will have no effect on designated silvery minnow critical habitat located upstream. Reclamation has also made a no effect determination for the endangered New Mexico meadow jumping mouse, *Zapus hudsonius luteus* (jumping mouse), however several conservation measures have been included as part of the proposed action. Reclamation expects the proposed action and the analysis of its effects will remain in effect until April 15, 2017. The Delta Channel Project will be located within the boundaries of the Elephant Butte Reservoir which extends from River Mile (RM) 57.8 in the Upper Reach of the Delta Channel south to the current reservoir pool. River maintenance activities will be conducted annually along 20.8 miles (33.5 km) of the Delta Channel, and project-related road and staging area maintenance will be conducted annually within the approximately 293 square mile (187,520 acre) action area boundary in Socorro and Sierra Counties, New Mexico. Request for formal consultation through submittal of the BA, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), was received on November 26, 2014.

This BO is based on information submitted in the November 2014 BA (Reclamation 2014) and other sources of information available to the Service. A complete administrative record of this consultation is on file at the Service's New Mexico Ecological Services Field Office (NMESFO).

Southwestern Willow Flycatcher

Reclamation has determined the proposed project "may affect, but is not likely to adversely affect," the flycatcher. We concur with this determination for the reasons described below.

Occupied flycatcher habitat currently exists within the action area, and direct effects on flycatchers are possible as a result of disturbances from equipment operations. In-channel maintenance activities however, will not occur during the timeframe when flycatchers would be present (April 15 – August 15), and the proposed vegetation control activities (mowing and herbicide treatments) are not expected to occur during this timeframe. Should vegetation control be needed between April 15 and August 15, migratory bird surveys will be conducted prior to any treatment, and a 0.25 mile buffer will be observed around any nests found. All vegetation control activities will occur alongside already existing and maintained areas, and Reclamation will coordinate with the Service prior to any potential new road construction activity. Road maintenance activities such as grading and washout repair may be performed throughout the year, however the majority of these activities will be conducted in upland areas outside of suitable flycatcher habitat. Road maintenance activities have occurred routinely during the past several years with no negative impacts to flycatchers, which continue to nest successfully near these roads (V. Ryan, Reclamation, *pers. comm.* 2014). Brief periods of noise disturbance associated with maintenance support operations, such as airboat transport and pumping water from the river may also interrupt flycatcher behavior. Neither of these activities however, is expected to occur between April 15 and August 15. Should either activity become necessary during this timeframe, Reclamation will coordinate with the Service to avoid impacts to flycatchers.

Direct effects on flycatchers are also possible from the removal of any vegetation that represents suitable nesting habitat. The vegetation that will be removed within the existing Delta Channel however, is located in small areas on sandbars and is not suitable habitat for flycatchers based on both patch size and vegetation maturity. The majority of vegetation to be treated alongside site access and staging areas is located upland and outside of suitable flycatcher habitat, and consists mostly of salt cedar (*Tamarix spp.*).

Given the conservation measures in place, we expect that direct effects on flycatchers are insignificant and discountable.

Indirect effects on flycatchers are possible as a result of riverbed degradation, which has the potential to negatively impact downstream vegetation. Riverbed degradation may occur as a result of reservoir lowering but is not expected to occur as a result of maintenance activities described in this project and no new Delta Channel construction is being proposed.

During the proposed in-channel maintenance, breaks in the Delta Channel berm may be constructed, or naturally occurring breaches may be allowed to remain, providing overbanking flow to the adjacent floodplain. Overbanking at both constructed and natural breaches would likely increase the development of flycatcher habitat as well as improve vegetative health and territory establishment.

Thus, indirect effects on flycatchers from maintenance activities within the existing Delta Channel are considered insignificant in the short-term, and potentially beneficial through improvement of flycatcher habitat in the long-term.

Yellow-Billed Cuckoo

Reclamation has determined the proposed project "may affect, but is not likely to adversely affect," the cuckoo. We concur with this determination for the reasons described below.

Occupied cuckoo habitat currently exists within the action area, and direct effects on cuckoos are possible as a result of disturbances from equipment operations. In-channel maintenance activities however, will not occur during the timeframe when cuckoos would be present (April 15 – August 15), and the proposed vegetation control activities (mowing and herbicide treatments) are not expected to occur during this timeframe. Should vegetation control be needed between April 15 and August 15, migratory bird surveys will be conducted prior to any treatment, and a 0.25 mile buffer will be observed around any nests found. All vegetation control activities will occur alongside already existing and maintained areas, and Reclamation will coordinate with the Service prior to any potential new road construction activity. Road maintenance activities such as grading and washout repair may be performed throughout the year, however the majority of these activities will be conducted in upland areas outside of suitable cuckoo habitat. Brief periods of noise disturbance associated with maintenance support operations, such as airboat transport and pumping water from the river may also interrupt cuckoo behavior. Neither of these activities however, is expected to occur between April 15 and August 15. Should either activity become necessary during this timeframe, Reclamation will coordinate with the Service to avoid impacts to cuckoos.

Direct effects on cuckoos are also possible from the removal of any vegetation that represents suitable nesting habitat. The vegetation that will be removed within the existing Delta Channel however, is located in small areas on sandbars and is not suitable habitat for cuckoos based on both patch size and vegetation maturity. The majority of vegetation to be treated alongside site access and staging areas is located upland and outside of suitable cuckoo habitat, and consists mostly of salt cedar.

Given the conservation measures in place, we expect that direct effects on cuckoos are insignificant and discountable.

Indirect effects on cuckoos are possible as a result of riverbed degradation, which has the potential to negatively impact downstream vegetation. Riverbed degradation may occur as a result of reservoir lowering but is not expected to occur as a result of maintenance activities described in this project and no new Delta Channel construction is being proposed.

During the proposed in-channel maintenance, breaks in the Delta Channel berm may be constructed, or naturally occurring breaches may be allowed to remain, providing overbanking flow to the adjacent floodplain. Overbanking at both constructed and natural breaches would likely increase the development of cuckoo habitat as well as improve vegetative health and territory establishment. Thus, indirect effects on cuckoos from maintenance activities within the existing Delta Channel are considered insignificant in the short-term, and potentially beneficial through improvement of cuckoo habitat in the long-term.

Given the conservation measures in place during the proposed Delta Channel Project, anticipated effects to the cuckoo and flycatcher from the proposed action are insignificant and discountable. Reclamation has made a no effect determination for designated flycatcher habitat and proposed cuckoo habitat within the action area. There is no designated critical habitat for the silvery minnow within the action area. The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow.

Consultation History

On August 8, 2013, the Service received a final BA for the San Marcial Delta Water Conveyance Channel Maintenance Project (Reclamation 2013) as a supplement to Part II of the Joint BA for Bureau of Reclamation and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico (Cons. #02ENNM00-2012-F-0006). On August 14, 2014, Reclamation and the Service met and agreed to consult over a shorter term river maintenance project (2 years) in the Delta Channel in the interim of obtaining ESA compliance through a final BO for Reclamation's MRG water management and maintenance activities. The Service received revised draft BAs for the Delta Channel Project on September 29 and October 22, 2014. On November 26, 2014, the Service received a final BA on the proposed action and request for formal ESA consultation. On December 11, 2014, the Service provided a draft BO to Reclamation for review. This BO is tiered off the 2003 *Biological and Conference Opinions on the Effects of the Bureau's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande* (March 2003 BO).

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Overview

Reclamation has authorization for river channel maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir, as specified by the Flood Control Acts of 1948 and 1950. Under this authority, Reclamation monitors priority sites along the river, which are locations where channel conditions could damage infrastructure, or impair or interrupt water delivery. One such priority site is the existing San Marcial Delta Water Conveyance Channel (Delta Channel, formerly known as the Temporary Channel). Reclamation and the New Mexico Interstate Stream Commission (ISC) have entered into a cooperative agreement for water salvage on the Rio Grande. In this agreement, Reclamation has agreed to maintain the existing Delta Channel to facilitate delivery of water and sediment so that the ISC can meet its water delivery obligations under the Rio Grande Compact (Compact).

The proposed action would apply river maintenance techniques within the existing Delta Channel over the next two years (December 2014 – April 2017). Specific activities include maintenance of access and staging areas, maintenance within the existing Delta Channel (Upper, Middle, and Lower Reaches), and associated support operations. Since the construction of the 3 Delta Channel reaches, the geomorphology and hydraulic capacity of the channel has changed over time, compromising the connection between the Rio Grande and the active reservoir pool at Elephant Butte. Implementation of the proposed action is necessary to minimize water loss and impacts to New Mexico's Compact deliveries.

Maintenance activities are expected to occur from December 2014 – April 2015 during the first year of the proposed action. A regular maintenance schedule from September 1 – April 1 is expected to occur in subsequent years, through 2017. The proposed in-channel maintenance and vegetation control activities will not be conducted between April 15 and August 15 of any year to avoid impacts to birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703). Table 1 summarizes the work windows for the proposed activities for any year covered by this BO.

Table1. Summary of work windows for Delta Channel maintenance activities with associated conditions (Reclamation 2014).

Activity	Work window	Conditions
Delta Channel maintenance	No work between April 15 and August 15	Coordinate with Service if emergency maintenance is needed during the no-work window
Access road maintenance (except for mowing and herbicide application)	May occur throughout the year	
Vegetation control (mowing and herbicide application)	No work between April 15 and August 15	
Staging area maintenance (including mowing and herbicide application)	No work between April 15 and August 15	Coordinate with Service if emergency maintenance is needed during the no-work window
Equipment launching site maintenance	No work between April 15 and August 15	Coordinate with Service if emergency maintenance is needed during the no-work window
Equipment launching site maintenance at Pete Well (Site #6 in Figure 8)	No work between April 15 and August 15; if suitable mouse habitat is found in spring 2015, then no work between August 15 and October 31	
Pumping from the Delta Channel for dust abatement	No pumping between April 15 and August 15	Coordinate with the Service if pumping is needed after August 15 and before the end of irrigation season (October 31)

Project Location

The proposed action will occur in the Upper, Middle, and Lower Reaches of the existing San

Marcial Delta Water Conveyance Channel (Delta Channel, formerly known as the Temporary Channel), located within the boundaries of the Elephant Butte Reservoir approximately between RM 62[1] and the current reservoir pool (Figure 1). The wetted perimeter of the reservoir pool continually fluctuates, but was estimated at RM 38 as of October 2014 (B. Hobbs, Reclamation, *pers. comm.* 2014). While the Upper Reach of the Delta Channel starts at RM 57.8, the project location extends to RM 62 to include the maintenance of an access road in that area. The lateral extent of the project area is the width of the active floodplain, as bounded by levees or natural geologic formations and the access roads. A description and map of the Delta Channel reaches are provided in Figure 2 and Table 2 (from November 2014 BA – Reclamation 2014). The length shown for each reach is the constructed channel length, which differs slightly from the RM lengths.

Proposed Actions

The purpose of the proposed action is to maintain the existing, man-made Delta Channel to facilitate delivery of Rio Grande water to Elephant Butte Reservoir and involves activities such as sediment removal, berm repair, and maintenance of existing site access and staging areas.

Site Access and Staging Areas

All access roads within the action area are public roads, constructed or improved during original construction of the Delta Channel (Figure 2). No new access roads are planned at this time, however if they should become needed, Reclamation will coordinate with the Service prior to any road construction activity. Eleven existing staging areas, also constructed during original Delta Channel construction, will also be used for future maintenance operations. Staging areas are leveled areas where equipment, materials, and temporary fuel tanks are stored. Spill prevention measures are provided for the fuel tanks. Equipment launching sites are located near each existing staging areas, and allow for the safe entry of equipment into the Delta Channel.

<u>Road surface and washout repair</u>

Road maintenance activities will be performed annually and include smoothing of the road surface with a road grader and the potential addition of gravel or excavated Delta Channel sediment for re-surfacing. When needed, washout areas will also be repaired using a road grader but will not include vegetation removal. Road maintenance such as grading and washout repair may be performed throughout the year to maintain safe access to and from the Delta Channel.

<u>Launching site maintenance</u>

Equipment launching sites are side channels leading to the Delta Channel where amphibious excavators, fuel transporters, or airboats can be launched to complete work in the Delta Channel. These side channels are maintained to allow the safe entry of equipment into the Delta Channel, and were originally constructed to prevent entrapment of silvery minnow and other fish due to drying. Maintenance includes the removal of sediment and vegetation using an amphibious excavator, with the excavated material then used to repair berms along the Delta Channel.

[1] RM locations in this document refer to Reclamation's 2002 RM delineation to maintain consistency with a previous Delta Channel consultation (January 25, 2008, Cons. #22420-2008-F-0017). 2012 RM locations have recently been established based on the channel centerline in 2012. RM locations are approximate and are not an exact measurement of channel distance.

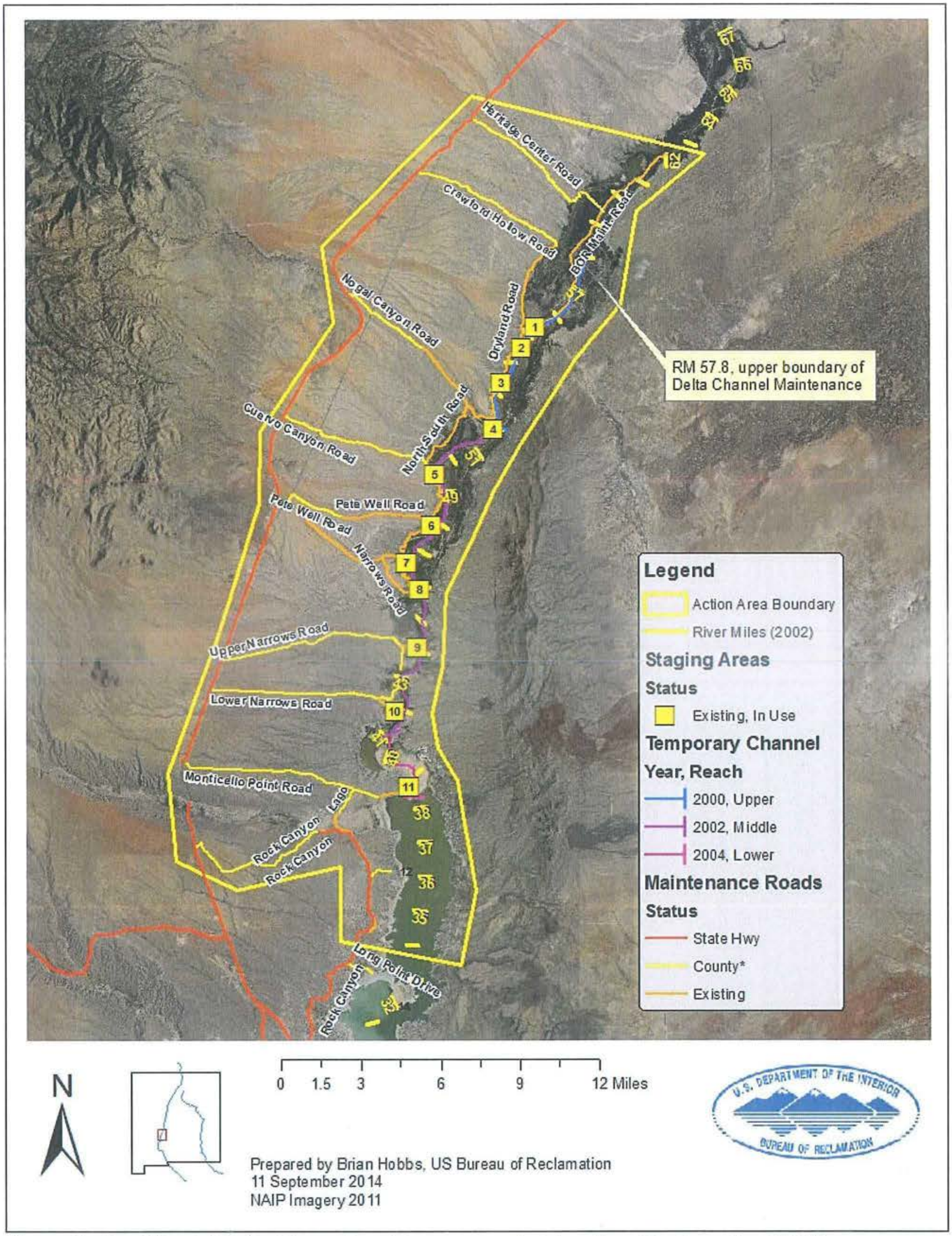

Figure 1. San Marcial Delta Channel maintenance project location (Reclamation 2014).

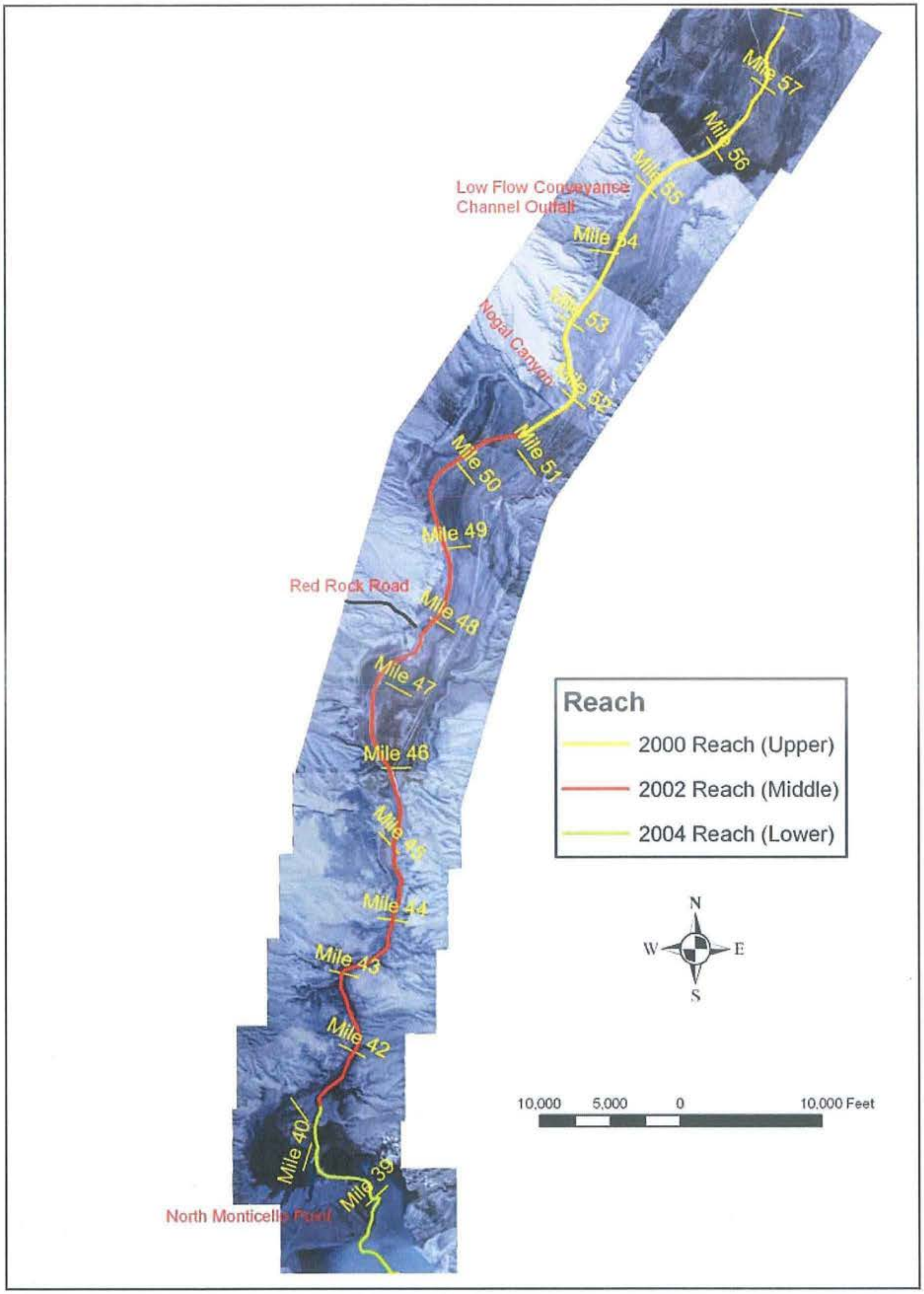

Figure 2. San Marcial Delta Channel reaches (Reclamation 2014).

Table 2. Summary of the San Marcial Delta Channel reaches (Reclamation 2014).

Project Reach	Construction	Length	Start	End
Upper	2000 to 2004	7.0 miles	RM 57.8	RM 51.2 Nogal Canyon
Middle	2003 to 2004	11.1 Miles	RM 51.2 Nogal Canyon	RM 40.7 d/s of Narrows
Lower	Started 2005	2.7 miles to date	RM 40.7 d/s of Narrows	Reservoir pool

Maintenance of equipment launching sites will be performed by excavators immediately preceding work in the adjacent section of the Delta Channel. If work is scheduled between August 15 and October 31 at these sites, vegetation surveys will first be conducted by Reclamation biologist to determine jumping mouse habitat suitability. If suitable habitat is found, Reclamation will coordinate with the Service prior to any maintenance work.

Vegetation control

Vegetation control will also be performed annually and will consist of both mowing and herbicide treatment along the road shoulders for safety, to a maximum distance of 10 feet from each road shoulder. Herbicides may be applied using low pressure spray rigs mounted to off-highway vehicles, trucks and trailers with spray bars, or backpack sprayers (for spot applications). Table 3 lists the Service-approved herbicides that may be applied and the most encompassing buffers for species covered in this BO.

Table 3. Aquatic and terrestrial herbicide buffers adapted from White (2007) (Reclamation 2014).

Herbicide (active ingredient)	Animal Ecotoxicity Rating*	Aquatic Buffer (Spot Application)	Aquatic Buffer (Mech. Application)	Terrestrial Buffer (Spot Application)	Terrestrial Buffer (Mech. Application)
AquaMaster® (glyphosate)	0, 0, 0	0 feet	0 feet	0 feet	0 feet
Garlon 3A™ (triclopyr -amine salt formulation)	0, 1e, 1e	10 feet	50 feet	0 feet	30 feet
Garlon 4™ (triclopyr -ester formulations)	2, 0, 1	20 feet	100 feet	10 feet	60 feet
Habitat© (imazapyr)	0, 0, 0	0 feet	0 feet	0 feet	0 feet
Polaris© (imazapyr)	0, 0, 0	0 feet	0 feet	0 feet	0 feet
Rodeo ® (glyphosate)	0, 0, 0	0 feet	0 feet	0 feet	0 feet
Telar™ (chlorsulfuron)	0, 1e, 1e	10 feet	50 feet	0 feet	30 feet
Agri-Dex (**)	1, 1, 1	10 feet	50 feet	0 feet	30 feet

* Animal ecotoxicity ratings are as follows: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, e = eye irritation. Ecotoxicity ratings are provided for the following animal groups: warm water fish, small avian, small mammal. Small mammal recommendations are based on those developed for Hualapai Mexican vole, as specific recommendations for jumping mouse are not yet available.
** Nonionic, crop oil concentrate surfactant containing heavy range paraffinic oil, polyol fatty acid esters, and polyethoxylated derivatives thereof.

Agri-Dex®, or a similar nonionic, ether-based surfactant such as Chemsurf 90 may also be added to the above herbicides to achieve desired application characteristics (as per label directions). When used according to label directions, surfactants enhance the effectiveness of the herbicide by decreasing surface tension which increases coverage of the treated vegetation. More effective treatments ideally result in fewer herbicide applications. When adding a surfactant to an herbicide, buffer distances for the most encompassing ecotoxicity rating will be followed (e.g. if the herbicide's rating is 0 but the surfactant's rating is 1, the buffer for the latter will be used). Treatments will be conducted by trained and approved personnel and will not take place when winds exceed 10 miles per hour or when rain is forecasted for the local area within 48 hours of application. Care will be taken when mixing or applying any herbicide to avoid runoff onto the ground, and application will be in accordance with label directions. Vegetation control is not planned to occur between April 15 and August 15. If vegetation control should be needed between April 15 and August 15, migratory bird surveys will be conducted prior to activities and no mowing or herbicide treatment will occur within a 0.25 mile buffer of any nests found.

Existing Delta Channel Maintenance

Delta Channel maintenance activities will include management of sediment accumulation, berm repair, and management of vegetation within the channel. Any combination of these maintenance activities may be implemented, depending on what is required to achieve the desired channel characteristics for each Delta Channel reach. Work will be conducted each year from August 15 and continue until April 15. Project activities will begin at the current reservoir pool, depending on the condition of the channel and whether work needs to be done, and then will proceed upstream. The maximum amount of channel maintenance will be along approximately 0.5 miles per day. Estimated areas for wetted disturbance as a result of channel maintenance activities are show in Tables 4 and 5 below.

Table 4. Estimated in-water area of disturbance per year maintenance of existing channel (20.8 miles) (Reclamation 2014 – Appendix A).

	Amphibious Tracked Machines		**Airboats**	
	Maintenance Work (acres)	**Movement in Channel** (acres)	**Maintenance Support** (miles)	**Inspection Trips** (miles)
Crew #1				
(a) In-channel maintenance work: 25% of channel area in northern 9 miles of channel	63			
(b) Movement of excavators (30' width): 2 excavators @ 2.5 x 9 miles; 1 excavator @ 2.5 x 2 miles		182		

(c) Personnel Transport & Fueling			648	144
Crew #2				
(a) In-channel maintenance work: 25% of channel area in southern 12.4 miles of channel	50			
(b) Movement of excavators (30' wide path): 2 excavators @ 2.5 x 11.8 miles; 1 excavator @ 2.5 x 2 miles		233		
(c)Fueling: Amphibious Transporter (22' wide path): 198 miles per year		529		
(d) Personnel Transport			595	198
Totals (average per year)	**113 acres**	**944 acres**	**1,243 miles**	**342 miles**

Table 5. Estimated in-water area of disturbance per year extra crew as needed (9 miles) (Reclamation 2014 – Appendix A).

	Amphibious Tracked Machines		**Airboats**	
	Maintenance Work (acres)	**Movement in Channel** (acres)	**Maintenance Support** (miles)	**Inspection Trips** (miles)
Crew #3				
(a) In-channel maintenance work: 100% of channel area	82			
(b) Movement of excavators (30' wide path): 3 excavators @ 2.5 x 9 miles		245		
(c) Fueling: Amphibious Transporter (22' wide path): 198 miles per year		384		
(d) Personnel Transport			432	144
Totals	**82 acres**	**629 acres**	**432 miles**	**144 miles**

<u>Upper Reach (RM 57.8 to 51.2)</u>

Maintenance of the Delta Channel in this section will focus on maintaining existing berms, management of sediment accumulation, and the management of vegetation growth within the channel cross section to maintain a target conveyance capacity equal to 5,000 cubic-feet per second (cfs). The existing low flow thalweg in this reach will remain, allowing low flows to meander within the boundaries of the channel. Disturbance during maintenance activities will be confined within the existing construction footprint.

Naturally occurring breaches may remain open for a period of several months, providing overbanking flow to the adjacent floodplain. Such breaches are typically not viewed as emergencies and will usually not be repaired immediately for a variety of reasons, such as flows may be too high to safely work in the river, silvery minnow spawning may be occurring, and to avoid disturbance to nesting migratory birds. The flows from the breaches return to the Delta Channel at a downstream location.

The existing channel berm was constructed with a break at RM 54.7, west side, at the current Low Flow Conveyance Channel (LFCC) outfall. The constructed LFCC ends between RM 60 and 61, and its discharge then follows a low point in the valley to the west of the river, returning to the Delta Channel at the RM 54.7 outfall. Delta Channel maintenance will include removal of sediment from the outfall area, to allow LFCC discharge to enter the Delta Channel. Approximately 850 feet downstream of the LFCC outfall is a constructed feature referred to as the wing wall, which is essentially a small secondary channel that collects excess LFCC discharge. The wing wall extends from the Delta Channel to the west, a length of approximately 1,300 feet. In the past, maintenance of the wing wall included periodic removal of sediment; however, maintenance is no longer planned for this feature in order to preserve the flycatcher habitat that has developed at this location.

Secondary channels protruding from the main Delta Channel will not be excavated for the purpose of draining water from adjacent areas. Breaks in the berms may be constructed or naturally occurring inflow breaches allowed to remain for the purpose of allowing natural drainage into the Delta Channel and to prevent water from accumulating behind the berms, thus compromising their stability. Additionally, these openings allow water from the river to inundate areas behind the levee during the snowmelt runoff, providing a measure of ecosystem function to those areas. These openings will be maintained as necessary within the limits of the existing Delta Channel footprint. The determination to create breaks will be evaluated through an annual adaptive maintenance approach based on the river and reservoir conditions and influenced by habitat for listed species.

Each of the four staging areas in this reach are located near existing equipment launching areas, and will be maintained to the general dimensions originally constructed. These launching areas consist of a ramp into a very short secondary channel where equipment can be put in and taken out of the channel. Airboats are also typically docked in these areas when Delta Channel work is in progress. Maintenance of the launching areas will involve periodic removal of accumulated sediment.

Middle Reach (RM 51.2 to 40.7)

Maintenance of the Delta Channel in this section will also focus on maintaining existing berms, management of sediment accumulation, and the management of vegetation growth within the channel cross section to maintain a target conveyance capacity equal to 4,000 cfs. The existing low flow thalweg in this reach will remain, allowing low flows to meander within the boundaries of the channel. Disturbance during maintenance activities will be confined within the existing berm to berm foot print of the channel.

Naturally occurring breaches and secondary channels in this reach will be managed in the same manner as the Upper Reach, as described above.

Five of the seven staging areas located within this reach have existing equipment launching areas, which will be maintained to the original constructed dimensions, as described above.

Lower Reach (RM 40.7 to Active Reservoir Pool)
The Delta Channel width varies from 50 to 75 feet, and the general maintenance strategy will be the same as the Upper and Middle Reaches. The portion of this reach that has been constructed to date ends at RM 38. In some years, this reach may require extensive maintenance if the reservoir inundates the area for periods of time, which typically causes significant damage to the Delta Channel and berms. Following a period of inundation, reconstruction of the channel may be required, in which case reconstruction will be in accordance with the typical section for the Lower Reach. General practice will be to reconstruct the channel in the same location, but conditions may necessitate construction of a new channel utilizing a different alignment.

Below RM 38, field observations during 2012 and 2013 show that a natural dominant channel has formed as the reservoir level dropped below RM 38, due to the naturally steeper reservoir slope downstream of The Narrows. Field observations in 2012 documented this natural channel was beginning to form distributary flowpaths. "A channel with defined banks became naturally established for a distance of more than one mile during April –September 2012 as the reservoir receded below RM 37" (Holste 2013). Reclamation will maintain the alignment of the natural channel below RM 38 until such time that the area is inundated by the rising pool elevation and destroyed. Reclamation will repeat this process below RM 38 as needed. Maintenance of the naturally formed channel will be in wet conditions, with amphibious excavators, in the same general manner as described for maintaining the existing Delta Channel. Accumulated sediment will be excavated to maintain the natural dominant flowpath and used to form berms along the side.

Reservoir recession may expose cottonwood and salt cedar snags that will be removed during maintenance of the naturally formed channel. Prior to removal of such snags, a biological evaluation will be conducted to determine their significance for raptor and other migratory bird use.

Maintenance of this reach may also include excavation of secondary channels extending a short distance from the main Delta Channel, in order to provide an outlet to the main Delta Channel for isolated side pools or side channels in the delta area. These are low areas in the delta area (where there is limited vegetation) that continue to hold water after the reservoir pool recedes; connecting them to the main Delta Channel will reduce evaporation losses and increase deliveries to the reservoir for Compact deliveries. Construction of these channels will not be conducted in a manner that would completely drain the large isolated pool on the west side of the Delta Channel, between RM 40 and RM 41. However, if extremely dry conditions persist and the reservoir recedes, it is uncertain if groundwater flows will continue to keep the isolated pool wet.

Equipment Operations and Channel Disturbance
Delta Channel maintenance work on all reaches generally consists of removal of sediment deposits within the channel and repair of damage to berms. Berm damage may occur in several ways, including: 1) erosion of berm slopes or overtopping of berms due to high flows within the channel; and 2) saturation of berm material or overtopping of berms due to arroyo flows. Typical channel maintenance procedures involve removal of sediment from within the channel and placement of the material on the berms. It is expected that all of the removed sediment will

be used on the berms. In rare cases however, sediment may be used for road maintenance. Before sediment can be used for road work, excavators will place it at one of the identified staging areas to dry.

In-water maintenance work is performed by amphibious excavators, and dozers often work on the berms, pushing material deposited by excavators into place for berm repairs. Dozers may also work on the elevated floodplain bench surface within the existing channel of the Upper Reach. Maintenance work will include the mechanical removal of vegetation from berm slopes and point bars within all reaches, and will be accomplished by excavators or dozers.

Amphibious excavators are conventional tracked excavators mounted on pontoons to allow operation on very soft ground. Excavators generally work in the channel, often in water, and also move between work sites within the channel. At a work site they are typically set up in a stable position for performing work within a radius of approximately 40 feet. When work within that radius is complete, the excavator moves and begins excavation from the new setup location. When work in the general area is complete the excavator moves to the next work site.

Typical excavator operation involves removal of accumulated sediment from the channel and placement of the material on berms. In some cases, the berms have been eroded and have vertical banks on the Delta Channel side, and these berms are reconstructed using material from the channel. The excavators move material from the channel to the berm in three ways: 1) working from the channel, the excavator scoops up a bucket of channel material, often mixed with water, and then dumps the bucket on the berm; 2) working from the channel, the excavator pushes material from the channel up the slope of the berm with the back of the bucket; 3) working from the berm, the excavator pulls material up the slope of the berm with the bucket. Excavator operators are given instructions to structure their excavation operations to avoid the creation of isolated pools that could trap fish. Although it is possible that fish could be caught in the excavator bucket and placed on the berms, operators and inspectors report that they have not observed this happening during the last 12 years.

Delta Channel maintenance activities for all reaches will be confined to the area within the existing construction footprint and will not occur between April 15 and August 15. The regular maintenance period is September 1 to April 1 every year, although the work typically does not last through that entire period. An exception to the regular maintenance period would be in the case of emergency channel and berm repairs during spring runoff, and we expect that this event would happen once in a five year period for a period of two weeks near the end of runoff. Reclamation will coordinate with the Service if emergency work is needed, prior to any activity. If it is determined in the future that Delta Channel maintenance between April 15 and August 15 needs to become a routine annual activity, Reclamation will coordinate with the Service prior to implementing that decision, and migratory bird and mouse surveys would be conducted prior to any activity that has the potential to disturb migratory bird or mouse behavior and no such activity would occur within a 0.25 mile buffer of any migratory bird nests found. Road maintenance, with the exception of mowing and herbicide treatment, may be performed throughout the year.

An estimation of the portion of the Delta Channel impacted by maintenance work each year is as follows. Computation details are provided in Appendix A of the 2014 BA (Reclamation 2014).

- 75 to 100% of the channel length is traveled by amphibious excavators and fuel transporters, moving back and forth between equipment launching areas and work sites. This computes to an estimated 944 acres of channel disturbance in most years. If workload requires a third crew, there would possibly be an additional 629 acres of channel disturbance, for a total possible 1,573 acres in those years with three crews.

- Active work sites, where excavation is performed within the channel, are estimated to cover approximately 25% of the entire channel area each year for most years. For most years where two crews are needed, this computes to an estimated 113 acres per year that will have an excavator working within the existing channel area. If workload requires a third crew, there would possibly be an additional 82 acres per year that would have an excavator working within the existing channel area. Thus, the total possible area of active work sites would be 195 acres in those years with three crews.

Maintenance Support Operations
Maintenance support operations will include activities such as the transport of equipment operators and fuel via airboat, refueling operations, and pumping of water from the river for dust abatement.

Airboat Transport
Equipment operators and fuel for the equipment are often transported from equipment launching areas to work areas via airboats while maintenance work is in progress. Additionally, airboats cover the entire length of the Delta Channel an average of eight times per year (four round trips) for channel inspections. Channel inspections are typically conducted with two airboats traveling together due to safety concerns.

Refueling
Amphibious excavators are often fueled while in the water, and fuel is transported to them either by airboat or by an amphibious fuel transporter, which is also on tracked pontoons. Excavators are equipped with spill kits, which include booms designed to contain spilled fuel and absorbent pads. Operators are trained and knowledgeable on how to deal with spills should they occur.

Dust Abatement
To provide dust abatement for access road and staging area maintenance and safety during high traffic periods, water may be pumped from the river at or near existing equipment launching areas, requiring no new ground disturbance. Pumping is not expected to be needed between April 15 and August 15, however Reclamation will coordinate with the Service to avoid impacts to silvery minnow eggs and larvae if pumping is needed during this time (emergencies only). Pumping rates will vary between 1.8 and 2.2 cfs, requiring four to eight minutes to fill a water truck. This would be a minimal impact to river flows, equating to a decrease in flows of approximately 0.7% for river flows of 300 cfs and approximately 0.2% for river flows of 800 cfs for four to eight minutes. A typical project may use four to six truckloads per day and, at a maximum, 18 truckloads per day. This project is expected to use the typical amount or less. If

flows in the Delta Channel are lower than 300 cfs, Reclamation will not pump from the river without first coordinating with the Service. Pump intake pipes will use a 0.25 in (0.64 cm) mesh screen at the opening to the intake hose to minimize entrainment of aquatic organisms and no impacts to silvery minnows are expected. Sumps or secondary channels adjacent to the river will be used whenever feasible.

Conservation Measures
Reclamation proposes the following conservation measures to minimize or avoid adverse effects of implementing the Delta Channel maintenance project.

Timing of the Proposed Action

- Reclamation will seek to avoid impacts to birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703) by conducting Delta Channel maintenance activities outside of the normal breeding and nesting season (April 15 to August 15). Road maintenance such as grading and washout repair may be performed throughout the year, but vegetation control will not occur between April 15 and August 15. If emergency channel maintenance is needed between April 15 and August 15, Reclamation will coordinate with the Service prior to making repairs.

- If maintenance activities are necessary between April 15 and August 15, suitable/occupied flycatcher and cuckoo habitat will be avoided as much as possible, utilizing the annual survey results in conjunction with habitat suitability. Reclamation will use current flycatcher monitoring data to avoid work within 0.25 miles of an active nest as much as possible. Coordination and consultation with the Service will occur prior to such work activities.

Water Quality

- Minimize impact of hydrocarbons: To minimize potential for spills into or contamination of aquatic habitat:
    - Hydraulic lines will be checked each morning for leaks and periodically throughout each work day. Any leaky or damaged hydraulic hoses will be replaced.
    - All fueling will take place outside the active floodplain with a spill kit ready. Fuel, hydraulic fluids, and other hazardous materials may be stored on site overnight, but outside the normal floodplain, not near the river or any location where a spill could affect the river.
    - All equipment will undergo high-pressure spray cleaning and inspection prior to initial operation in the action area.
    - Equipment will be parked on pre-determined locations on high ground away from the river overnight, on weekends, and holidays.
    - Spill protection kits will be onsite, and operators will be trained in the correct deployment of the kits.

- Spill Protection BMPs. The excavators and fuel transporters have fuel spill kits, which include booms designed to contain spilled fuel and absorbent pads. Operators are trained and knowledgeable on how to deal with spills should they occur. Regular update sessions on use of the kit and on prevention measures will take place with the equipment operators.

- External hydraulic lines are composed of braided steel covered with rubber. When there is increased risk of puncture such as during mastication while removing vegetation, external hydraulic lines will be covered with additional puncture-resistant material, such as steel-mesh guards, Kevlar, etc. to offer additional protection.

- Equipment will be removed from the channel in the event of high storm surges.

- Reclamation will visually monitor for water quality at the areas below areas of river work before and during the work day. Water quality will be monitored during maintenance and after equipment operates in the river channel. Monitoring will include visual observations and may include direct sampling, as appropriate.

- Reclamation will excavate an area as few times as possible in the annual maintenance effort to minimize disturbance of sediments. When excavating within the wetted channel, the following practices will be used to minimize disturbance of sediments: minimize movement of excavator tracks and minimize excavator bucket contact with riverbed when not excavating.

Vegetation Control

- Only Service-approved herbicides will be used for vegetation control along access roads and staging areas. Treatments will be conducted by trained and approved personnel observing appropriate buffer distances (see Table 4). Treatments will not take place when winds exceed 10 miles per hour or when rain is forecasted for the local area within 48 hours of application. Care will be taken when mixing or applying any herbicide to avoid runoff onto the ground or into the water, and application will be in accordance with label directions. Service-approved surfactants may also be used to maximize herbicide performance and minimize retreatments.

- Reservoir recession may expose cottonwood and salt cedar snags that will be removed during maintenance of the naturally formed channel below RM 38 or excavation of secondary channels to connect isolated pools to the Delta Channel. Prior to removal of such snags, an evaluation will be conducted by a biologist to determine their significance for raptor or other migratory bird use. The channel alignment will be adjusted to avoid removal of significant snags when possible.

Dust Abatement

- Water used for dust abatement will be pumped from the river at or near existing equipment launching areas, requiring no new ground disturbance.

- Pumping is not expected to be needed between April 15 and August 15, however Reclamation will coordinate with the Service to avoid impacts to silvery minnow eggs and larvae if pumping is needed during this time (emergencies only).

- Pumping rates will vary between 1.8 and 2.2 cfs, requiring four to eight minutes to fill a water truck. This would be a minimal impact to river flows, equating to a decrease in flows of approximately 0.7% for river flows of 300 cfs and approximately 0.2% for river flows of 800 cfs for four to eight minutes. A typical project may use four to six truckloads per day and, at a maximum, 18 truckloads per day. This project is expected to use the typical amount or less.

- If flows in the Delta Channel are lower than 300 cfs, Reclamation will not pump from the river without first coordinating with the Service.

- Pump intake pipes will use a 0.25 in (0.64 cm) mesh screen at the opening to the intake hose to minimize entrainment of aquatic organisms. Sumps or secondary channels adjacent to the river will be used whenever feasible.

Monitoring

- Maintenance activities that have the potential for adverse impacts will be monitored in order to ensure compliance.

- Reclamation will continue to closely monitor channel bed elevation in the Delta Channel and upstream reaches (to RM 69), with data collection performed at least annually.

- Reclamation will continue to conduct annual fish community surveys and flycatcher and cuckoo surveys (following established protocols).

- Reclamation biologists will conduct a jumping mouse habitat survey in the summer of 2015 at the Pete Well Road equipment launching site. If suitable habitat is identified, Reclamation will coordinate with the Service prior to working at this site.

- Reclamation will report annually to the Service the results of species surveys and work accomplished on the Delta Channel maintenance project.

Other Measures

- Reclamation will obtain all applicable permits prior to implementation of the project, including Clean Water Act permits (CWA). Reclamation will comply with the requirements of the CWA and other permits associated with the project, including required reporting to the appropriate authorities as needed.

- To allow fish time to leave the area before in-water maintenance activities begin, the first piece of equipment (excavator) will initially enter the water slowly at the start of each work sequence in the river. If the excavator is already in place at the start of the work day, then the bucket of the excavator will be lowered slowly into the water to begin work. In-water work will be fairly continuous during work days, so that fish are less likely to return to the area once work has begun.

- Whenever possible, airboats will be operated through the center of the channel to minimize disturbance to minnows.

- Reclamation will maintain a floodplain and low flow channel (thalweg) in the upper seven miles of the Delta Channel. To the extent feasible, maintenance actions will allow for the naturally created point bars and small embayments within the low flow channel to remain in place.

Action Area
The action area includes all areas to be affected directly or indirectly by the proposed action (see 50 CFR §402.02). The proposed action will be conducted within the Delta Channel of the Rio Grande in Socorro and Sierra Counties, New Mexico. River maintenance activities will be conducted specifically within the boundaries of the Elephant Butte Reservoir between RM 62 and the current reservoir pool, which was estimated at RM 38 as of October 2014 (B. Hobbs, Reclamation, *pers. comm.* 2014). For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande encompassing the disturbance zone boundaries of this priority site located between RM 62 and the current reservoir pool at Elephant Butte.

II. STATUS OF THE SPECIES

The proposed action considered in this biological opinion may affect the silvery minnow provided protection as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.;* ESA). A description of this species, its status, and its habitat is provided below and inform the effects analysis for this biological opinion.

RIO GRANDE SILVERY MINNOW

Description
The silvery minnow is one of seven species in the genus *Hybognathus* that is found in the United States (Pflieger 1980). The silvery minnow currently occupies a 280-km (174-mi) stretch of the Middle Rio Grande, New Mexico, from Cochiti Dam in Sandoval County, to the headwaters of Elephant Butte Reservoir in Socorro County (U.S. Fish and Wildlife Service 1994). This includes a small section of the lower Jemez River, a tributary to the Rio Grande north of Albuquerque. The silvery minnow's current habitat is limited to approximately seven percent of its former range, and is split into four discrete reaches by three river-wide dams (Angostura, Isleta, and San Acacia Diversion Dams). The species has not been found upstream of Cochiti Dam to Embudo or in the Rio Chama downstream of Abiquiu Dam during numerous surveys since 1983. It is therefore also presumed to be extirpated from the Rio Grande drainage upstream of Cochiti Dam (Platania and Dudley 2003, Buntjer and Remshardt 2005).

The silvery minnow was also introduced into the Rio Grande near Big Bend, Texas, beginning in December 2008 as an experimental, non-essential population under section 10(j) of the ESA. This effort is still ongoing, and annual monitoring has confirmed survival, breeding, and movement both upstream and downstream of release sites (A. Roberson, Service, *pers. comm.* 2013).

The silvery minnow is a stout minnow, with moderately small eyes, a small, sub-terminal mouth, and a pointed snout that projects beyond the upper lip (Sublette et al. 1990). Live specimens are light greenish-yellow dorsally and light cream to white ventrally. The fins are moderate in length and variable in shape, with the dorsal and pectoral fins rounded at the tips. The body is fully scaled, with breast scales slightly embedded and smaller. The scales about the lateral line are sometimes outlined by melanophores, suggesting a diamond grid pattern. The eye is small and orbit diameter is much less than gape width or snout length (Bestgen and Propst 1996). Maximum length attained is about 90 mm (3.5 in) in standard length (SL)[2]. The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1996).

In the past, the silvery minnow was included with other species in the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinct from other species of *Hybognathus* (Cook et al. 1992, Bestgen and Propst 1996). It is now recognized as one of seven species in the genus *Hybognathus* in the United States and was formerly one of the most widespread and abundant minnow species in the Rio Grande basin of New Mexico, Texas, and Mexico (Pflieger 1980, Bestgen and Platania 1991). Currently, *Hybognathus amarus* is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande. The speckled chub *(Extrarius aestivalus),* Rio Grande shiner *(Notropis jemezanus),* phantom shiner *(Notropis orca),* and bluntnose shiner *(Notropis simus simus)* are either extinct or have been extirpated from the Middle Rio Grande (Bestgen and Platania 1991).

Legal Status

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (58 FR 36988; see U.S. Fish and Wildlife Service 1994). The species is also listed as an endangered species by the state of New Mexico (19 NMAC 33.1), the state of Texas (sections 65.171-65.184 of Title 31 T.A.C), and the Republic of Mexico (Secretaria de Desarrollo Social 1994). Primary reasons for listing the silvery minnow are described below in the *Reasons for Listing/Threats to Survival* section. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088). See description of designated critical habitat below.

Habitat

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette et al. 1990), yet generally prefers low velocity (< 10 cm/s or 0.33 ft/s) areas over silt or sand substrate that are associated with shallow (< 40 cm or 15.8 in) braided runs, backwaters, embayments, eddies formed by debris piles, or pools (Dudley and Platania 1997, Watts et al. 2002, Remshardt

[2] Standard length, or SL, is measured from the tip of the snout to the base of the tail whereas total length or TL, is measured from the tip of the snout to the end of the tail.

2007). Habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by the silvery minnow (Sublette et al. 1990, Bestgen and Platania 1991). This preference for low velocity habitat, especially for survival and recruitment of larval and juvenile minnows, exemplifies the habitat preferences and recruitment requirements of most common native Rio Grande fishes (Pease et al. 2006).

Passively drifting eggs and larvae are found throughout all habitat types, whereas adult silvery minnows are most commonly found in backwaters, pools, and habitats associated with debris piles, and young-of-year (YOY) fish occupy shallow, low velocity backwaters with silt substrates (Dudley and Platania 1997). A study conducted between 1994 and 1996 characterized habitat availability and use at two sites in the Middle Rio Grande - one at Rio Rancho and the other at Socorro. From this study, Dudley and Platania (1997) reported that the silvery minnow was most commonly found in habitats with depths less than 50 cm (19.7 in). Over 85 percent were collected from low-velocity habitats (<10 cm/s or 0.33 ft/s) (Dudley and Platania 1997, Watts et al. 2002). Habitat use also varies seasonally, with preferred summer habitat including pools and backwaters, while preferred winter habitat is found in or adjacent to instream debris piles and associated with deeper water (Dudley and Platania 1996, 1997).

In addition, silvery minnows have been shown to prefer silt and sand substrates over coarser substrates throughout all size classes (Dudley and Platania 1997). This preference has been linked to feeding requirements for benthic grazing of phytoplankton (Platania and Dudley 2003) and possibly swimming efficiency as a function of surface velocity (Bestgen et al. 2003; Bestgen et al. 2010). This type of habitat in the MRG was once prevalent, but coarsening of river bed sediments below Cochiti dam has been measured since the dam began to operate in 1974 (Lagasse 1981, Salazar 1998). Channel incision and stability have escalated as a result of hydrological changes as well, resulting in decreased connectivity of the main channel with floodplain habitat required by silvery minnows (Porter and Massong 2004).

Designated Critical Habitat

The action area for this consultation does not occur within designated critical habitat for the silvery minnow. However, a description of critical habitat is included here as it informs the overall status of the silvery minnow. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088; see U.S. Fish and Wildlife Service 2003a). The critical habitat designation extends approximately 252 km (157 mi) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility line crossing the Rio Grande, a permanent identified landmark in Socorro County, New Mexico north of Elephant Butte Reservoir and River Mile 62.1. The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 91.4 m (300 ft) of riparian zone adjacent to each side of the bankfull stage of the Middle Rio Grande. Some developed lands within the 300-ft lateral extent are not considered critical habitat because they do not contain the primary constituent elements of critical habitat and are not essential to the conservation of the silvery minnow. Lands located within the lateral boundaries of the critical habitat designation, but not considered critical habitat include: developed flood control facilities, existing paved roads, bridges, parking lots, dikes, levees, diversion structures, railroad tracks, railroad trestles, water diversion and irrigation canals outside of natural stream channels, the Low Flow Conveyance Channel, active gravel pits, cultivated agricultural land, and residential, commercial, and industrial developments. The Pueblo lands of Santo Domingo, Santa Ana, Sandia, and Isleta within this area are not included in the critical habitat designation because specific management plans for the Rio Grande silvery minnow were developed for these Pueblos prior to critical habitat designation (68 FR 8088; February 19, 2003). Except for these Pueblo lands, the remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat.

The Service determined the primary constituent elements (PCEs) of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology. These PCEs include:

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity – all of which are necessary for each of the particular silvery minnow life history stages in appropriate seasons (e.g., the silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) and fall (October) that do not increase prolonged periods of low- or no flow, and relatively constant winter flow (November through February));

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variation of habitats with a wide range of depth and velocities;

3. Substrates of predominantly sand or silt; and

4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1°C (35°F) and less than 30°C (85°F) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

These PCEs provide for the physiological, behavioral, and ecological requirements essential to the conservation of the silvery minnow. While all of these PCEs are found in each of the four sub-reaches within the MRG, it does not imply that optimal conditions for silvery minnows occur equally or at all times throughout this designated critical habitat.

Life History

Prior to Federal listing little was known of the life history and ecology of the silvery minnow (Sublette et al. 1990). Most of the following information has been derived from studies undertaken since the mid-1990s and in the Middle Rio Grande where habitat degradation and loss has occurred.

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event that passively drift while developing (Platania 1995, Platania and Altenbach 1998). The majority of adults in the wild spawn in about a one-month period in late spring to early summer (May to June) in association with spring runoff. Platania and Dudley (2000, 2001a) found that the highest collections of silvery minnow eggs occurred in mid-to late May. In 1997, Smith (1999) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple silvery minnow spawning events during the spring and summer, perhaps concurrent with flow spikes. Artificial spikes have apparently induced silvery minnows to spawn (Platania and Hoagstrom 1996). In captivity, silvery minnows have been induced to spawn as many as four times a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000); however, it is unknown if individual silvery minnows spawn more than once per year in the wild or if multiple spawning events suggested during spring and summer represent the same or different individuals.

The spawning strategy of releasing semi-buoyant eggs can result in the downstream displacement of eggs, especially in years or locations where overbank opportunities are limited. The presence of diversion dams (Angostura, Isleta, and San Acacia diversion dams) prevents the natural recolonization of upstream habitats (Platania 1995) and has reduced the species' effective population size (Ne) to critically low levels (Alo and Turner 2005, Osborne et al. 2005). Adults, eggs and larvae may also be transported downstream to Elephant Butte Reservoir. It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes (U.S. Fish and Wildlife Service 1999). Eggs that enter the reservoir may also settle out as velocity decreases in the delta area and subsequently suffocate as they become buried in silt and sediment (Platania and Altenbach 1998).

Platania (2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30°C water began hatching in approximately 24 hours while eggs reared in 20-24°C water hatched within 42-50 hours. Eggs were 1.6 mm (0.06 in) in size upon fertilization, but quickly swelled to 3.0 mm (0.12 in). Recently hatched larval fish are about 3.7 mm (0.15 in) in standard length and grow about 0.13 mm (0.005 in) per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for three to five days, and could be transported from 216 to 359 km (134 to 223 mi) downstream depending on river flows and availability of nursery habitat (Platania 2000). Approximately three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Colder water temperatures, however, would result in longer hatch times and larval development. This could result in longer time in the drift before the larval minnows would be self-mobile and able to move out of the deeper channel into nursery habitat (Platania 2000).

The majority of spawning silvery minnows are one year in age (U.S. Fish and Wildlife Service 2010). High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer (U.S. Fish and Wildlife Service 2010). Post-spawning mortality in adult fish is fairly common and has been documented in other cyprinid riverine fish (Meffe et al. 1988). Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1998). In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability.

The silvery minnow is primarily herbivorous, feeding mainly on algae, which is inferred indirectly by the elongated and coiled gastrointestinal tract (Sublette et al. 1990). Silvery minnows are also opportunistic benthic feeders, filtering detritus from the bottom substrate, primarily sand and silt (Sublette et al. 1990, U.S. Fish and Wildlife Service 1999, Magaña 2007). The presence of sand and silt in the gut of wild-captured minnows suggest that epipelic (growing on clay/silt) and epepsammic (growing on the surface of sand) algae are important foods (Shirey et al. 2008). Silvery minnows reared in the laboratory have also been directly observed to graze on algae in the aquaria (Platania 1995, Magaña 2007).

Age Classes, Longevity, and Population Dynamics

Based on length-frequency data collected from 2002 through 2006, there appears to be a minimum of two age classes at any one time in the silvery minnow population of the Middle Rio Grande, primarily of age-0 and age-1 fish between June and December, and age-1 and age-2 fish between January and June (Remshardt 2007, 2008a). This is based upon a minimum criterion of 35 mm standard length (SL) to differentiate age-1 from age-0 fish. Some individuals appear to be age-3, although estimated age-2 and age-3 individuals appear to comprise a very small proportion of the total population (<5%) in any given year (U.S. Fish and Wildlife Service 2010). Young-of-year (YOY; Age-0) attain lengths of 38 to 41 mm (1.5 to 1.6 in) by late autumn (U.S. Fish and Wildlife Service 2010). Age-l fish are 46 to 48 mm (1.8 to 1.9 in) by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, the maximum longevity documented is about three years based on a study of otolith and scale examinations (Horwitz et al. 2011). In comparison to longevity in the wild, it is not uncommon for captive silvery minnows to live beyond two years, especially at lower water temperatures (U.S. Fish and Wildlife Service 1999). The U.S. Geological Survey's (USGS) Columbia Environmental Research Center in Yankton, South Dakota has documented several silvery minnows in captivity with a maximum age of 11 years, ranging in size from 46 to 73 (± 8.1) mm SL (K. Buhl, *pers. comm.* as cited in U.S. Fish and Wildlife Service 2010).

The recent study by Horwitz et al. (2011) examined both scales and otoliths taken from 158 specimens of wild Rio Grande silvery minnows (83 collected in Fall 2009 and 75 collected in Spring 2010) to assign ages to fish. The authors found that the size and age structure of the Rio Grande silvery minnow is similar to that of other *Hybognathus* species (Horwitz et al. 2011). Horwitz et al. (2011) demonstrated Rio Grande silvery minnows live up to 3 years in the wild, with Age 3 fish being extremely rare and not appearing in every sample. The study found that 82% of the fish in the fall sampling were Age 0 and 1, and 96% of the fish were Age 1 and 2 in the spring (Horwitz et al. 2011).

Distribution and Abundance

Historically, the silvery minnow occurred in approximately 3,862 km (2,400 mi) of rivers in

New Mexico and Texas and was one of the most abundant and widespread species in the Rio Grande basin (Bestgen and Platania 1991, U.S. Fish and Wildlife Service 2010). The species was known to have occurred upstream to Española, New Mexico (upstream from Cochiti Lake); in the downstream portions of the Chama and Jemez Rivers; throughout the Middle and Lower Rio Grande to the Gulf of Mexico; and in the Pecos River from Sumner Reservoir downstream to the confluence with the Rio Grande (Sublette et al. 1990, Bestgen and Platania 1991). The current distribution of the silvery minnow is limited to the Rio Grande between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately seven percent of its historic range and encompasses several large municipalities, including the City of Albuquerque and several Native American Pueblos. This current range is fragmented by dams (Cochiti, Angostura, Isleta, and San Acacia) into four discrete reaches: Cochiti Reach (35.9 km/22.3 mi), Angostura Reach (65 km/40.4 mi), Isleta Reach (85.5 km/53.1 mi), and San Acacia Reach (93.7 km/58.2 mi) (U.S. Fish and Wildlife Service 2010). The species has also been found in the lower Jemez River, between the Jemez Canyon Dam and its confluence with the Rio Grande (approximately 2.8 mi).

In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). Monitoring of this reintroduced population, including genetics and reproduction, began in May 2009 and is ongoing. In 2010, the Service found evidence of successful reproduction with the detection of silvery minnow eggs, larvae and juvenile fish. An extensive monitoring effort in June 2011 determined that silvery minnows had extended their range in the recovery area almost 70 miles downstream and 15 miles upstream from the furthest downstream and upstream release sites, respectively (A. Roberson, Service, *pers. comm.*). Success of the Big Bend 10(j) population continues to be evaluated and relevant information incorporated into the assessment for potential reintroductions in additional locations.

Long-term Population Monitoring

Long-term monitoring for the Rio Grande silvery minnow began in 1993 and has continued annually, with the exception of 1998 and the majority of 2009. The area monitored for silvery minnows is the Middle Rio Grande from Cochiti Dam downstream to Elephant Butte Reservoir. Currently, there are 20 sites sampled 9 times annually: 5 sites in the Angostura Reach, 6 sites in the Isleta Reach, and 9 sites in the San Acacia Reach. Fifteen of these monitoring sites have been consistently used since 1993. Five additional sites were added in 2001 to increase the spatial extent of monitoring (Platania and Dudley 2001b, U.S. Fish and Wildlife Service 2010).

The long-term monitoring of silvery minnows has recorded substantial fluctuations (order of magnitude increases and decreases) in the overall population. It has also shown that silvery minnows tend to exhibit a heterogeneous spatial distribution within the Angostura, Isleta, and San Acacia reaches, most likely indicative of different micro- and macro-habitat conditions throughout the reach (Dudley et al. 2005). Rio Grande silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2004, but then increased three to four orders of magnitude in 2005 (see Figure 3). Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2007). The capacity of the species to respond to good hydrologic years (e.g. 2005, 2008) is dependent on a variety of factors including the previous year's survivorship and number of adults available to reproduce. The decline of silvery minnows after 2009 is the most precipitous recorded in the history of the silvery minnow monitoring program. The October 2012 data from all 20 sampling sites indicated a density of 0.0 silvery minnows per 100 m^2 (Dudley et al. 2012a). October monitoring data for 2013 showed silvery minnow persisting at extremely low densities (Dudley and Platania 2013), and the October 2014 data again indicated a density of 0.0 silvery minnows per 100 m^2 at all 20 sampling sites (Dudley and Platania 2014).

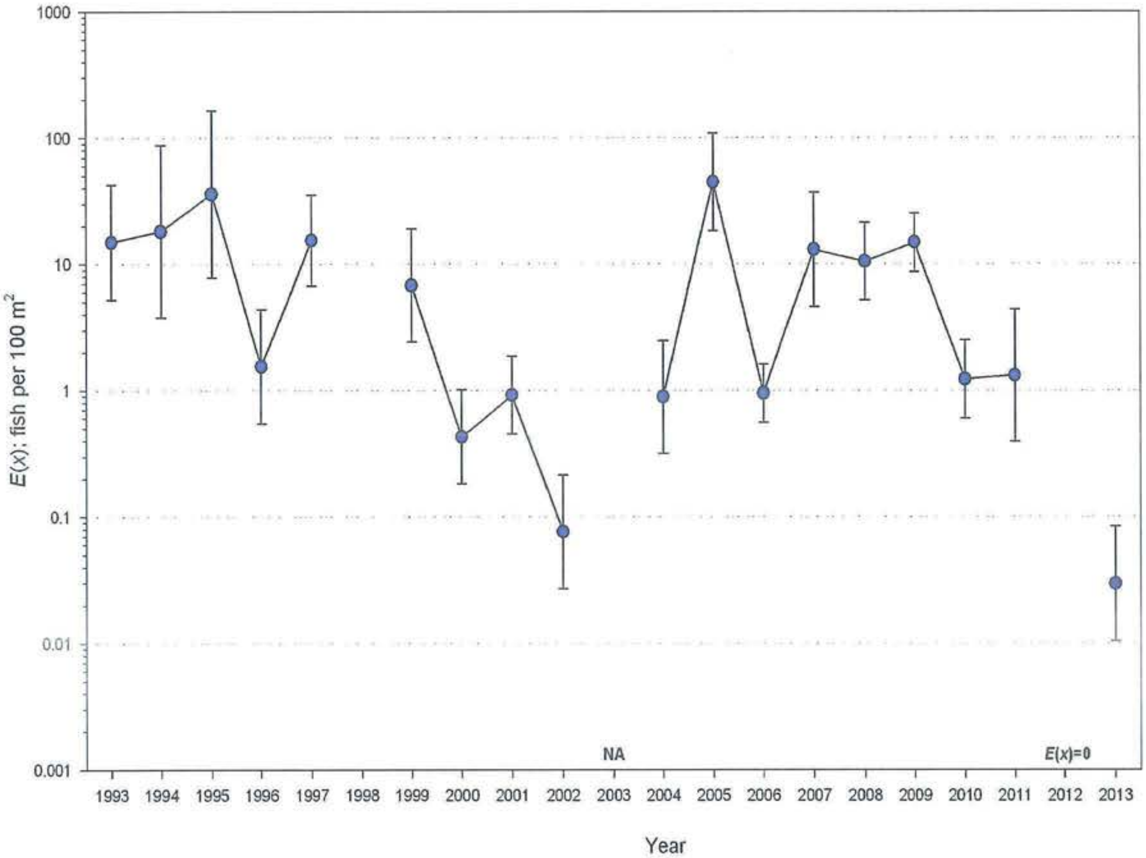

Figure 3. Rio Grande Silvery Minnow Catch Rate Trends 1993-2013 based on October CPUE data (Dudley et al. 2014)

The 20 sampling sites for long-term population monitoring include monitoring at RM 58.8 (10 miles below the San Marcial Railroad Bridge, site #18), which is approximately 3.2 miles upstream from the proposed action area. Population monitoring data from this site collected during the proposed river maintenance season (Sept – April) over the past five years indicates a trend of declining densities following augmentation each November, resulting in extremely low densities by the Fall of the following year (Table 6) (Dudley and Platania 2009a, 2011a, 2012, 2013, 2014).

Table 6. Monitoring conducted by ASIR at RM 58.8. Weighted line indicates the break between pre and post augmentation monitoring results.

Month	2010	2011	2012	2013	2014
CPUE (# of silvery minnow per 100m^2)					
September	1.06	0.19	0.00	0.00	0.00
October	0.00	2.87	0.00	0.00	0.00

December	6.55	15.43	****	9.16	****
February	13.99	14.99	4.04	****	1.47
April	1.65	0.00	0.39	****	0.00
Average	**4.65**	**6.70**	**1.11**	**3.05**	**0.37**

**** CPUE data is not currently available for December 2012, February 2013, April 2013, and December 2014.

Silvery minnow monitoring has also been conducted by Reclamation staff within the Delta Channel at 13 separate sites from RM 55 downstream to RM 37 (silvery minnows are not expected to be found past the inflow to the active reservoir pool). Monitoring was conducted at 4 sites in September 2010, at 5 sites in September 2011, at 4 sites in October 2012, at 8 sites in October 2013, and at 7 sites in October 2014 (Table 7, Figure 4). During the 2010, 2011, and 2013 surveys, silvery minnow were found in suitable habitat (shorelines, backwaters, pools). Though there was not a statistically significant difference between the densities of silvery minnow at individual sites, the upper two sites had higher mean density than the downstream sites (K. Oliver-Amy, Reclamation, *pers. comm.*). The decrease in mean density between 2010 and 2013 follows a similar pattern for silvery minnow throughout the MRG due to drought and decreased spring runoff (K. Oliver-Amy, Reclamation, *pers. comm.*). Reclamation biologists also conducted electrofishing surveys in February 2014 near the confluence of the LFCC and downstream into the Delta Channel. The sampling yielded 10 silvery minnow detections (J. Bachus, Reclamation, *pers. comm.* 2014).

Table 7. Silvery minnow catch rates from 2010 to present within the Delta Channel. River Miles are to the nearest whole RM, based on Reclamation's 2002 RM delineation (K. Amy-Oliver and B. Hobbs, Reclamation, *pers comm.* 2014).

River Mile (2002 delineation)	2010 (September)	2011 (September)	2012 (October)	2013 (October)	2014 (October)
CPUE (# of silvery minnow per $100m^2$)					
55	--	5.56	--	0.00	0.00
53	--	--	0.00	--	--
52	--	3.47	--	0.00	--
51	63.09	1.33	0.00	--	0.12
50	27.01	--	--	--	0.15
48	1.98	2.40	0.00	0.00	0.35
47	--	1.81	--	--	--
46	10.07	--	0.00	0.34	--
44	--	--	--	--	0.28
43	--	--	--	0.39	--
41	--	--	--	0.00	--
39	--	--	--	--	0.41
37	--	--	--	--	0.00
Average	**24.07**	**2.83**	**0.00**	**0.08**	**0.13**

Augmentation of the Silvery Minnow Population

Augmentation has likely sustained the silvery minnow population throughout its range. Over 2.3

million silvery minnows have been released in the Middle Rio Grande since 2002 (Archdeacon 2013, T. Archdeadon, Service, *pers. comm.* 2014). Captively propagated and released fish supplement the native adult population, most likely prevented extinction during the extremely low water years of 2002 and 2003, and allowed for quicker and more robust population responses in all reaches due to improved water conditions observed in recent years. Starting in 2001, the Angostura Reach had been the focus of augmentation efforts; however, beginning in 2008, augmentation shifted focus to the Isleta and San Acacia Reaches only (J. Remshardt, Service, *pers. comm.* 2010). To accurately determine the success of these efforts and the continued effects of these releases, a period of five years (2008-2012) without intensive stocking is being evaluated. Augmentation was re-initiated for the Angostura Reach in 2013.

Middle Rio Grande Distribution Patterns

During the early 1990s, the density of silvery minnows generally increased from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnow captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This distributional pattern can be attributed to downstream drift of eggs and larvae and the inability of adults to repopulate upstream reaches because of diversion dams.

This pattern has changed in recent years. In 2004, 2005, and 2007, catch rates were highest in the Angostura Reach and lower in the Isleta and San Acacia Reaches. Routine augmentation of silvery minnows in the Angostura Reach (the focus of augmentation efforts starting in 2001) may partially explain this pattern. Transplanting of silvery minnows rescued from drying reaches, approximately 743,385 individuals through 2012 (Remshardt and Archdeacon 2011), has also occurred since 2003; however, it is not possible to quantify the effects of those efforts on silvery minnow distribution patterns (J. Remshardt, Service, *pers. comm.* 2010). Good recruitment conditions (i.e., high and sustained spring runoff) throughout the Middle Rio Grande during April and May followed by wide-scale drying in the Isleta and San Acacia reaches from June September in these years, may also explain the shift. High spring runoff (>3,000 cfs for 7-10 days) and perennial flow lead to increased availability of nursery habitat and increased survivorship in the Angostura Reach. In contrast, south of the Isleta and San Acacia Diversion Dams, large stretches of river (30+ miles) have been routinely dewatered and young silvery minnows in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low-flows) or were trapped in drying pools where they perished.

In 2006, densities of silvery minnows were again highest downstream of San Acacia. Spring runoff volumes were exceedingly low in 2006. Flows at the Albuquerque gage never exceeded 3,000 cfs in 2006 (U.S. Geological Survey 2010) and likely very little nursery habitat was inundated during critical recruitment times.

Distribution patterns for silvery minnows shifted again in 2007 and again in 2008 and 2009. In 2007, population monitoring of silvery minnow densities indicated the highest densities occurred in the Angostura Reach. Available reports for 2008 indicated high recruitment, with silvery minnows occurring at all 20 sampling sites along the Middle Rio Grande, and flow conditions (i.e., strong runoff over an extended duration from May to July, no summer river drying) leading to elevated numbers of this species. Sampling in October 2009 also indicated high recruitment, with silvery minnows present at 19 of the 20 sampling sites. The highest densities were noted to persist in the San Acacia Reach during the population monitoring census in October of both 2008 and 2009, and the lack of extensive river drying these years, combined with favorable spring flows, was likely an important factor in this distribution shift compared to 2007 (i.e., from highest densities in the Angostura Reach in 2007 to highest densities in the San Acacia Reach in 2008 and 2009) (Dudley and Platania 2008, 2009b).

During October 2010, Rio Grande silvery minnows were collected in low numbers at the 20 sampling sites, with densities that were significantly lower than in recent years (e.g., 2007, 2008, and 2009). And in 2011, silvery minnows were collected at only eight of the 20 sampling sites in October; catch rates were generally low at all sites, with a few exceptions in the southern portion of the San Acacia Reach (Dudley and Platania 2011c). Recruitment success throughout the Middle Rio Grande was fairly low in 2011 given the poor spring runoff and low flows during the remainder of the summer (Dudley and Platania 2011c). The pattern of highest densities occurring in the San Acacia Reach and the lowest in the Angostura Reach continued in both 2010 and 2011 (Dudley and Platania 2011b, c). Silvery minnow densities continued to decline in 2012 and during the October 2012 monitoring effort, no silvery minnow were detected at any of the 20 monitoring sites (Dudley et al. 2012a). This represents the lowest silvery minnow densities seen since the monitoring program began in 1993. Densities in 2013 and 2014 were again extremely low, and no silvery minnow were detected at any of the 20 monitoring sites during the October 2014 monitoring effort (Dudley et al. 2014, Dudley and Platania 2014).

Available information for 2014 indicates that silvery minnow densities remain extremely low (Feb = 1.2/100m^2; May = 0.05/100m^2; June = 0.4/100m2; July = 0.4/100m^2; Aug = 0.36/100m^2; Sep = 0.22/100m^2; Oct = 0.00m^2), and few wild adult and YOY silvery minnow captured during the 2014 population monitoring effort (Dudley and Platania 2014). Rescue and salvage activities documented a total of 630 silvery minnow, with 557 silvery minnow salvaged, transported, and released alive to continuously flowing sites. Of the total number of silvery minnow observed, 90.2% were VIE tagged, indicating that they were hatchery-released individuals from Fall 2013 (T. Archdeacon, Service, *pers. comm.* 2014).

Reasons for Listing/Threats to Survival

The 1994 listing package (59 FR 36988) described numerous threats to the Rio Grande silvery minnow. Originally identified threats to the species, along with additional threats identified since the silvery minnow was federally listed as endangered include (a) the present or threatened destruction, modification, or curtailment of its habitat or range through dewatering and diversion, water impoundment, river modification, and water pollutants, (b) possible overutilization for commercial, recreational, scientific, or educational purposes through scientific collection and bait collection, (c) disease or predation through risk of stress and disease when confined to pools during periods of low river flows and when exposed to high levels of pollutants, as well as predation by non-native fishes, birds, and mammals and competition for resources during low flows, (d) the lack of protection of habitat under State law, the inability to acquire instream water rights for the benefit of fish and wildlife, and inadequate regulations related to bait fish, and (e) other factors such as loss of genetic diversity, competition from non-native fish, and climate change.

A more comprehensive explanation of listing factors and current threats to the species can be found in the Recovery Plan (U.S. Fish and Wildlife Service 2010). These reasons for listing continue to threaten the species throughout its currently occupied range in the Middle Rio Grande.

Recovery Efforts

A final Recovery Plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999). The Recovery Plan was updated and revised, and the First Revision of the Rio Grande Silvery Minnow Recovery Plan was finalized and issued on February 22, 2010 (75 FR 7625). The revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2010). The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are:

1. Prevent the extinction of the Rio Grande silvery minnow in the Middle Rio Grande of New Mexico.

2. Recover the Rio Grande silvery minnow to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).

3. Recover the Rio Grande silvery minnow to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Downlisting (Goal 2) for the Rio Grande silvery minnow may be considered when the criteria have been met resulting in three populations (including at least two that are self-sustaining) that have been established within the historical range of the species and have been maintained for at least five years.

Delisting (Goal 3) of the species may be considered when the criteria have been met resulting in three self-sustaining populations that have been established within the historical range of the species and have been maintained for at least ten years (U.S. Fish and Wildlife Service 2010).

Conservation efforts targeting the Rio Grande silvery minnow are also summarized in the revised Recovery Plan. These efforts include habitat restoration activities; research and monitoring of the status of the silvery minnow, its habitat, and the associated fish community in the Middle Rio Grande; and programs to stabilize and enhance the species, such as tagging fish and egg monitoring studies, salvage operations, captive propagation, and augmentation efforts. In addition, specific water management actions in the Middle Rio Grande valley over the past several years have been used to meet river flow targets and March 2003 BO requirements for silvery minnows.

III. ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the ESA (50 FR 402.02) define the environmental baseline as 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 actions in the action area that have already undergone formal or early section 7 consultation; and the impact of State and private actions that are contemporaneous with the consultation in process. The environmental baseline defines the effects of these activities in the action area on the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.

Several activities have contributed to the current status of the silvery minnow and its habitat in the action area, and are believed to affect the survival and recovery of silvery minnows in the wild. Many of these activities are broader than the action area but have effects that extend into the action area. These include changes to the natural hydrology of the Rio Grande, changes to the morphology of the channel and floodplain, current weather patterns including climate change, water quality, storage of water and release of spike flows, captive propagation and augmentation, silvery minnow salvage and relocation, ongoing research, and past projects in the Middle Rio Grande.

Changes in Hydrology

There have been two primary changes in hydrology as a result of the construction of dams on the Rio Chama and Rio Grande that affect the silvery minnow: (1) loss of water in minnow habitat and (2) changes to the magnitude and duration of peak flows.

Loss of Water in Minnow Habitat

Prior to the large-scale influence of humans on the watershed, the Rio Grande ecosystem was a highly dynamic fluvial system with channel dimension, planform and profile reflective of the natural basin hydrology, sediment regime, and site-specific geological and local controls (U.S. Fish and Wildlife Service 2010). It is believed that a significant portion of the river was a wide, braided, sand-bedded system with an extensive active floodplain composed of numerous secondary channels, floodplain lakes and marshes, and woody debris. The Rio Grande River has undergone considerable change in the last 150 years and is no longer the highly dynamic system it once was. Several large dams and irrigation diversions have been built on the river, and the entire system (U.S. Fish and Wildlife Service 2010). There is now strong evidence that the Middle Rio Grande first began drying up periodically after the development of Colorado's San Luis Valley in the mid to late 1800s (Scurlock 1998). After humans began exerting greater influence on the river, there are two documented occasions when the river became intermittent during prolonged, severe droughts in 1752 and 1861 (Scurlock 1998). The silvery minnow historically survived low-flow periods because such events were infrequent and of lesser magnitude than they are today. There were also no diversion dams at that time to block repopulation of upstream areas, the fish had a much broader geographical distribution, and there were oxbow lakes, cienegas, and sloughs associated with the Rio Grande that supported fish until the river became connected again.

Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the Middle Rio Grande Conservancy District (MRGCD) was 535,280 acre-feet (ac-ft) for the period from 1975 to 1989 (Bureau of Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 ac-ft, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent or dry for extended reaches. Irrigation diversions and drains significantly reduce water volumes in the river. However, the total water use (surface and groundwater) in the Middle Rio Grande by the MRGCD may range from 28 – 37 percent (S.S. Papadopulos & Associates Inc. 2000, Bartolino and Cole 2002). A portion of the water diverted by the MRGCD returns to the river and may be re-diverted, sometimes more than once (Bullard and Wells 1992). Although the river below Isleta Diversion Dam may be drier than in the past, small inflows may contribute to maintaining flows. Since 2001, improvements to physical and operational components of the irrigation system have contributed to a reduction in the total diversion of water from the Middle Rio Grande by the MRGCD. Prior to 2001, average diversions were 630,000 ac-ft per year and now average 370,000 ac-ft per year. The change was possible because of the considerable efforts of MRGCD to install new gages, automated gates at diversions, and the scheduling and rotation of diversions among water users. The new operations reduce the amount of water diverted; however, this also reduces return flows that previously supported flow in the river. In February 2007, the City of Albuquerque and Albuquerque Bernalillo County Water Utility Authority with six conservation groups established a fund that will provide the opportunity to lease water from Rio Grande farmers and have that water remain in the river channel to support the silvery minnow. The Pilot Water Leasing Project supports the need for reliable sources of water to support conservation programs as identified by the Collaborative Program (Middle Rio Grande Endangered Species Collaborative Program 2004).

River reaches particularly susceptible to drying occur immediately downstream of the Isleta Diversion Dam (river mile 169), a 5-mile (8-km) reach near Tome (river miles 150-155), a 5-mile (8-km) reach near the U.S. Highway 60 Bridge (river miles 127-132), and an extended 36-mile (58-km) reach from near Brown's Arroyo (downstream of Socorro) to Elephant Butte Reservoir (U.S. Fish and Wildlife Service 2010). Extensive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried. It is assumed that mortalities during river intermittence are likely greater than documented levels, for example due to predation by birds in isolated pools (J. Smith, NMESFO, *pers. comm.* 2003). From 1996 to 2007, an average of 32 miles of the Rio Grande has dried each year, mostly in the San Acacia Reach. The most extensive drying occurred in 2003 and 2004 when 60 and 68.7 miles, respectively, were dewatered. Most documented drying events lasted an average of two weeks before flows returned. In contrast, 2008 was considered a wet year, with above average runoff and at least an average monsoon season. As a result, there was no river intermittency and no minnow salvage that year, which is the first time there has been no river drying since at least 1996. The 2012 irrigation season exhibited the greatest amount of drying since 2004, with approximately 51 total unique miles dried in both the San Acacia (31.8 mi) and Isleta (19.2 mi) Reaches (Archdeacon and Remshardt 2013). The maximum duration of intermittency was approximately 6 weeks in the San Acacia Reach and 15 weeks in the Isleta Reach. As of July 31, 2013, rescue and salvage activities have been conducted on 36.8 unique miles of the Rio Grande (T. Archdeacon, Service, *pers. comm.* 2013).

Changes to Magnitude and Duration of Peak Flows

Water management has also resulted in a loss of peak flows that historically triggered the initiation of silvery minnow spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows or altered timing of flows may inhibit reproduction. Since completion of Elephant Butte Dam in 1916, four additional dams have been constructed on the Middle Rio Grande, and two have been constructed on one of its major tributaries, the Rio Chama (Scurlock 1998). Construction and operation of these dams, which are either irrigation diversion dams (Angostura, Isleta, San Acacia) or flood control and water storage dams (Elephant Butte, Cochiti, Abiquiu, El Vado), have modified the natural flow of the river. Mainstem dams store spring runoff and summer inflow, which would normally cause flooding, and release this water back into the river channel over a prolonged period of time. These releases are often made during the winter months, when low-flows would normally occur. For example, release of carryover storage from Abiquiu Reservoir to Elephant Butte Reservoir during the winter of 1995-96 represented a substantial change in the flow regime. The Army Corps of Engineers (Corps) consulted with the Service on the release of water from November 1, 1995 to March 31, 1996, during which time 98,000 ac-ft of water was released at a rate of 325 cfs. Such releases depart significantly from natural, historic winter flow rates, and can substantially alter the habitat for silvery minnows. In spring and summer, artificially low-flows may limit the amount of habitat available to the species and may also limit dispersal of the species (U.S. Fish and Wildlife Service 1999).

In the spring of 2002 and 2003, an extended drought raised concerns that silvery minnows would not spawn because of a lack of spring runoff. River discharge was artificially elevated through short duration reservoir releases during May to induce silvery minnow spawning. In response to the releases, significant silvery minnow spawning occurred and was documented in all reaches except the Cochiti Reach (Dudley et al. 2005). Fall populations in 2003 and 2004 continued to decrease despite large spawning events, indicating a lack of recruitment.

By contrast, spring runoff in 2005 was above average, leading to a peak of over 6,000 cfs at Albuquerque and sustained high flows (> 3,000 cfs) for more than two months. These flows improved conditions for both spawning and recruitment. October 2005 monitoring indicated a significant increase in silvery minnows in the Middle Rio Grande compared to 2003 and 2004. In 2006, however, October numbers declined again after an extremely low runoff period and channel drying in June and July (Dudley et al. 2006). October samples that year yielded no small silvery minnows, indicating poor recruitment in the spring.

Runoff conditions in 2007, 2008, and 2009 were average or above average, however conditions since 2009 have been progressively poorer, with 2010 through 2014 all exhibiting dry flow year conditions. In 2010, the maximum spring peak flow through Albuquerque (measured at the Central Avenue Bridge gage) had a mean daily discharge of 4,900 cfs, due in part to the Army Corps of Engineers' release of stored water for overbank flooding. The maximum duration of these sustain high flows however, only lasted for 10 days (U.S. Geological Survey 2012). October 2010 monitoring indicated reduced recruitment success for silvery minnow in all 3 reaches (Dudley and Platania 2010). In 2011, the maximum spring peak flow had a mean daily discharge of only 1,330 cfs (U.S. Geological Survey 2012). During October 2011 population monitoring, no larval silvery minnow were collected, and recruitment success throughout the Middle Rio Grande was fairly low given the poor spring runoff and low flows seen during the summer (Dudley and Platania 2011a). The spring runoff conditions were again poor in 2012, with the mean daily discharge peaking at 2,070 cfs (U. S. Geological Survey 2013). During the September 2012 monitoring effort, only 3 adult and 2 larval silvery minnows were collected, and no silvery minnow were collected during October 2012 sampling. These low numbers again indicate very poor recruitment given poor spring runoff conditions and extensive drying during the irrigation season (Dudley et al. 2012b, a). In 2013, spring runoff conditions were extremely low, with the highest discharge measured at Albuquerque being 849 cfs (U.S. Geological Survey 2013, provisional). In 2014, natural spring runoff conditions were augmented resulting in a maximum discharge of 1,470 cfs in May and a second pulse in June with a maximum discharge of 1,580 cfs (U.S. Geological Survey 2014, provisional). Extremely low densities of silvery minnow were observed in October 2013 and 2014, even despite efforts to augment the 2014spring flow. These results appear to indicate that current management efforts have not been successful in buffering the silvery minnow population against decline (Dudley et al. 2014).

Mainstem dams and the altered flows they create can affect habitat by preventing overbank flooding, trapping nutrients, altering sediment transport regimes, reducing and dewatering main channel habitat, modifying or eliminating native riparian vegetation, and creating reservoirs that favor non-native fish species. These changes may affect the silvery minnow by reducing its food supply; altering its preferred habitat, preventing dispersal, and providing a continual supply of non-native fish that may compete with or prey upon silvery minnows. Altered flow regimes may also result in improved conditions for other native fish species that occupy the same habitat, causing those populations to expand at the expense of the silvery minnow (U.S. Fish and Wildlife Service 1999).

In addition to providing a cue for spawning, flood flows also maintain a channel morphology to which the silvery minnow is adapted. The changes in channel morphology that have occurred from the loss of flood flows are discussed below.

<u>Changes in Channel and Floodplain Morphology</u>

Historically, the Rio Grande was sinuous, braided, and freely migrated across the floodplain. Changes in natural flow regimes, narrowing and deepening of the channel, and restraints to channel migration (i.e., jetty jacks) adversely affected the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These anthropogenic changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species' survival and recovery (U.S. Fish and Wildlife Service 1993).

The active river channel within occupied habitat is also being narrowed by the encroachment of vegetation, resulting from continued low-flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as salt cedar and Russian olive to encroach on the river channel (Bureau of Reclamation and U.S. Army Corps of Engineers 2001). These non-native plants are very resistant to erosion, resulting in channel narrowing and a subsequent increase in water velocity. Higher velocities result in fine sediment such as silt and sand being carried away, leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow is decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and YOY.

Within the current range of the silvery minnow, human development and use of the floodplain have greatly restricted the width available to the active river channel. A comparison of river area between 1935 and 1989 shows a 52 percent reduction, from 26,598 acres (10,764 ha) to 13,901 acres (5,626 ha) (Crawford et al. 1993). These data refer to the Rio Grande from Cochiti Dam downstream to the "Narrows" in Elephant Butte Reservoir. Within the same stretch, 234.6 mi (378 km) of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 mi (290 km) of river, only 1 mi (1.6 km), or 0.6 percent of the floodplain has remained undeveloped. Development in the floodplain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. As a result, reduced releases have decreased available habitat for the silvery minnow and allowed encroachment of non-native species into the floodplain.

<u>Climate Change</u>

"Climate" refers to an area's long-term average weather statistics (typically for at least 20- or 30-year periods), including the mean and variation of surface variables such as temperature, precipitation, and wind. "Climate change" refers to a change in the mean and variability of climate properties that persists for an extended period (typically decades or longer), whether due to natural processes or human activity (Intergovernmental Panel on Climate Change 2007a). Although changes in climate occur continuously over geological time, changes are now occurring at an accelerated rate. For example, at continental, regional, and ocean basin scales, recent observed changes in long-term trends include: a substantial increase in precipitation in eastern parts of North American and South America, northern Europe, and northern and central Asia, and an increase in intense tropical cyclone activity in the North Atlantic since about 1970 (Intergovernmental Panel on Climate Change 2007a); and an increase in annual average temperature of more than 1.1 °C (2 °F) across U.S. since 1960 (Karl et al. 2009).

The IPCC used Atmosphere-Ocean General Circulation Models and various greenhouse gas emissions scenarios to make projections of climate change globally and for broad regions through the 21st century (Meehl et al. 2007, Randall et al. 2007), and reported these projections using a framework for characterizing certainty (Solomon et al. 2007). Examples include: 1) it is virtually certain there will be warmer and more frequent hot days and nights over most of the earth's land areas; 2) it is very likely there will be increased frequency of warm spells and heat waves over most land areas, and the frequency of heavy precipitation events will increase over most areas; and 3) it is likely that increases will occur in the incidence of extreme high sea level (excluding tsunamis), intense tropical cyclone activity, and the area affected by droughts (Intergovernmental Panel on Climate Change 2007b, Table SPM.2). More recent analyses using a different global model and comparing other emissions scenarios resulted in similar projections of global temperature change across the different approaches (Prinn et al. 2011).

All models (not just those involving climate change) have some uncertainty associated with projections due to assumptions used, data available, and features of the models; with regard to climate change this includes factors such as assumptions related to emissions scenarios, internal climate variability and differences among models. Despite this, however, under all global models and emissions scenarios, the overall projected trajectory of surface air temperature is one of increased warming compared to current conditions (Meehl et al. 2007, Prinn et al. 2011). Climate models, emissions scenarios, and associated assumptions, data, and analytical techniques will continue to be refined, as will interpretations of projections, as more information becomes available. For instance, some changes in conditions are occurring more rapidly than initially projected, such as melting of Arctic sea ice (Comiso et al. 2008, Polyak et al. 2010), and since 2000 the observed emissions of greenhouse gases, which are a key influence on climate change, have been occurring at the mid- to higher levels of the various emissions scenarios developed in the late 1990's and used by the IPCC for making projections (Raupach et al. 2007, Figure 1, Pielke et al. 2008, Manning et al. 2010, Figure 1). The best scientific and commercial data available indicates that average global surface air temperature is increasing and several climate-related changes are occurring and will continue for many decades even if emissions are stabilized soon (Meehl et al. 2007, Gillett et al. 2011, Church et al. 2010).

Changes in climate can have a variety of direct and indirect impacts on species, and can exacerbate the effects of other threats. Rather than assessing "climate change" as a single threat in and of itself, we examine the potential consequences to species and their habitats that arise from changes in environmental conditions associated with various aspects of climate change. For example, climate-related changes to habitats, the quality, availability, and timing of prey to developing fish and wildlife, predator-prey relationships, disease and disease vectors, or conditions that exceed the physiological tolerances of a species, or that alter the rate of metabolic and biochemical processes within organisms, the occurring individually or in combination, may affect the status of a species. Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and adaptive capacity (Intergovernmental Panel on Climate Change 2007a, Glick et al. 2011).

While projections from global climate model simulations are informative and in some cases are the only or the best scientific information available, various downscaling methods are being used to provide higher-resolution projections that are more relevant to the spatial scales used to assess impacts to a given species (see Glick et al. 2011). With regard to the area of analysis for the silvery minnow, the following downscaled projections are available.

The New Mexico Office of the State Engineer (2006) made the following observations about the impact of climate change in New Mexico:

1. warming trends in the Southwest exceed global averages by about 50 percent;

2. modeling suggests that even moderate increases in precipitation would not offset the negative impacts to the water supply caused by increased temperature;

3. temperature increases in the Southwest are predicted to continue to be greater than the global average;

4. there will be a delay in the arrival of snow and acceleration of spring snow melt, leading to a rapid and earlier seasonal runoff; and

5. the intensity, frequency, and duration of drought may increase.

Most of the upper Rio Grande basin is arid or semiarid, generally receiving less than 25 cm (10 in) of precipitation per year (Bureau of Reclamation 2011). In contrast, some of the high mountain headwater areas receive on average over 100 cm (40 in) of precipitation per year. Most of the total annual flow in the Rio Grande basin results, ultimately, from runoff from mountain snowmelt (Bureau of Reclamation 2011). In the Middle Rio Grande, there is expected earlier peak streamflows, reduced total streamflows, and more water lost to evaporation (Hurd and Coonrod 2007).

Climate change predicts four major impacts on silvery minnow habitat: 1) increased water temperature; 2) decreased streamflow; 3) a change in the hydrograph; and 4) an increased occurrence of extreme events (fire, drought, and floods). These impacts may reduce the amount and quality of silvery minnow habitat, may affect silvery minnow physiology and phrenology (the timing and availability of resources necessary for silvery minnow growth to maturity), may affect the density, type and seasonal availability of prey available to developing larvae and maturing silvery minnow, as well as the amount of primary productivity and oxygen saturation, and may affect biological interactions with other aquatic and terrestrial species. Decreased streamflow may result in the river becoming more intermittent, and fish isolated in pools may be subject to increased stress and predation. And changes to the hydrograph during spring runoff would affect the reproductive success of the silvery minnow that is dependent on river flow pulses to spawn. As such, the slivery minnow may be adversely affected by impacts due to climate change. Overall, the predicted effects of climate change are expected to result in degradation of the remaining silvery minnow habitat, with potential adverse consequences on species viability.

Water Quality

Many natural and anthropogenic factors affect water quality in the Middle Rio Grande, including the action area. Water quality in the Middle Rio Grande varies spatially and temporally throughout its course primarily due to inflows of groundwater, as well as surface water discharges and tributary delivery to the river. Factors that are known to cause poor fish habitat include temperature changes, sedimentation, runoff, erosion, organic loading, reduced oxygen content, pesticides, and an array of other toxic and hazardous substances. Both point source pollution (e.g., pollution discharges from a pipe) and non-point source pollution (i.e., diffuse sources) affect the Middle Rio Grande. Major point sources include waste water treatment plants (WWTPs) and feedlots. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), urban storm water run-off, and mining activities (Ellis et al. 1993).

Large precipitation events wash sediment and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Constituents of concern that are commonly found in stormwater include petroleum hydrocarbons (from oil spills, parking lot runoff, illicit dumping, roadways); the metals aluminum, cadmium, lead, nickel, copper, chromium, mercury, and zinc; nutrient runoff (phosphates, nitrogen compounds, potassium, trace elements); pesticide runoff (herbicides, insecticides, fungicides, termiticides); solid waste; sedimentation, erosion, and salts (which reduce oxygen content in water and alter habitat); toxics such as PCBs and controlled substances; the industrial solvents trichloroethene and tetracholoroethene (TCE); and the gasoline additive methyl tert-butyl ether (U.S. Geological Survey 2001, New Mexico Environment Department 2010; J. Lusk, Service, *pers. comm.* 2010).

Sediment is the sand, silt, organic matter, and clay portion of the river bed, or the same material suspended in the water column. Ong *et al.* (1991) recorded the concentrations of trace elements and organochlorine pesticides in suspended sediment and bed sediment samples collected from the Middle Rio Grande between 1978 and 1988. These data were compared to numerical sediment quality criteria (Probable Effects Criteria [PEC]) proposed by Polyak *et al.* (2000). According to MacDonald *et al.* (2000) most of the PEC provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although the PEC were developed to assess bed (bottom) sediments, they also provide some indication of the potential adverse effects to organisms consuming these same sediments when suspended in the water column.

Semi-volatile organic compounds are a large group of environmentally important organic compounds. Three groups of compounds, polycyclic aromatic hydrocarbons (PAHs), phenols, and phthalate esters, were included in the analysis of bed sediment collected by the USGS (Levings et al. 1998). These compounds were abundant in the environment, are toxic and often carcinogenic to organisms, and could represent a long-term source of contamination. The analysis of the PAH data by Levings *et al.* (1998) show one or more PAH compounds were detected at 14 sites along the Rio Grande with the highest concentrations found below Albuquerque and Santa Fe. Polycyclic aromatic hydrocarbons and other semi-volatile compounds affect the sediment quality of the Rio Grande and may affect silvery minnow behavior, habitat, feeding, and health.

Pesticide contamination occurs from agricultural activities, as well as from the cumulative impact of residential and commercial landscaping activities. The presence of pesticides in surface water depends on the amount applied, timing, location, and method of application. Water quality standards have not been set for many pesticides, and existing standards do not consider cumulative effects of several pesticides in the water at the same time. Roy *et al.* (1992) reported that DDE, a degradation product of DDT, was detected most frequently in whole body fish collected throughout the Rio Grande. The authors suggested that fish in the lower Rio Grande may be accumulating DDE in concentrations that may be harmful to fish and their predators.

In addition to the compounds discussed above, several other constituents are present and affect the water quality of the Rio Grande. These include nutrients such as nitrates and phosphorus, total dissolved solids (salinity), and radionuclides. Each of these also has the potential to affect the aquatic ecosystem and health of the silvery minnow. As the river dries, pollutants will be concentrated in the isolated pools. Even though these pollutants do not cause the immediate death of silvery minnows, the evidence suggests that the amount and variety of pollutants present in the Rio Grande, could compromise their health and fitness (Rand and Petrocelli 1985).

Results from a recent Rio Grande silvery minnow health study (Lusk et al. 2012) have indicated that temperature and dissolved oxygen (DO) may also be factors affecting the health of the silvery minnow. Water temperature is thought to be responsible for the elevated frequency of physical anomalies seen in silvery minnows, and there is a positive relationship between water temperature and the number of silvery minnows infected with bacteria. Reduced DO in the Middle Rio Grande is associated with storm events, which may result in chronic or behavioral effects on silvery minnows and the avoidance of low DO environments.

Chemical Spills

Based on information reported in the National Response Center (NRC) database (http://www.nrc.uscg.mil), two incidents involving releases into the Rio Grande have occurred in Sierra County since 1991 – both involving the release of oil. There is concern about the potential adverse effects of spills from these events for the silvery minnow and its critical habitat; however, these reported incidents were either in the downstream direction from the action area or at a substantial distance from the action area such that effects in the action area for this consultation would not be expected.

Silvery Minnow Propagation and Augmentation

In 2000, the Service identified captive propagation as an appropriate strategy to assist in the recovery of the silvery minnow. Captive propagation is conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctiveness of the silvery minnow and minimize risks to existing wild populations.

Silvery minnows are currently housed at three facilities in New Mexico that conduct captive propagation of the species, including the Service's Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Southwestern Native ARRC, formerly Dexter National Fish Hatchery and Technology Center), the City of Albuquerque's BioPark propagation facility, and the New Mexico Interstate Stream Commission (ISC) Refugium in Los Lunas, New Mexico. These facilities are actively propagating and rearing silvery minnow. Silvery minnows are also held at the Service's New Mexico Fish and Wildlife Conservation Office (FWCO) and at the U.S. Geological Survey Biological Resources Division Lab in Yankton, South Dakota; however, there are no active spawning programs at these facilities.

Since 2002, more than 2.3 million silvery minnows have been released in the Middle Rio Grande (Archdeacon 2013, T. Archdeacon, Service, *pers. comm.* 2014). Wild-caught silvery minnows are successfully spawned in captivity at the propagation facilities. Eggs are raised and released as larval fish. Marked fish have been released into the Middle Rio Grande by the FWCO since 2002 under a formal augmentation effort funded by the Collaborative Program. Eggs left in the wild have a very low survivorship and this helps ensure that an adequate number of spawning adults are present to repopulate the river each year. While hatcheries continue to successfully spawn silvery minnow, wild eggs and larvae are collected to maximize genetic diversity within the remaining population (Turner and Osborne 2004).

Silvery Minnow Salvage and Relocation

During river drying, the Service's silvery minnow salvage crew captures and relocates silvery minnows. From 2001 to 2014, approximately 770,156 silvery minnows have been rescued and relocated to wet reaches (T. Archdeacon, Service, *pers. comm.* 2012, 2013, 2014; Remshardt 2008b, 2010; Remshardt and Archdeacon 2011, 2012; U.S. Fish and Wildlife Service 2007a, 2007b). Caldwell et al. (2010) reported on studies that assessed the physiological responses of wild silvery minnows subjected to collection and transport associated with salvage. The authors examined primary (plasma cortisol), secondary (plasma glucose and osmolality), and tertiary indices (parasite and incidence of disease) and concluded that the effects of stressors associated with river intermittency and salvage resulted in a cumulative stress response in wild silvery minnows. Caldwell et al. (2010) also concluded that fish in isolated pools experienced a greater risk of exposure and vulnerability to pathogens (parasites and bacteria), and that the stress response and subsequent disease effects were reduced through a modified salvage protocol that applied specific criteria to determine which wild fish are to be rescued from pools during river intermittency (Caldwell et al. 2010).

Ongoing Research

There is ongoing research by the New Mexico FWCO and University of New Mexico (UNM) to examine the movement of silvery minnows. Augmented fish are marked with a visible fluorescent elastomer tag and released in large numbers in a few locations. Crews sample upstream and downstream from the release site in an attempt to capture the marked fish. Preliminary results indicate that the majority of silvery minnows disperse a few miles downstream. One individual was captured 15.7 mi (25.3 km) upstream from its release site (Platania et al. 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. The farthest downstream point of recapture was 9.4 mi (15.1 km). Studies have also been conducted by New Mexico FWCO using Passive Integrated Transponder (PIT) tags to examine silvery minnow movement and use of the fishway at the Albuquerque Bernalillo County Water Utility Authority's drinking water diversion site near the Alameda Bridge in Albuquerque. Results indicate use of the fishway and both upstream and downstream movement of silvery minnows in that location (e.g., Archdeacon and Remshardt 2012).

In 2002, a hybridization study involving the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. Plains minnow are found in the Pecos River where reintroduction of the silvery minnow is being considered. The results are preliminary because the number of trials was low and because there is some question about the fitness of the females used in the experiments. The plains minnow and silvery minnow did spawn with each other and the hybrid eggs hatched. However, none of the larvae lived longer than 96 hours. The control larvae (non-hybrids) for both the plains minnow and silvery minnow lived until the end of the study (24 days) (Caldwell 2002).

Due to the increased efforts in captive propagation, recent studies by UNM have focused on the genetic composition of the silvery minnow. Several studies since 2003 have documented a significant decline in overall mitochondrial (mt) DNA and gene diversity in the silvery minnow (e.g., Osborne et al. 2005, Turner et al. 2006), which may correspond to an increased extinction risk. Research indicates that the net effective population size (N_e) (the number of individuals that contribute to maintaining the genetic variation of a population) of the silvery minnow in the wild is a fraction of the census size (Alò and Turner 2005, Turner et al. 2005, U.S. Fish and Wildlife Service 2007c). In addition, estimates of the current genetic effective size for silvery minnow have consistently fallen well below the values recommended to maintain the adaptive potential of the species. For example, Alò and Turner (2005) found that genetic data from 1999 to 2001 indicated the current effective population size of the largest extant population of silvery minnows is 78. Other estimates have ranged as low as 50 (for 2004 and 2005; cited in U.S. Fish and Wildlife Service 2007c). It has been suggested that a N_e of 500 fish is needed to retain the long-term adaptive potential of a population (Franklin 1980). Because the number of wild fish in the river appears to be low, the addition of thousands of silvery minnows raised in captivity could impact the genetic structure of the population. For example, estimates of the effective population size for stocks that were reared from wild-caught eggs were consistently lower than for wild counterparts; in addition, stocks produced by captive spawning consistently show lower levels of allelic diversity than those reared from wild-caught eggs (Osborne et al. 2006). This indicates that samples collected and reared in captivity do not accurately reflect the allelic frequencies or diversity seen in the wild population (U.S. Fish and Wildlife Service 2007c). Results indicate that while captive propagation can be important for reducing the loss of some genetic markers (including microsatellite allelic diversity and heterozygosity) as seen in recent years, it cannot be relied upon to fully address declines in genetic diversity in the silvery minnow population.

In 2013, the Southwestern Native ARRC completed the spawning portion of a study examining the fecundity of four different year classes of silvery minnow. The adult fish and resulting eggs have been preserved a provided to the U.S. Geological Survey, New Mexico Cooperative Fish and Wildlife Research Unit at New Mexico State University, Las Cruces for enumeration. The final analysis and reporting should be completed by the end of calendar year 2014.

10(j) Experimental Population

In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). Since 2008, over 1.9 million silvery minnows have been released in this portion of the species' historic range in Texas (Edwards and Garrett 2013; T. Archdeacon, Service, *pers. comm.* 2013, 2014). The four release sites are distributed across Federal, State, and private lands: one in Big Bend Ranch State Park; two within Big Bend National Park; and one on the Adams Ranch del Carmen, a privately-owned and managed conservation area. The silvery minnows came from the Service's Southwester Native ARRC and the City of Albuquerque's Rio Grande Silvery Minnow Rearing and Breeding Facility.

Monitoring has been conducted since 2009 to determine the success of the Big Bend reintroduction effort, and the results have been positive. It is expected to take years of monitoring to fully evaluate if the species is established and will remain viable in this river reach. However, post-release monitoring of silvery minnows in proximity to the four release sites has found silvery minnows. In 2010, the Service detected successful breeding of silvery minnows in the Big Bend reach for the first time since releases began, including documentation of eggs, larval fish, and juvenile fish. This indicates that silvery minnows are successfully breeding in Big Bend and that wild born silvery minnows are surviving to be recruited into the population and hopefully will contribute to future reproduction. In 2011, silvery minnows were detected up to 70 miles downstream and 15 miles upstream from the nearest release sites. These are significant milestones in working toward the recovery of the silvery minnow. Monitoring results from February and May 2012 indicated the presence of silvery minnows at seven of the sampling sites, including YOY (Edwards and Garrett 2013). Approximately 72,000 silvery minnow were augmented into Big Bend in the Fall of 2013, and the 10(j) population will continue to be monitored and evaluated following this last scheduled release to determine success. Relevant information from this effort will be incorporated into the assessment for potential reintroductions in additional locations.

Past Projects in the Middle Rio Grande

"Take" of ESA-listed species is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (see ESA section 3(19)). Take of silvery minnows has been permitted or authorized during prior projects conducted in the Middle Rio Grande. The Service has issued permits authorizing take for scientific research and enhancement purposes under ESA section 10(a)(1)(A), and incidental take under section 7 for actions authorized, funded, or carried out by Federal agencies. Applicants for ESA section 10(a)(1)(A) permits must also acquire a permit from the State of New Mexico to "take" or collect silvery minnows. Many of the section 10 permits issued by the Service allow take for the purpose of collection and salvage of silvery minnows and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve the silvery minnow. Because of the population decline from 2002-2004, the Service has reduced the amount of take permitted for voucher specimens in the wild.

The Service has conducted numerous section 7 consultations on past projects in the Middle Rio Grande. In 2001 and 2003, the Service issued jeopardy biological opinions resulting from programmatic section 7 consultation with Reclamation and the U.S. Army Corps of Engineers (Corps), which addressed water operations and management on the Middle Rio Grande and the effects on the silvery minnow and the southwestern willow flycatcher (U.S. Fish and Wildlife Service 2001, 2003b). Incidental take of listed species was authorized associated with the 2001 programmatic biological opinion (2001 BO), as well as consultations that tiered off that opinion. The 2003 jeopardy biological opinion (2003 BO) was issued on March 17, 2003, is the current programmatic biological opinion on Middle Rio Grande water operations, and contains one RPA with multiple elements. These elements set forth a flow regime in the Middle Rio Grande and describe habitat improvements necessary to alleviate jeopardy to both the silvery minnow and southwestern willow flycatcher. In 2005, the Service revised the Incidental Take Statement (ITS) for the 2003 BO using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Incidental take of silvery minnows is authorized with the 2003 BO (with 2005 revised ITS), and now fluctuates on an annual basis relative to the total number of silvery minnows found in October across the 20 population monitoring locations. Incidental take is authorized through consultations tiered off this programmatic BO and on projects throughout the Middle Rio Grande.

Within the Delta Channel of the Rio Grande, the Service has conducted numerous section 7 consultations on past projects, including the following:

- Temporary Channel Construction: The first and second phases of the temporary channel to the Reservoir were consulted on in 1996 and 2000 for effects to silvery minnow and flycatcher (Cons. #2-22-97-I-053). In 2002 and 2004, Reclamation made a determination of 'no effect' for both species for additional construction in the lower portion of the temporary channel. In December 2005, silvery minnow were documented throughout the Delta Channel prompting the need for re-initiation. In the fall of 2006, Reclamation and the Service agreed to implement protective measures for the silvery minnow until survey reports and a BO could be provided.

- Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on 17 March 2003, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one Reasonable and Prudent Alternative (RPA) with several elements. These elements set forth a flow regime in the Middle Rio Grande and described habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher.

- In 2008, Reclamation requested formal consultation with the Service on the effects of actions associated with the Elephant Butte Reservoir Temporary Channel Maintenance Project. The Service transmitted a BO that anticipated up to 324,153 silvery minnows being harassed during channel maintenance and construction, and take in the form of harassment for all flycatcher territories between RM 61 to the northern border of Bosque del Apache National Wildlife Refuge due to channel degradation.

Summary of the Environmental Baseline

The remaining population of the silvery minnow is restricted to approximately seven percent of its historic range. With the exception of 2008, every year since 1996 has exhibited at least one drying event in the river that has negatively affected the silvery minnow population. The species is unable to expand its distribution because poor habitat quality and Cochiti Dam prevent upstream movement and Elephant Butte Reservoir blocks downstream movement (U.S. Fish and Wildlife Service 1999). Augmentation of silvery minnows with captive-reared fish has been ongoing, and monitoring and evaluation of these fish provide information regarding the survival and movement of individuals.

Water withdrawals from the river and water regulation severely limit the survival of silvery minnows. The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (Bureau of Reclamation and U.S. Army Corps of Engineers 2003). However, under New Mexico State law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The effect of water withdrawals means that discharges from WWTPs and irrigation return flows will have greater importance to the silvery minnow and a greater impact on water quality. And the overall predicted effects of climate change are expected to result in degradation of the remaining silvery minnow habitat, with potential adverse consequences on species viability.

Various conservation efforts have been undertaken in the past and others are currently being carried out in the Middle Rio Grande for the benefit of the silvery minnow. Population monitoring indicates that densities of this species had increased compared to extremely low levels seen in 2002–2003. However, current data show catch rates are currently lower than levels at the time of its listing as an endangered species in 1994, with the decline of silvery minnows after 2009 the most precipitous recorded since the silvery minnow monitoring program began, which lead to an absence of detections in October 2012. The threat of extinction for the silvery minnow continues because of increased reliance on captive propagation to supplement the wild population, the fragmented and isolated nature of currently occupied habitat, and the absence of the silvery minnows throughout most of the species' historic range.

IV. EFFECTS OF THE ACTION

Regulations implementing the ESA (50 FR 402.02) define the *effects of the action* as 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, which will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. 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.

Effects on Silvery Minnow
As described earlier, the action area for this consultation is defined as the entire width of the 100-year floodplain of the Rio Grande encompassing the disturbance zone boundaries of the San Marcial Delta Channel located between RM 62 and the current reservoir pool at Elephant Butte. Consistent monitoring data are available from RM 58.8 (10 miles below the San Marcial Railroad Bridge, site #18), which is approximately 1 mile upstream from the in-channel portion of the action area (RM 57.8). Additional monitoring data are also available for select locations within the action area (RM 55 – 41), however monitoring at these locations is not routine.

The past five years of population data indicate it is likely minnows are present at the project site at varying densities, and therefore the species may be affected by the proposed action. Given the current drought, as slightly moderated by this summer's monsoons, and the uncertainty over flows in 2015, the most representative density for this site is an average of available data from the past year (2014), collected during the same months as the proposed action would occur (September – April). The average density is a CPUE of 0.25 minnows per 100 square meters (see compilation in Tables 5 and 6 earlier).

The Service reviewed the proposed action, including measures implemented to reduce risk to listed species. The action area occurs outside of designated critical habitat for the silvery minnow, and Reclamation has determined there will be no effect on silvery minnow critical habitat (for critical habitat designation see 68 FR 8088; February 19, 2003).
The proposed action has the potential for adverse effects on silvery minnows as a result of (1) direct effects during maintenance and associated support operations within the existing Delta Channel (2) indirect effects due to sediment disturbance by equipment working in the channel. All site access and road maintenance work will be conducted in the dry and will not adversely affect silvery minnows.

We expect the proposed action may generate adverse effects on silvery minnows as a result of in-channel maintenance activities (sediment excavation and the movement of equipment), and proposed maintenance support operations (airboat transport). Short-term adverse effects on silvery minnows are expected due to in-channel disturbance (to include noise) during the operation of amphibious excavator and dozer equipment, and during airboat transport and refueling operations. Conservation measures implemented during in-channel maintenance and support operations – including BMPs for equipment operation, re-fueling, and spill prevention measures – are expected to minimize the risk of effects on silvery minnows. However, we expect silvery minnows may be present during these activities and harassed as a direct effect of the proposed action. The Service has defined take by harassment 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 behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (see 50 CFR 17.3). Silvery minnows are expected to exhibit an avoidance response to maintenance and river transport activities, and given the operating speed of equipment we do not expect fish will be directly injured or their movement impeded by the equipment. Avoidance behavior, or fleeing from the disturbance, represents a disruption in normal behaviors and an expenditure of energy that an individual silvery minnow would not have experienced in the absence of the proposed action. However, this form of harassment is expected to be short in duration, with pre-exposure behaviors to resume after fleeing the disturbance.

We expect an initial flight response at the onset of in-channel maintenance and transport activities. The potential number of silvery minnows affected within the immediate vicinity of maintenance equipment should be minimized, along with sustained avoidance for the duration of in-channel maintenance work. We expect the sustained avoidance response will also minimize the risk of repeated harassment of individuals over the course of in-channel maintenance activities, especially given the slow procession of work upstream (maximum of 0.5 miles per day).

In addition, the applicable work window with no in-water construction activities from April 15 to August 15 will help minimize adverse effects on pre-spawn and spawning adult silvery minnows, as well as YOY fish during early growth. Given the mobility of silvery minnows and the timing of the proposed in-water activities, we do not expect the avoidance response – or the timing of that response relative to the species' life history – will lead to any long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering.

Adverse effects on silvery minnows may also occur due to sediment disturbance by amphibious excavator equipment working in the channel. These activities may affect water quality, causing localized increases in turbidity and suspended sediments. Direct effects from excess suspended sediments on a variety of fish species have included alarm reactions, abandonment of cover, avoidance responses, reduced feeding rates, increased respiration, physiological stress, poor condition, reduced growth, delayed hatching, and mortality (Newcombe and Jensen 1996). In addition, indirect effects from sediment mobilization in the channel are possible, including the potential smothering and mortality of algae and aquatic invertebrates, depressed rates of growth, reproduction, and recruitment or reduced physiological function of invertebrates. Decreases in primary production are also associated with increased sedimentation and turbidity and can produce negative cascading effects through depleted food availability for zooplankton, insects, mollusks, and fish. We expect silvery minnows will exhibit an avoidance response to in-channel maintenance activities as described earlier. Conservation measures will help minimize the risk due to dispersal of suspended sediments (e.g., minimize the disturbance of sediments and water quality monitoring). As a result, beyond the initial avoidance response to activities, we do not expect suspended sediments will result in significant direct effects on silvery minnows. Those same conservation measures are also expected to reduce the risk of indirect effects on silvery minnows from these activities.

Given our assessment of anticipated effects on silvery minnows, and the available information on in-water area disturbed for each activity (see Tables 3 and 4), we expect silvery minnows will be affected by in-channel maintenance activities and the movement of equipment over a maximum total area of 1,768 wetted acres (7.15 km^2) per year (195 acres for maintenance work + 1,573 acres for equipment movement along the channel). The maximum number of minnows harassed by in-channel maintenance activities and equipment movement is calculated to be 17,888 silvery minnows during 2015 using 1,768 maximum wetted acres (or 7,154,837 square meters) and an estimated density of 0.25 silvery minnows per 100 square meters. It is not possible to calculate the amount of harassment due to airboat transport, though we expect that most transport activities will occur in the deeper, faster portions of the channel where suitable habitat is lacking and silvery minnows are scarce. Any disturbances within side channels and backwaters (such as when airboats access the Delta Channel) is expected to be infrequent and of short duration.

Water used for dust abatement may use a minimal amount of water from the Rio Grande, and therefore there is the potential to cause adverse effects on the silvery minnow through reduction in available habitat. Pumping from the Delta Channel however, is not proposed between April 15 and August 15 (which includes the timeframe when silvery minnow spawn), and Reclamation will coordinate with the Service to avoid impacts to silvery minnow eggs and larvae if pumping is needed during this time (emergencies only). In addition, if flows in the Delta Channel are lower than 300 cfs, Reclamation will not pump from the river without first coordinating with the Service. Given the minimal amount of water that would be used for dust abatement (0.2 to 0.7 percent of river flows), the short duration of each episode where the Delta Channel would be affected (four to eight minutes), and the refrainment from pumping during the spawning season as when flows are below 300 cfs, the available information indicates that such water use would exhibit insignificant effects on silvery minnow habitat and we do not expect adverse effects resulting in take would occur.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion (50 FR 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.

The Service expects the natural phenomena in the action area will continue to influence silvery minnows as described in the *Environmental Baseline*. The Service also expects the continuation of habitat restoration projects and research to benefit silvery minnows, for example projects funded and carried out by the State of New Mexico, City of Albuquerque, the Pueblos, and other groups. In addition, we expect cumulative effects to include the following:

- Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantities of water that would overbank and create low velocity habitats that silvery minnows prefer.

- Increased urban use of water, including municipal and private uses. Further use of surface water or further groundwater withdrawals that reduce surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow.

- Contamination of water (i.e., sewage treatment plants; runoff from urban areas, small feed lots, and dairies; and residential, industrial, and commercial development). A decrease in water quality and gradual changes in floodplain vegetation from native riparian species to non-native species (e.g., salt cedar), as well as riparian clearing and chemical use for vegetation control and crops could adversely affect the silvery minnow and its habitat. Silvery minnow larvae require shallow, low velocity habitats for development. Therefore, encroachment of non-native species will result in a reduction of habitat available for the silvery minnow.

- Human activities that may adversely impact the silvery minnow by decreasing the amount and suitability of habitat include dewatering the river for irrigation; increased water pollution from point and non-point sources; habitat disturbance from recreational use, suburban development, and removal of large woody debris.

The Service anticipates the continued and expanded degradation of silvery minnow habitat as a result of these types of activities. Effects from these activities will continue to threaten the survival and recovery of the species by reducing the quality and quantity of minnow habitat.

VI. CONCLUSION

After reviewing the current status of the silvery minnow, the environmental baseline for the action area, the anticipated effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that Reclamation's San Marcial Delta Channel Project, as proposed in the November 2014 BA, is not likely to jeopardize the continued existence of the silvery minnow. We expect the level and type of take associated with the Project is unlikely to appreciably diminish the abundance of silvery minnows in the Delta Channel, nor diminish the species as a whole. We expect harassment of silvery minnows may occur due to river maintenance activities; however, we do not expect this to result in any significant long-term effects on individuals in the Delta Channel or for the species as a whole.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without 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 the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, 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 ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by Reclamation so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to assume and implement the terms and conditions or (2) fails to require adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation 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 Anticipated

The Service has developed the following incidental take statement based on the premise that Reclamation's San Marcial Delta Channel river maintenance project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment due to the proposed river maintenance activities and associated support operations, and is restricted to the actions as proposed. If actual incidental take meets or exceeds the predicted level, Reclamation must reinitiate consultation. Based on the best available information concerning the silvery minnow, the habitat needs of this species, the project description, and information furnished by Reclamation, take is considered likely for the silvery minnow during the proposed actions.

The population of silvery minnow within the action area will vary annually, therefore estimated take will change for each year for which this BO is issued to account for fluctuations in silvery minnow population size. Take will be estimated using the following formula:

(estimated CPUE for a given year)(area of disturbance) =* *<u># silvery minnows harassed for a given year</u>*

For 2015, the Service anticipates that take in the form of harassment may affect up to 17,888 juvenile and adult silvery minnows due to in-channel maintenance activities and the movement of equipment along the channel. We base this figure on the best available information on silvery minnow density in the area to be disturbed by the proposed activities during 2015 project implementation.

We also expect take in the form of harassment of juvenile and adult silvery minnows due to airboat transport, however it is not possible to estimate the number of individuals that would be taken. Disturbance due to airboat transport is anticipated to be infrequent and short in duration as the majority of airboat activity will occur in deeper, faster areas of the Delta Channel where suitable habitat is lacking and silvery minnows are scarce. Take of eggs and larvae (direct mortality) is not expected as in-channel maintenance and associated support operations are not proposed during the silvery minnow spawning season.

The Service notes that this represents a best estimate of the extent of take that is likely during the proposed action. Thus, estimated incidental take may be modified from the above should population monitoring information or other research indicate substantial deviations from the estimated extent of incidental take, or if it allows for a calculation of the amount of take that will occur. In this case further consultation may be necessary.

Effect of Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow. In-channel maintenance and associated support operations are likely to have adverse effects on individual silvery minnows but those effects are not anticipated to result in any long-term consequences on the population. Incidental take will result from harassment of silvery minnows during excavation of sediment within the Delta Channel, the movement of equipment along the wetted channel, as equipment and airboats enter the Delta Channel, and as airboats traverse the channel for refueling or inspection.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the silvery minnow resulting from the proposed actions:

1. Minimize take of silvery minnows due to the proposed river maintenance activities.

2. Manage for the protection of water quality from activities associated with the river maintenance projects.

3. Continue to work collaboratively with the Service on the Middle Rio Grande Endangered Species Collaborative Program and throughout the transition to a Recovery Implementation Program.

Terms and Conditions

Compliance with the following terms and conditions must be achieved in order to be exempt from the prohibitions of section 9 of the ESA. These terms and conditions implement the Reasonable and Prudent Measures (RPMs) described above. These terms and conditions are non-discretionary.

To implement RPM 1, Reclamation shall:

1. Ensure that all project construction in the action area is conducted within the timeframes described in this biological opinion (not between April 15 and August 15).

2. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to equipment and operations, staging and access, water quality, dust abatement, and others.

3. Report to the Service findings of injured or dead silvery minnows.

4. Monitor the implementation of RPM 1 and its associated Terms and Conditions.

To implement RPM 2, Reclamation shall:

1. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to water quality, equipment and operations, and staging and access.

2. Ensure that all river maintenance work is conducted during low flow periods, minimizing water quality impacts, by working within the timeframes described in this biological opinion (not between April 15 and August 15 of each year).

3. Report to the Service any significant spills of fuels, hydraulic fluids, and other hazardous materials.

4. Monitor the implementation of RPM 2 and its associated Terms and Conditions.

To implement RPM 3, Reclamation shall:

1. Work to further conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA 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 conservation activities:

1. Evaluate the effectiveness of habitat restoration techniques implemented in the Middle Rio Grande for ESA-listed species, including an evaluation of site longevity and benefits provided to species.

2. Encourage adaptive management of flows and conservation of water to benefit listed species.

3. Implement recovery actions identified in the southwestern willow flycatcher and Rio Grande silvery minnow recovery plans.

4. Seek opportunities to restore, enhance, and protect habitats on MRG Project lands for the Pecos sunflower, New Mexico meadow jumping mouse, and the yellow-billed cuckoo.

5. Schedule adequate time into future projects to complete vegetation surveys for suitable jumping mouse habita,t and further refine Frey and Kopp's (2014) potentially suitable jumping mouse habitat designations. This information will greatly assist all parties in determining not only project-related impacts, but also gain a better understanding of the current status of the species.

RE-INITIATION NOTICE

This concludes formal consultation on the action described in the November 2014 Biological Assessment. As provided in 50 CFR § 402.16, re-initiation 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 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 BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this BO; 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 re-initiation.

In future correspondence on this project, please refer to consultation number 02ENNM00-2015-F-0103. If you have any questions or would like to discuss any part of this biological opinion, please contact David Campbell in my office at (505) 761-4745.

Wally Murphy

cc:
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