DOE/EA-1408

Proposed Future Disposition of Certain Cerro Grande Fire Flood and Sediment Retention Structures at Los Alamos National Laboratory, Los Alamos, New Mexico

August 8, 2002

Department of Energy
National Nuclear Security Administration
Los Alamos Site Office

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ACRONYMS AND TERMS

ac	acres
ACMs	articulated concrete mattresses
AEI	area of environmental interest
BAER	Burned Area Emergency Rehabilitation
BMPs	best management practices
CASA	critical assembly storage area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeters
CMR	Chemistry and Metallurgy Research
dB	decibel
dBA	A-weighted frequency scale
DOE	(U.S.) Department of Energy
DOE/ SEA-03	Special Environmental Analysis
EA	environmental assessment
EAP	Emergency Action Plan
EIS	environmental impact statement
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act of 1973
FRS	flood retention structure
ft	feet
ha	hectares
HE	high explosives
HMP	Habitat Management Plan
in.	inches
JMVF	Jemez Mountains volcanic field
km	kilometers
LANL	Los Alamos National Laboratory
m	meters
m^3	cubic meters
MAP	mitigation action plan
mi	miles
NEPA	National Environmental Policy Act of 1969
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OEL	occupational exposure limit
PPE	personal protective equipment
PRS	potential release site
RCC	roller compacted concrete
ROD	Record of Decision
SR	State Road
SWEIS	Site-Wide Environmental Impact Statement
SWPP	Storm Water Pollution Prevention
TA	technical area (at LANL)
UC	University of California
U.S.	United States
USACE	(U.S.) Army Corps of Engineers
USC	United States Code
yd^3	cubic yards

EXPONENTIAL NOTATION: Many values in the text and tables of this document are expressed in exponential notation. An exponent is the power to which the expression, or number, is raised. This form of notation is used to conserve space and to focus attention on comparisons of the order of magnitude of the numbers (see examples):

1×10^{4}	=	10,000
1×10^{2}	=	100
1×10^{0}	=	1
1×10^{-2}	=	0.01
1×10^{-4}	=	0.0001

Metric Conversions Used in this Document

Multiply	By	To Obtain
Length		
inch (in.)	2.50	centimeters (cm)
feet (ft)	0.30	meters (m)
yards (yd)	0.91	meters (m)
miles (mi)	1.61	kilometers (km)
Area		
acres (ac)	0.40	hectares (ha)
square feet (ft^2)	0.09	square meters (m^2)
square yards (yd^2)	0.84	square meters (m^2)
square miles (mi^2)	2.59	square kilometers (km^2)
Volume		
gallons (gal.)	3.79	liters (L)
cubic feet (ft^3)	0.03	cubic meters (m^3)
cubic yards (yd^3)	0.76	cubic meters (m^3)
Weight		
ounces (oz)	29.60	milliliters (ml)
pounds (lb)	0.45	kilograms (kg)
short ton (ton)	0.91	metric ton (t)

SUMMARY

This environmental assessment (EA) has been prepared to analyze the environmental consequences resulting from the future disposition of certain flood retention structures built in the wake of the Cerro Grande Fire within the boundaries of Los Alamos National Laboratory (LANL). In May 2000, a prescription burn, started on Federally-administered land to the northwest of LANL, blew out of control and was designated as a wildfire. This wildfire, which became known as the Cerro Grande Fire, burned approximately 7,650 acres (3,061 hectares) within the boundaries of LANL before it was extinguished. During the fire a number of emergency actions were undertaken by the Department of Energy (DOE), National Nuclear Security Administration (NNSA) to suppress and extinguish the fire within LANL; immediately thereafter, NNSA undertook additional emergency actions to address the post-fire conditions. Due to hydrophobic soils (non-permeable soil areas created as a result of very high temperatures often associated with wild fires) and the loss of vegetation from steep canyon sides caused by the fire, surface runoff and soil erosion on hillsides above LANL were greatly increased over pre-fire levels. The danger to LANL facilities and structures and homes located down-canyon from the burned area was magnified.

NNSA constructed certain flood and sediment detention structures in the wake of the Cerro Grande Fire as part of its emergency response actions. These structures were built to address the changes in local watershed conditions that resulted from the fire. The long-term disposition of these structures was not considered as a part of the decision to undertake the construction actions. Watershed conditions are expected to return to a pre-fire status or approximate the pre-fire condition over the next three to eight years. NNSA needs to take actions regarding the disposition of these structures when they are no longer necessary to protect LANL facilities and the businesses and homes located downstream. The structures that are addressed in this EA are 1) a flood retention structure (FRS) constructed of roller compacted concrete located in Pajarito Canyon; 2) a low-head weir, constructed of rectangular rock-filled wire cages (gabions), and associated sediment detention basin in Los Alamos Canyon; 3) reinforcements of four road crossings, including a land bridge along Anchor Ranch Road in Two-Mile Canyon and State Road 501 embankment reinforcements at Two-Mile Canyon, Pajarito Canyon, and Water Canyon; and 4) a steel diversion wall upstream of Technical Area (TA) 18 in Pajarito Canyon.

The Proposed Action is to remove part of the above ground portion of the FRS, including gabions that are currently being installed along the downstream channel. Design studies would be performed at the time of removal to determine the channel width needed and the required slope. At the end of the partial FRS removal, the streambed would be graded, the remaining sides of the FRS would be stabilized, and the banks would be reseeded. In addition, the Proposed Action would also include removal of the access road in order for that part of the canyon wall to be recontoured and stabilized if TA-18 facilities remain in place; if TA-18 facilities are relocated, this access road might remain in place. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. The Proposed Action also includes removal of the entire above ground portions of the steel diversion wall at TA-18. Any removal of the two identified structures would not occur until after the Pajarito watershed has returned to pre-fire conditions, or the location ecosystem has recovered enough to approximate a pre-fire condition. The Proposed Action would leave the other subject structures in place with continued performance of routine maintenance activities.

A second alternative analyzed the Disassembly Of All Structures Alternative. Under this alternative, NNSA would remove all of the above ground portion of the FRS, the low-head weir and detention basin, the road reinforcements and the entire above ground portions of the steel diversion wall.

The No Action Alternative was also considered. Under this alternative NNSA would leave the FRS and the steel diversion wall at TA-18 intact and continue inspection and maintenance activities. The steep embankment remaining at the FRS from the No Action Alternative would also require continued maintenance for erosion control. In addition, if structural or stability problems of the FRS were to be detected, DOE would make a decision on repair or disposition of the FRS at that time and additional National Environmental Protection Agency compliance reviews would be needed. The No Action Alternative for the other subject structures would be the same as for the Proposed Action.

The subject flood and sediment detention structures are located within floodplains. Under the Proposed Action, removal activities for the FRS and steel diversion wall would require the placement of best management practices (BMPs) involving storm water storm controls in accordance with the Storm Water Pollution Prevention Plan, which is required by the LANL National Pollution Discharge Elimination System permit. The BMPs would be placed at the FRS and the steel diversion wall before demolition activities begin. Most of the debris generated by the Proposed Action would be recycled for future use in construction projects at LANL. Effects from waste disposal would be minor as the remaining non-recyclable waste would be disposed of at existing landfills that have the capacity to accept waste. Demolition activities for the two identified structures are expected to produce only temporary and localized air emissions. There would also be temporary periods of short-term increases in nitrogen oxide emissions due to the use of heavy equipment and vehicles. The Proposed Action could have short-term effects on the floodplains. Temporary BMPs would be implemented to prevent or minimize any adverse effects. There could be a minor effect on biological resources, although adherence to the LANL Habitat Management Plan would minimize adverse effects. Controlled demolition and proper removal actions, including BMPs, would be put in place to preserve water quality during actual demolition activities. Long-term site stabilization at each of the subject structures would help protect surface and groundwater quality. The Proposed Action is expected to have only minor short-term and temporary effects on current traffic patterns. Implementation of the Proposed Action would not affect the geology of the structural sites, any known cultural resources, and is not expected to result in an adverse effect on noise or the health of demolition maintenance workers or the public.

1.0 PURPOSE AND NEED

1.1 Introduction

The *National Environmental Policy Act of 1969* (NEPA) requires Federal agency officials to consider the environmental consequences of their proposed actions before decisions are made. In complying with NEPA, the United States (U.S.) Department of Energy (DOE), National Nuclear Security Administration (NNSA[1]) follows the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500–1508) and DOE's own NEPA implementing procedures (10 CFR 1021). The purpose of an environmental assessment (EA) is to provide Federal decision makers with sufficient evidence and analysis to determine whether to prepare an environmental impact statement (EIS) or issue a Finding of No Significant Impact. This EA has been prepared to assess environmental consequences resulting from the future disposition of certain flood retention structures built in the wake of the Cerro Grande Fire within the boundaries of Los Alamos National Laboratory (LANL). LANL is one of the national security laboratories under the authority of the Under Secretary for Nuclear Security of the NNSA who serves as the Administrator for Nuclear Security and the head of the NNSA (50 USC Chapter 41, § 2402[b]).

The objectives of this EA are to (1) describe the underlying purpose and need for NNSA action; (2) describe the Proposed Action and identify and describe any reasonable alternatives that satisfy the purpose and need for NNSA action; (3) describe baseline environmental conditions at LANL; (4) analyze the potential indirect, direct, and cumulative effects to the existing environment from implementation of the Proposed Action, and (5) compare the effects of the Proposed Action with the No Action Alternative and other reasonable alternatives. For the purposes of compliance with NEPA, reasonable alternatives are identified as being those that meet NNSA's purpose and need for action by virtue of timeliness, appropriate technology, and applicability to LANL.

The EA process also provides NNSA with environmental information that can be used in developing mitigative actions, if necessary, to minimize or avoid adverse effects to the quality of the human environment and natural ecosystems should NNSA decide to proceed with implementing the Proposed Action at LANL. Ultimately, the goal of NEPA and this EA is to aid NNSA officials in making decisions based on an understanding of environmental consequences and taking actions that protect, restore, and enhance the environment.

1.2 Background

LANL covers an area of 43 square miles (111 square kilometers) in north-central New Mexico (Figure 1) within a region characterized by forested areas with mountains, canyons, and valleys, as well as diverse cultures and ecosystems. The Federal government agency with administrative responsibility for LANL has evolved from the post-World War II Atomic Energy Commission, to the Energy Research and Development Administration, and finally to the DOE, NNSA. The University of California (UC) is the current LANL Management and Operating Contractor and has served in this capacity since the facility's inception.

[1] The NNSA is a separately organized agency within DOE established by Congress in 2000 under Title 50 United States Code (USC) Chapter 41, Subchapter I, Section 2401.

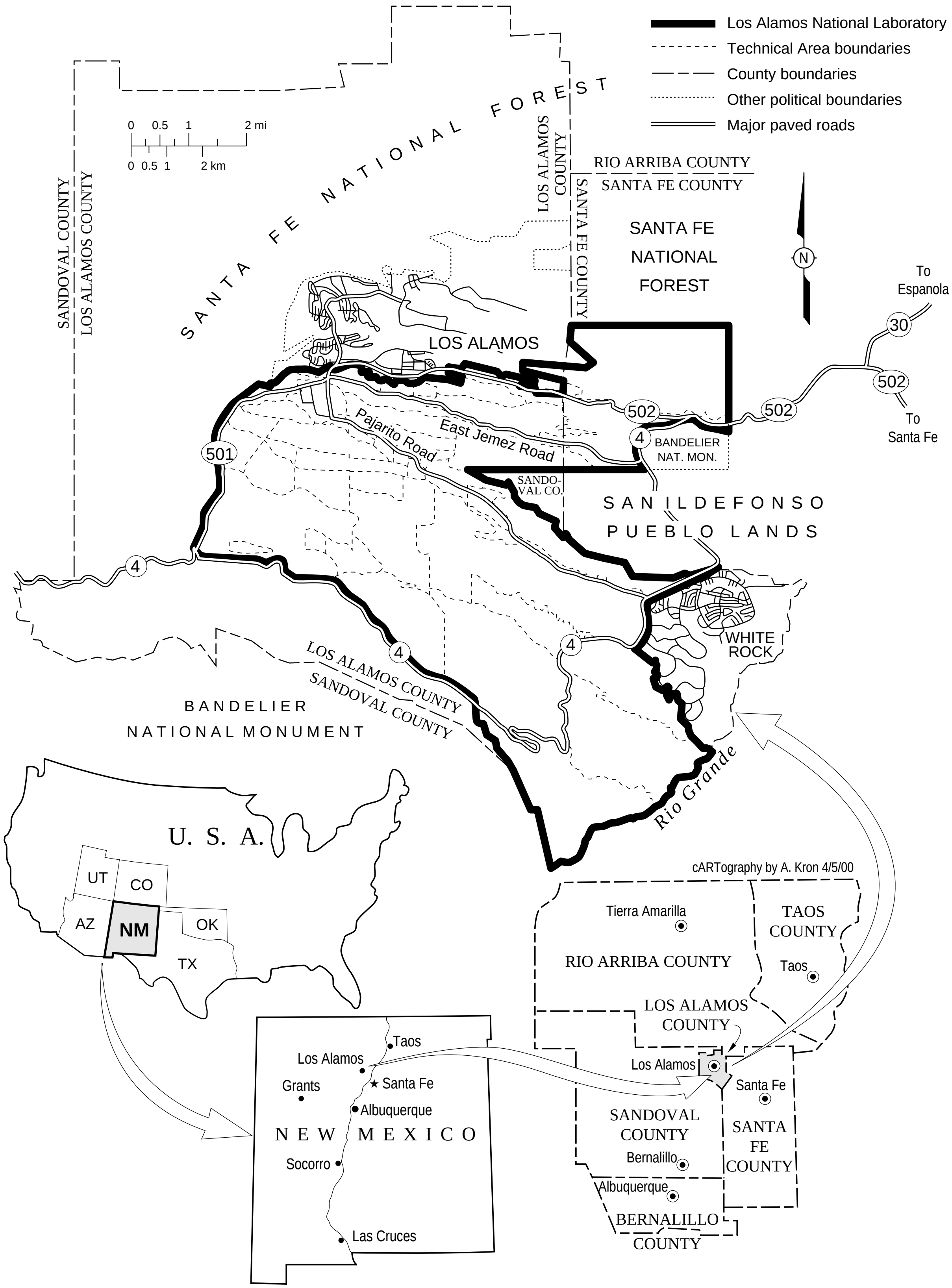

Figure 1. Location of Los Alamos National Laboratory.

In May 2000, a prescription burn, started on Federally administered land to the northwest of LANL, blew out of control and was designated as a wildfire. This wildfire, which became known as the Cerro Grande Fire, burned over 43,000 acres (ac) (17,200 hectares [ha]) of forest along the eastern flank of the Pajarito Plateau before it was extinguished. Approximately 7,650 ac (3,061 ha) within the boundaries of LANL were burned (Figure 2); nearly 10 percent (over 200 residential units occupied by over 400 families) of the Los Alamos townsite nearby was also burned. During the fire a number of emergency actions were undertaken by NNSA to suppress and extinguish the fire within LANL; immediately thereafter, NNSA undertook additional emergency actions to address the post-fire conditions.

The Cerro Grande Fire resulted in the creation of areas of hydrophobic soils, which are non-permeable soil areas created as a result of very high temperatures often associated with wildfires. These hydrophobic soils, combined with the loss of vegetation from steep canyon sides as a result of high- and moderate-severity fires, greatly affected the hydrologic functions of the watersheds in the LANL area. Surface runoff and soil erosion on the hillsides above LANL were greatly increased over pre-fire levels. The danger to LANL facilities and structures and homes located down-canyon from the burned area was magnified. Decisions to install storm water and flood control and erosion damage reduction features were made during the summer following the Cerro Grande Fire based on the perceived increased risk of damages to LANL and offsite facilities, structures, and homes. Computer modeling was used to estimate the risks using data collected on the amount of rain that fell and subsequent runoff generated in June, July, and August 2000. Storm water and flood damage control actions undertaken included the placement of sand bags, rocks, logs, straw bales and wattles, silt fences, and concrete barriers at numerous locations throughout LANL and the installation of trash racks at several locations. In addition, the U. S. Army Corps of Engineers (USACE) or LANL contractors constructed certain flood and sediment retention structures. These certain constructed flood and sediment retention structures and their watershed canyon locations are as follows:

1. A flood retention structure (FRS) constructed of roller compacted concrete (RCC) located in Pajarito Canyon.
2. A low-head weir, constructed of rectangular rock-filled wire cages (gabions), and associated detention basin in Los Alamos Canyon.
3. Reinforcements of several road crossings;
    a. a land bridge along Anchor Ranch Road in Two-Mile Canyon,
    b. State Road (SR) 501 embankment reinforcements in Two-Mile Canyon,
    c. SR 501 reinforcements in Pajarito Canyon, and
    d. SR 501 reinforcements in Water Canyon.
4. A steel diversion wall upstream of Technical Area (TA) 18 in Pajarito Canyon.
5. A downstream access road to the Los Alamos Reservoir and reinforcement of the reservoir embankment[2].

These structures are identified by number on the map in Figure 3.

[2] The disposition of reinforcements to the Los Alamos Reservoir and the access road will not be considered in this document because they are no longer under the administrative control of DOE, NNSA.

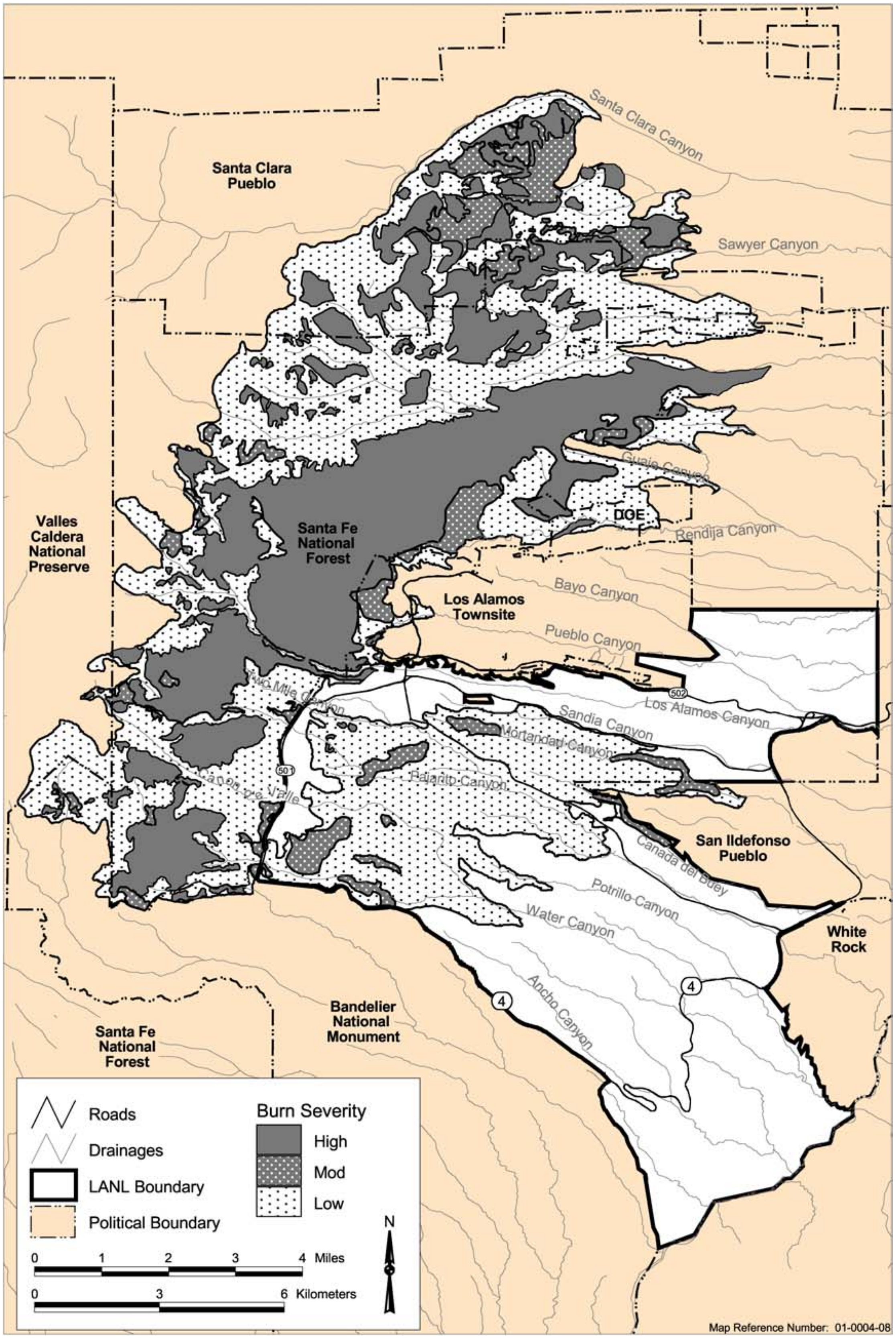

Figure 2. Extent and severity of the Cerro Grande Fire.

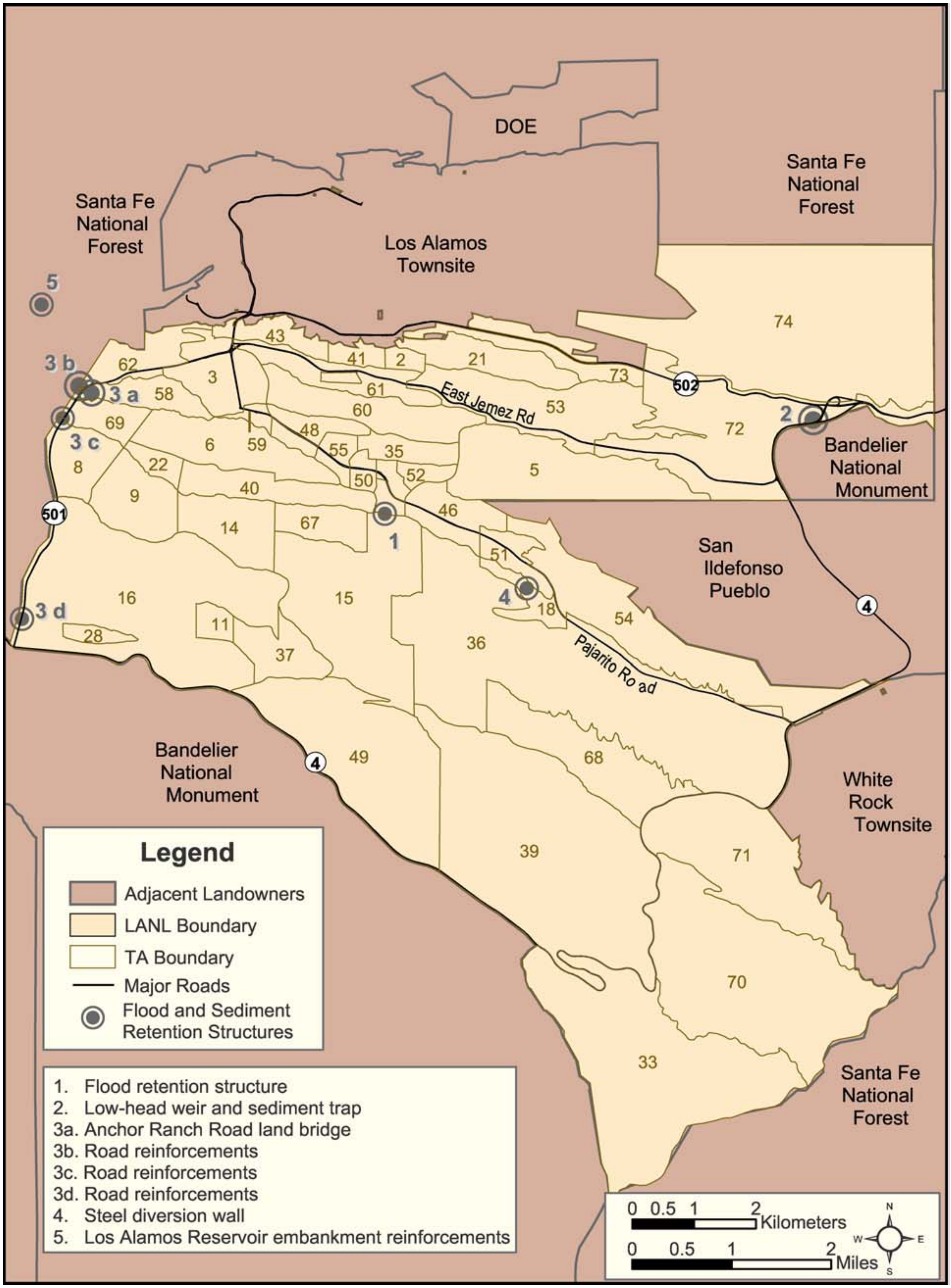

Figure 3. Location of certain flood and sediment retention structures.

The construction of these structures and other activities taken by NNSA in the wake of the Cerro Grande Fire, and their impacts, were analyzed in the *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration, Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/SEA-03) (DOE 2000a) issued by NNSA in September 2000. This document can be found in DOE Reading Rooms in Albuquerque (at the Government Information Department, Zimmerman Library, University of New Mexico), and in Los Alamos (at the Community Relations Office located at 1619 Central Avenue).

Subsequent modeling performed in 2001 based on additional site information shows little recovery (Springer 2002). However, many of the areas that were reseeded as part of the recovery efforts have new vegetative cover due to favorable growing conditions experienced over the past year. It is expected that this vegetation coverage as it grows, matures, spreads, and is augmented by the germination and growth of native species, will begin to moderate the flood threat substantially over the next two to five years. A return to pre-fire conditions, or at least stabilization of the regional ecosystem, is expected to occur over the next three to eight years (2005 to 2010). The need for protection afforded by the placement of the flood and sediment retention structures will diminish accordingly.

While the impacts of constructing the identified flood and sediment retention structures were included in the analysis provided in DOE/SEA-03, the future disposition of these structures, some of which were designed to last for decades, was not considered. Mitigation measures listed in the DOE/SEA-03 include the following commitment: "Removal of the constructed flood control and erosion damage reduction features and the FRS when storm water flows have returned to pre-fire levels as denoted by vegetation recovery and annual modeling estimates will be considered. Additional NEPA and other regulatory compliance would be necessary when these actions become ripe for consideration. If structures are removed, re-contouring and reseeding of these areas with appropriate site-specific seed mixtures would be conducted until these construction sites have been completely revegetated." A mitigation action plan (MAP) (DOE 2000b) was prepared for the mitigation measures called out in the DOE/SEA-03. The first annual mitigation plan progress and status report for activities in 2001 was issued by NNSA in March 2002 (NNSA 2002). This annual report is publicly available in the previously identified DOE Reading Rooms.

1.3 Purpose and Need for Agency Action

NNSA constructed certain flood and sediment detention structures in the wake of the Cerro Grande Fire as part of its emergency response actions. These structures were built to address the changes in local watershed conditions that resulted from the fire, which are expected to return to a pre-fire status or become stabilized over the next three to eight years. The long-term disposition of these structures was not considered as a part of the decision to undertake the construction actions. NNSA needs to take actions regarding the disposition of these structures when they are no longer necessary to protect LANL facilities and the businesses and homes located downstream.

1.4 Scope of This EA

A sliding-scale approach (DOE 1993) is the basis for the analysis of potential environmental and socioeconomic effects in this EA. That is, certain aspects of the Proposed Action have a greater potential for creating environmental effects than others; therefore, they are discussed in greater detail in this EA than those aspects of the action that have little potential for effect. For example, implementation of the Proposed Action could affect waste management resources at LANL. This EA, therefore, presents in-depth descriptive information on these resources to the fullest extent necessary for effects analysis. On the other hand, implementation of the Proposed Action would cause only a minor effect on socioeconomics at LANL. Thus, a minimal description of effects to this resource is presented.

When details about a Proposed Action are incomplete, as a few are for the Proposed Action evaluated in this EA (for example, the exact amount of waste potentially generated), a bounding analysis is often used to assess potential effects. When this approach is used, reasonable maximum assumptions are made regarding potential emissions, effluents, waste streams, and project activities (see Sections 2.0 and 4.0 of the EA). Such an analysis usually provides an overestimation of potential effects. In addition, any proposed future action(s) that exceeds the assumptions (the bounds of this effects analysis) would not be allowed until an additional NEPA review could be performed. A decision to proceed or not with the action(s) would then be made.

1.5 Public Involvement

NNSA provided written notification of this NEPA review to the State of New Mexico, the four Accord Pueblos (San Ildefonso, Santa Clara, Jemez, and Cochiti), Acoma Pueblo, the Mescalero Apache, and to over 30 stakeholders in the area on August 17, 2001. Upon release of this draft EA, NNSA will allow for a 21-day comment period. Where appropriate and to the extent practicable, concerns and comments received after the close of the comment period will be considered in the final EA.

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2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and alternatives for the disposition of certain flood and sediment detention structures built in the wake of the Cerro Grande Fire and listed in Section 1.2 of this EA. Section 2.1 describes the structures in more detail. Sections 2.2, 2.3, and 2.4 describe the Proposed Action, the Disassembly of All Structures Alternative, and the No Action Alternative, respectively. Note that the disposition of reinforcements to the Los Alamos Reservoir and the access road that was described in DOE/SEA-03 and mentioned in Section 1.2 on page 3 will not be considered in this document because they are no longer under the administrative control of DOE, NNSA.

Until NNSA determines that site conditions have returned to pre-fire status or the local ecosystem has recovered enough to approximate pre-fire conditions, the various subject structures will be maintained as described in Section 2.1; this may be the case for the next several years. The exact duration for the continuance of the status quo cannot be established at this time because of the unpredictability of weather patterns, revegetation rates, changes in soil structure, and the possibility of other events that would affect revegetation and flows, such as other fires in the watersheds above where the subject structures are located. In addition, there may be changes in NNSA missions, land management policies, and environmental stewardship policies that might affect when disposition of the subject structures should occur. The Proposed Action and alternatives described in this chapter are based on the continuance of LANL mission support activities and capabilities for the foreseeable future, as described in LANL's Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999) and other DOE NEPA documents and planning documents. If changes in mission support activities or policies occur such that these alternatives are no longer suitable, further NEPA analysis might be required. Additionally, the Proposed Action and alternatives are based on the projection of adequate recovery of the ecosystem at LANL within the next eight years (by 2010) (DOE 2000b). Proposed activities under each alternative would occur by the end of 2010.

2.1 Description of Structures

2.1.1 Flood Retention Structure

The FRS, located 800 feet (ft) (240 meters [m]) downstream of the confluence of Two-Mile and Pajarito Canyons, rises 72 ft (21.6 m) above the natural ground surface and stretches 390 ft (117 m) across Pajarito Canyon (Figure 4). Beneath the FRS, the foundation is comprised of moderately welded to unwelded tuff bedrock (loosely fused volcanic ash). Near the crest of the FRS, the tuff is more welded (fused) and is identified by harder, cliff-forming units prominently visible on the north side of the valley (LANL 2001a).

The FRS construction material is RCC. Upstream, the semi-formed, near-vertical face of the FRS was trimmed by a backhoe to a roughened finish. Figure 5 shows a close-up of the surface. The unformed downstream face slopes one foot horizontally for every foot of vertical rise. The crest width is 10 ft (3.3 m). Figure 6 is a composite cross-section of the FRS. A 1-ft- (0.3-m-) wide, 10-ft- (3.3-m-) high parapet wall rises above the FRS crest, except at the 200-ft- (60-m-) long overflow spillway section in the middle (Figure 7), and ties into welded tuff at both abutments (LANL 2001a).

Figure 4. Upstream face of the FRS from upstream, north bank.

Figure 5. Close-up of RCC construction material. Quarter is placed to show scale.

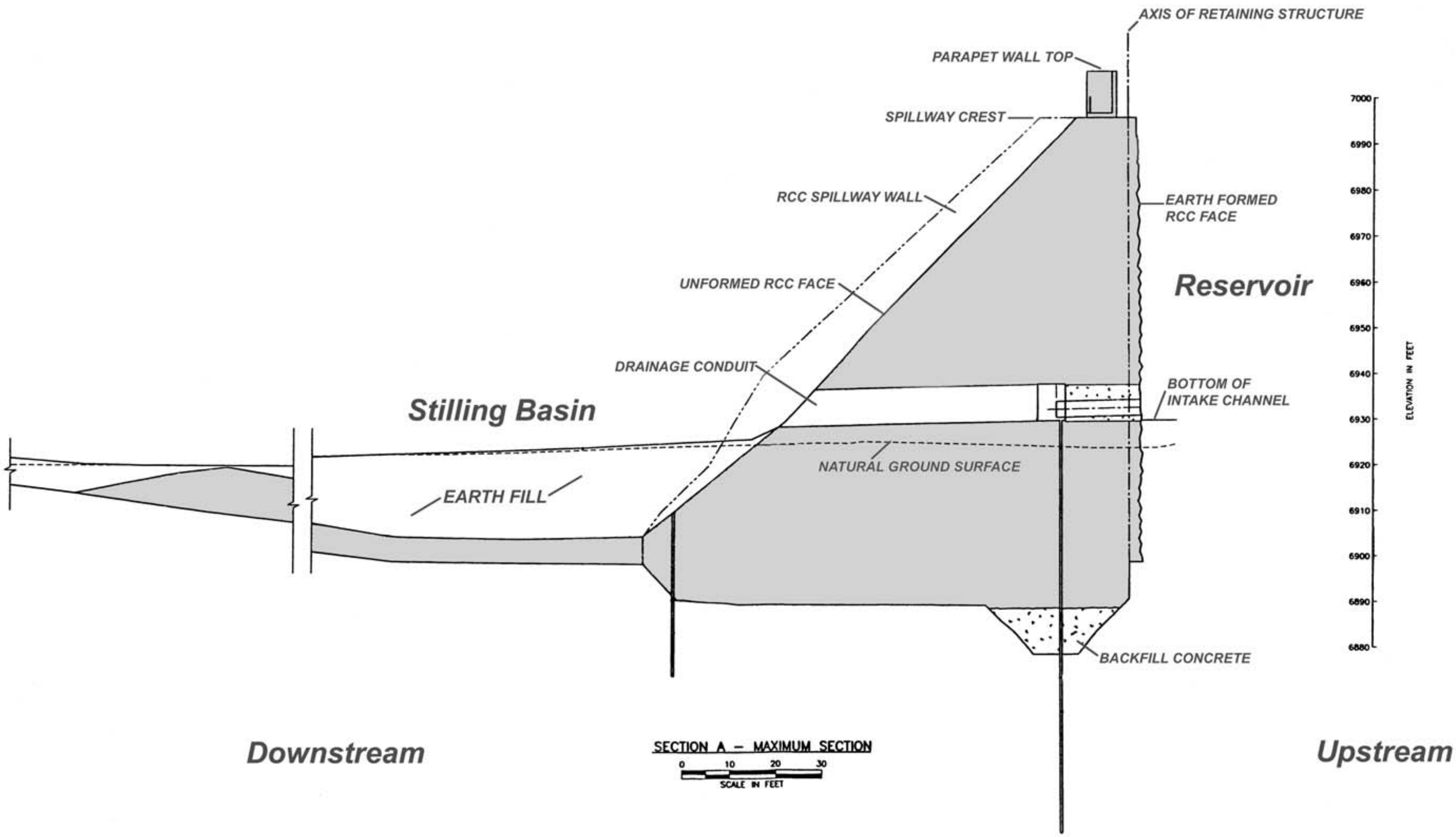

Figure 6. Composite cross section of the FRS.

Figure 7. FRS from top of canyon to show 200-ft-wide (60 m) spillway.

During construction the streambed at the retention structure site was excavated to a depth of 50 ft (15 m) below the natural ground surface and backfilled with poured concrete and RCC up to the natural ground surface (streambed) to form the underground base of the FRS. Beyond the spillway RCC was placed in a 5-ft- (1.5-m-) thick slab that overlies unwelded volcanic tuff to form the floor to the stilling basin downstream from the FRS. The floor slopes upward from the basin floor downstream to the original streambed. The stilling basin is 90 ft (27 m) wide and 60 ft (18 m) long at the foot of the FRS, 55 ft (16.5 m) wide at the streambed transition, and has an overall length of 160 ft (48 m). The stilling basin has been filled in with soil.

The FRS is designed to retain the runoff and sediment volume from precipitation events up to the 100-year, 6-hour storm, also referred to as the design basis event. Runoff from the 100-year storm would be retained in the upstream reservoir and slowly released within a 96-hour period to assist in minimizing flooding downstream.

The bottom of the FRS is equipped with a 42-inch (in.) (105-centimeter [cm]) diameter drainage conduit, placed in the direction of the stream channel, which will allow accumulated storm water to exit. This conduit is connected to a 73-ft (21.9-m) intake tower with 15-in.- (37.5-cm-) thick structural concrete walls located at the center of the FRS on the upstream side (Figure 8) to form the total outlet works. The tower contains 2-ft by 2-ft (0.6-m by 0.6-m) openings spaced at 8-ft (2.4-m) centers on two sides of the tower (Figure 9). Galvanized metal trash rack grids cover the openings (Figure 10). During a flood event, if sediment clogs lower windows, water can enter the inlet tower through the upper windows and flow out the drainage conduit down the existing

Figure 8. Close-up of the 73-ft (21.0-m) intake tower taken from reservoir on upstream side of FRS.

Figure 9. Inlet tower taken from north bank of reservoir to show spacing of openings.

Figure 10. Close-up of inlet tower to show galvanized trash rack.

streambed. As sediment in the bottom of the reservoir accumulates, the lower openings can be closed permanently by attaching steel plates. This would prevent any future “cave-ins” of silt into the drainage tower. For storm water runoff flows at rates greater than the design basis event, the structure will release water through both the outlet and over the 200-ft (60-m) spillway located along the crest of the FRS (see Figure 7).

Currently, a maintenance project is underway to correct erosion that is occurring at the outlet from the FRS. The area directly below the outlet and downstream for approximately 210 ft (63 m) will be excavated to allow for installation of gabions. Gabion work will also be completed in the areas of the structure where it joins the canyon walls in order to preclude further erosion.

The functional design life of the FRS is a minimum of 20 years. The FRS is currently under the administrative control of the USACE, which constructed the FRS on behalf of the NNSA. Transfer of the FRS from the USACE to DOE is expected to occur subsequent to core drilling work being done for the USACE to provide quality assurance data. Upon turnover from the administrative control of the USACE and acceptance of the structure, the NNSA would administer the FRS, and UC staff at LANL would be responsible for the proper operation and maintenance. The USACE Albuquerque District would inspect the FRS initially; thereafter, it would be the responsibility of UC staff at LANL to perform periodic inspections and maintenance in accordance with the LANL site-specific procedures. The annual periodic inspections for the FRS would be to determine the condition and to ascertain the adequacy of the operation and maintenance. In addition to the annual inspection, special periodic inspections are to be made to evaluate the structural safety, stability, and operational adequacy of the FRS.

UC will adapt the USACE Operation and Maintenance program (USACE 2000) into LANL site-specific procedures including routine maintenance activities and activities required by the DOE/SEA-03 MAP (DOE 2000b). The LANL site-specific procedure for the FRS includes the Operations and Maintenance Plan (LANL 2001a) and the Emergency Action Plan (EAP) (LANL 2001b), which is discussed further in this section.

During floods or periods of water retention, an inspection is required to ensure that the FRS is performing as designed. Maintenance is required to ensure that the serviceability of the FRS remains intact; this would include removing flood debris and repairing any damage caused by erosion or other forces within the reservoir on the upstream side and within the stilling basin on the downstream side. The reservoir behind the FRS and the intake structure of the outlet works are also to be cleared of logs, trees, trash, litter, and debris. The existing access road to the base of the FRS from Pajarito Road would also be maintained.

UC personnel have prepared the LANL EAP for the Pajarito Canyon Flood Retention Structure (LANL 2001b). The condition requiring the implementation of the EAP is the potential for flooding in the Pajarito watershed vicinity, as advised by the National Weather Service. Using the Federal Emergency Management Association guidelines, the EAP focuses on establishing a procedural system to complement and outline the use of physical flood control and emergency systems already in place. Although the possibility of failure of the FRS is minute, developing and maintaining the EAP is essential to safeguarding lives and minimizing physical damage in an emergency event.

As part of the MAP measures discussed in Chapter 1 of this EA, UC staff at LANL are monitoring vegetation re-growth and modeling runoff above LANL annually. This is to determine when onsite storm water flows return to pre-fire levels or the ecosystem has at least reached a stable state approximating that condition.

At the time of FRS construction, a 3-ac (1.2-ha) staging area was created at the top of the mesa near Pajarito Road. An existing unimproved road along the south side of Pajarito Road was graded and widened to accommodate construction trucks and vehicles. A new access road was constructed from this existing road between the mesa top and the upstream side of the FRS in the canyon bottom. The road is approximately one-quarter (or 0.25) mile (mi) (0.4 kilometers [km]) in length with a maximum 28 percent grade. Four-wheel drive capability passenger vehicles are required to safely traverse the road. An existing road along the bottom of Pajarito Canyon connecting to TA-18 was also regraded and improved for use when the FRS was constructed.

2.1.2 Low-head Weir and Detention Basin

The low-head weir and detention basin (Figure 11) are located in Los Alamos Canyon near the intersection of SR 4 and SR 501 within TA-72. It was constructed to provide sediment control and detention and to decelerate storm water flow. The weir includes a large, relatively shallow depression that serves as a detention basin. The detention basin is about 500 ft (150 m) long by 100 ft (30 m) wide and is about 10 ft (3 m) deep at its deepest point. The weir is located on the downstream side of the detention basin and is about 10 ft (3 m) above ground level. It is constructed of gabions, which are rectangular wire baskets filled with large cobblestones. Approximately 11,900 cubic yards (yd^3) (9,044 cubic meters [m^3]) of soil and rock were excavated during construction and stockpiled along the sides of the canyon. The total area affected, including the weir, detention basin, and excavated backfill area, is less than 3 ac (1.2 ha).

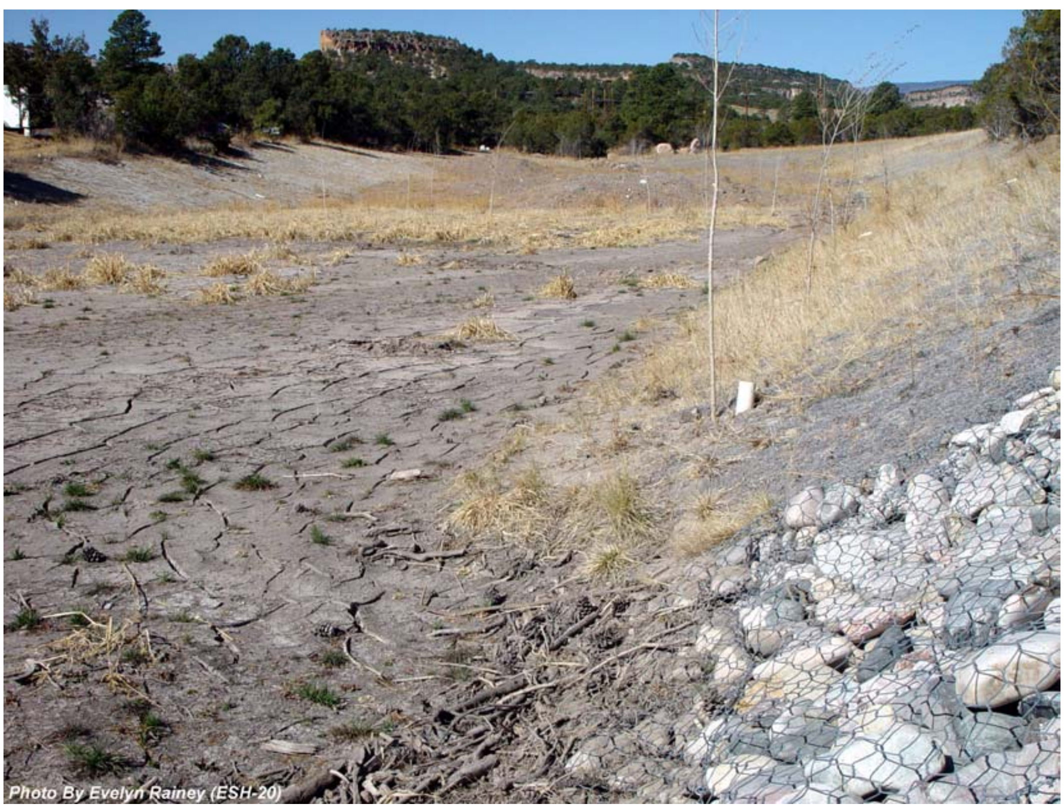

Figure 11. Los Alamos Canyon weir showing detention basin on the left and gabions on the right.

An area of about one-quarter acre in size is potentially evolving into a wetland area within the detention basin. As part of recovery efforts after the fire, typical wetland species such as willows (*Salix* spp.) were planted here. It is unknown if these can be sustained under diminishing soil saturation conditions over time. Maintenance of the weir and detention basin consists of routine inspections, possible sediment removal, and repair when required. Repair or replacement of damaged gabions is performed when necessary to maintain structural integrity of the weir. As part of the MAP implementation, sediments in the detention basin are sampled to monitor the level of contaminants washed down the canyon from upstream sources within LANL. Removal of these sediments would be performed as required based on contaminant buildup levels and the resulting wastes would be disposed of as appropriate at LANL or offsite.

2.1.3 Road Reinforcements

A test pit was excavated west (upstream) of the existing inlet for the Anchor Ranch Road land bridge across Two-Mile Canyon to characterize the road foundation material. The embankment at this canyon crossing and the embankments where SR 501 crosses Two-Mile Canyon, Pajarito Canyon, and Water Canyon were then reinforced with concrete to protect the roadbeds from becoming saturated and failing. Existing slope reinforcements and matting were removed as necessary, along with trees on or near highway embankment slopes. The slopes were then cleared, tree roots and rocks were removed, and the area was regraded. Trenches, as necessary, were excavated at all embankments. Embankments were reinforced with soil nails (shafts drilled into the embankment and pressure grouted), articulated concrete mattresses (ACMs) (concrete and steel flexible barriers or blankets that are used to stabilize soils or steep slopes that are prone to erosion), and shotcrete (a concrete mix blown onto surfaces). A spillway coated with shotcrete (Figure 12) was incorporated into the design and construction of the Anchor Ranch

Figure 12. Road reinforcements along SR 501.

Road land bridge site at Pajarito Canyon. Outlet structures were also incorporated into the design and construction of all four canyon-crossing road locations so that water would not be retained behind the roadbeds for more than four days (96 hours) after a storm event. Maintenance of the road reinforcements consists of routine inspections and repair when required. Repair or replacement of damaged sections is done when necessary to maintain structural integrity of the reinforcements.

2.1.4 Steel Diversion Wall

A 760-ft-long (228-m-long) steel diversion wall was constructed upstream of TA-18 facilities within Pajarito Canyon (Figures 13 and 14). The wall was installed quickly as an interim measure to protect TA-18 capabilities until the FRS could be built. The purpose of the wall was to divert storm water and debris to the south of Critical Assembly Storage Area I (CASA I) at TA-18. Steel panels attached to large metal beams were installed to form the wall.

The beams were driven vertically into the ground with a vibratory hammer to a depth of 30 ft to 40 ft (9 m to 12 m). The sheets extended approximately 5 ft to 6 ft (1.5 m to 1.8 m) above ground. The structure was backfilled with earth to provide additional strength on the downstream side. The functional design life of this structure is a minimum of 25 years. Routine maintenance, such as repair or replacement of the metal sheets or removal of the vegetation, will be performed over the lifetime of the wall.

Figure 13. Steel diversion wall at TA-18 under construction.

Figure 14. Detail of joined steel panel in steel diversion wall.

2.2 Proposed Action

The Proposed Action is to remove part of the above ground portion of the FRS and the entire above ground portions of the steel diversion wall; the other subject structures would remain in place with continued performance of routine maintenance activities. All of the various subject structures are located within floodplains; removal activities at the two identified structure sites would require the placement of best management practices (BMPs), such as straw bales, silt fences, and similar storm water flow controls, in accordance with a Storm Water Pollution Prevention (SWPP) Plan, which is required by the LANL National Pollutant Discharge Elimination System (NPDES) permit. The BMPs would be placed at the FRS and the steel diversion wall before demolition activities begin. LANL personnel would ensure that the New Mexico and National Air Quality Standards for particulate emissions are met throughout any demolition activities through the use, in part, of standard dust suppression methods such as water sprays or soil tackifiers[3].

To prevent serious injuries, all site construction contractors are required to submit and adhere to a Construction Safety and Health Plan. This Plan is reviewed and approved by UC staff before construction activities can begin. Following approval of this Plan, UC and NNSA site inspectors would routinely verify that construction contractors are adhering to the Plan, including applicable Federal and state health and safety standards.

[3] Tackifiers are chemical dust suppressants often added to water that acts to disperse the chemicals, then evaporates after application. The chemicals that are left behind bind the soil particles together into larger particles that are less easily blown into the air.

2.2.1 Flood Retention Structure

Implementing the Proposed Action would result in the removal of part of the FRS above ground level and in the removal of sediments sufficient to allow resumption of the natural flow in the streambed without future floodwater retention. Currently, the volume of sediment that has accumulated behind the FRS is estimated to be about 9,680 yd^3 (7,357 m^3) of material at a depth of 6 ft (1.8 m) at the base of the FRS. This volume of sediment represents two years accumulation. With continuing revegetation in the watershed above the FRS, sediment is likely to be deposited and accumulate at a diminishing rate. As part of the DOE/SEA-03 MAP (DOE 2000b), the sediment is tested annually for chemical, radiological, and heavy metal constituents. Removal of sediment volumes under the Proposed Action would be based on the sediment composition as well as on the amount of accumulation over the next several years. A bounding volume of 48,400 yd^3 (36,785 m^3) of sediment material could be removed (to ground level) from the FRS site; this is the amount estimated to accumulate over 10 years based on the accumulation in the two years following the Cerro Grande Fire.

As described in Section 2.1, gabions are presently being installed along the downstream channel; some of these would also be removed as part of the Proposed Action. Design studies would be performed at that time to determine the width of the channel needed and required slope. This analysis estimates that a maximum 200-ft- (60-m-) wide breach would need to be opened in the FRS. Figure 15 shows a digitally altered picture to visualize partial removal of the FRS.

Figure 15. Digitally altered picture of the FRS to show partial removal.

The concrete structure would be broken up mechanically using equipment such as jackhammers or hydraulic splitters or with controlled explosives blasting, or by a combination of these means. Dust suppression measures would be used when appropriate to control particulate emissions. Approximately 25,000 yd^3 (19,000 m^3) of concrete debris from the FRS, approximately 48,400 yd^3 (36,785 m^3) of sediment material, and approximately 200 yd^3 (153 m^3) of gabion rock would be removed and hauled out of the canyon by 6-wheel-drive capability vehicles.

There are two different options for removal of sediment, concrete and gabion rock resulting from the demolition of the FRS, depending on the decisions made about the future disposition of the TA-18 capabilities and facilities that are currently located downstream from the FRS (see Related Actions discussion later in the text of this chapter). Option A describes the Proposed Action under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS. Option B describes the Proposed Action under the condition that the TA-18 mission has been relocated and that the existing facilities are not subject to heightened national security measures, allowing construction equipment access through that site. The project conducted under either option would take about seven months to complete. There would be about 20 workers at the site during the time of highest activity.

Option A. TA-18 Capabilities are Not Relocated

If TA-18 capabilities continue at their present location, the Proposed Action project would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade. Each truck could transport about 20 yd^3 (15.2 m^3), resulting in approximately 1,250 loads[4] of concrete debris and 10 loads of gabion rocks to be transported up the access road. An additional 2,420 loads of sediment material could also be removed. The concrete, rocks, and sediment would be hauled to the existing 3-ac (1.2-ha) staging area located along Pajarito Road at the intersection of the access road.

Alternatively, DOE may decide to use a continuous generator conveyor belt, such as those that are used in the mining industry, to haul debris out of the canyon. This would minimize truck traffic in the canyon. The aforementioned staging area at Pajarito Road would be required.

At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. The concrete removed from the canyon could be crushed at the Pajarito Road staging area site or at the long-term storage site. The concrete rubble and gabion rock would be stored long term until used for construction projects at LANL or off site. Currently this type of material is stored at Sigma Mesa. Sediment would be removed by dump truck and properly disposed of.

At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. The access road would be removed and that part of the canyon wall would be recontoured and stabilized.

[4] For each truckload of material removed from the site, this analysis assumes two truck trips (one full and one empty) over LANL roads.

Option B. Proposed Action if TA-18 Capabilities are Relocated

If the TA-18 capabilities and facilities are relocated away from TA-18, it is unlikely that NNSA would decide to use the existing site for any NNSA mission support activity that had the same level of national security requirements. Currently, access to the maintenance road below the FRS connecting to the TA-18 facilities is restricted because of enhanced security conditions. If this mission relocation occurs before the disposition of the FRS, the existing maintenance road below the FRS and the area occupied by the TA-18 facilities could be used for transportation and staging of the concrete, rock, and sediment. The road would be upgraded and erosion BMPs would be installed. Similar to Option A, the removal would require 6-wheel-drive off-road vehicles to carry the concrete, rocks, and sediment up the road. The truckloads and material quantities would be the same as for Option A. A new 3-ac (1.2-ha) staging area would be established and used in TA-18. The staging area would be located outside of the floodplain and would be sited so as to avoid any cultural resources and potential release sites (PRSs). At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. The concrete removed from the canyon could be crushed at the Pajarito Road staging area site or at the long-term storage site. The concrete rubble and gabion rock would be stored long term until used for construction projects at LANL or off site. Currently this type of material is stored at Sigma Mesa. Sediment would be removed by dump truck and properly disposed of.

At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. Unlike Option A, at the end of the FRS removal activities, both the maintenance road and the access road to the upstream side of the FRS would be retained as fire roads for vehicle access to the upper portion of Pajarito Canyon and the firing sites at TA-22.

2.2.2 Low-head Weir and Detention Basin

The low-head weir and detention basin would be left in place as part of the Proposed Action; routine maintenance activities would be performed. As described previously in this EA, a wetland could be present in the detention basin, although this is uncertain. If present, the wetland would remain in place. Current maintenance activities would be carried out, including the replacement of wire mesh containers as they rust or fail. Sampling of sediments would be performed to evaluate potential chemical radiological and heavy metal constituent concentrations in the detention basin, and sediments would be removed as required and disposed of appropriately through the LANL waste management program.

2.2.3 Road Reinforcements

Road reinforcements would be left in place as part of the Proposed Action. Routine inspection and maintenance activities would continue to be conducted when required.

2.2.4 Steel Diversion Wall

Under either option for the TA-18 facilities, the steel diversion wall above TA-18's CASA I would be removed. The pilings would be removed down to ground level with a cutting torch or similar tool. The 25 yd^3 (19 m^3) of panels and beams generated by the demolition would be removed and shipped offsite for recycling. A crew of eight would be required to work for approximately six weeks to accomplish removal of this structure.

2.3 Disassembly of All Structures Alternative

The Disassembly of All Structures (Disassembly) Alternative is to remove all of the above ground portion of the FRS, the low-head weir and detention basin, the road reinforcements, and the entire above ground portions of the steel diversion wall. All of the various subject structures are located within floodplains; removal activities would require the placement of BMPs, such as straw bales, silt fences, and similar storm water flow controls in accordance with a SWPP Plan, which is required by the LANL NPDES permit. The BMPs would be placed at the FRS and the steel diversion wall before demolition activities begin. LANL personnel would ensure that the New Mexico and National Air Quality Standards for particulate emissions are met throughout any demolition activities through the use, in part, of standard dust suppression methods such as the use of water sprays.

2.3.1 Flood Retention Structure

Implementing the Disassembly Alternative would result in the total removal of the FRS to ground level, along with sediments and gabion rocks, and restoration of the entire area of the FRS and reservoir surface to approximately preconstruction topographic conditions. This is shown in Figure 16, which is a digitally altered representation of complete removal of the FRS. Vegetation would be reseeded and small saplings may be planted as deemed appropriate.

Figure 16. Digitally altered picture of complete removal of the FRS.

As described under the Proposed Action, the maximum volume of sediment that could build up behind the FRS is 48,400 yd^3 (36,785 m^3); up to this amount of sediment material would be removed from the FRS site under this Disassembly Alternative. Approximately 300 yd^3 (230 m^3) of gabion rocks and 50,000 yd^3 (38,000 m^3) of concrete debris from the FRS would be removed.

The concrete structure would be broken up mechanically using equipment such as jackhammers or hydraulic splitters or with controlled explosives blasting, or by a combination of these means. Dust suppression measures would be used when appropriate to control particulate emissions.

There are two different options for removal of sediment and concrete resulting from the demolition of the FRS, depending on the decisions made about the future disposition of the TA-18 capabilities and facilities that are currently located downstream from the FRS (see Related Actions discussion later in the text of this chapter). Option A describes the Disassembly Alternative under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS. Option B describes the Disassembly Alternative under the condition that the TA-18 mission has been relocated and that the existing facilities are not subject to heightened national security measures, allowing construction equipment access through that site. The project conducted under either option would take about 10 months to complete. There would be about 20 workers at the site during the time of highest activity.

Option A. Disassembly Alternative if TA-18 Capabilities are Not Relocated

If TA-18 capabilities continue at their present location, the Disassembly Alternative project would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade. Each truck could transport about 20 yd^3 (15.2 m^3) of material, resulting in approximately 2,500 loads of concrete and 15 loads of gabion rocks to be transported up the access road. An additional 2,420 loads of sediment could also be removed. The concrete and rock debris and sediment would be hauled to the existing 3-ac (1.2-ha) staging area located along Pajarito Road at the intersection of the access road.

Alternatively, DOE may decide to use a continuous generator conveyor belt, such as those that are used in the mining industry, to haul material out of the canyon. This would minimize truck traffic in the canyon. The aforementioned staging area at Pajarito Road would be required.

At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. The concrete removed from the canyon could be crushed at the Pajarito Road staging area site or at the long-term storage site. The concrete rubble and gabion rocks would be stored long term until used for construction projects at LANL or off site. Currently this type of material is stored at Sigma Mesa. Sediment would be removed by dump truck and properly disposed of.

At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The banks would be stabilized and reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. The access road would be removed and that part of the canyon wall would be recontoured.

Option B. Disassembly Alternative if TA-18 Capabilities are Relocated

If the TA-18 capabilities and facilities are relocated away from TA-18, it is unlikely that NNSA would decide to use the existing site for any NNSA mission support activity that had the same level of national security requirements. Currently, access to the maintenance road below the FRS connecting to the TA-18 facilities is restricted because of enhanced security conditions. If this mission relocation occurs before the disposition of the FRS, the existing maintenance road below the FRS and the area occupied by the TA-18 facilities could be used for transportation and staging of the concrete, rock, and sediment. The road would be upgraded and erosion BMPs would be installed. Similar to Option A, the removal would require 6-wheel-drive off-road vehicles to carry the concrete debris, rocks, and sediment up the road. The truckloads and material quantities would be the same as for Option A. A new 3-ac (1.2-ha) staging area would be established and used in TA-18. The staging area would be located outside of the floodplain and would be sited so as to avoid any cultural resources and PRSs. At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. The concrete removed from the canyon could be crushed at the Pajarito Road staging area site or at the long-term storage site. The concrete rubble and gabions would be stored long term until used for construction projects at LANL or off site. Currently this type of material is stored at Sigma Mesa. Sediment would be removed by dump truck and properly disposed of.

At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The banks would be stabilized and reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. Unlike Option A, at the end of the FRS removal activities, both the maintenance road and the access road to the upstream side of the FRS would be retained as fire roads for vehicle access to the upper portion of Pajarito Canyon and the firing sites at TA-22.

2.3.2 Low-head Weir and Detention Basin

The low-head weir and detention basin would be removed as part of this alternative. As described previously in this EA, a wetland could be present in the detention basin, although this is uncertain. A bounding volume of 17,000 yd^3 (12,900 m^3) of sediment (850 truckloads) could be removed from the site; this is the amount estimated to accumulate over 10 years based on the accumulation of 3,400 yd^3 (2,600 m^3) in the two years following the Cerro Grande Fire. In addition, approximately 1,700 yd^3 (1,300 m^3) of gabion rock (85 truckloads) could be removed, as would the potential wetland if it is sustainable.

The low-head weir would be removed using hand-held tools, front-end loaders, and other heavy construction machinery. The accumulated sediment would be tested for potential elevated constituents and would be removed from the site and disposed of appropriately. Fill material would be brought in to fill the detention basin or some of the approximately 11,900 yd^3 (9,044 m^3) of excavated soil, and rocks would be used from the sides of the canyon where it was stockpiled during construction activities. A crew of five would be required to work approximately three weeks to accomplish total removal of the low-head weir and detention basin.

2.3.3 Road Reinforcements

The ACMs and shotcrete would be removed from the road under this alternative. The volume of material would be 500 yd^3 (380 m^3) or 25 truckloads. The road banks would be re-graded. Demolition debris would be removed from the site and disposed of appropriately. This would leave these roads without any reinforcements because the work performed as part of the Cerro

Grande Fire rehabilitation replaced reinforcements that already existed. A crew of 10 would be required to work for approximately six weeks to accomplish removal of the reinforcements.

2.3.4 Steel Diversion Wall

Under this alternative, the steel diversion wall above TA-18's CASA I would be removed to ground level. This action is described in Section 2.2.4.

2.4 No Action Alternative

2.4.1 Flood Retention Structure

Under the No Action Alternative, the FRS would remain intact. UC staff at LANL would continue inspection and maintenance activities. However, because the ecosystem would have returned to pre-fire or to near pre-fire conditions and the danger of major flooding would be reduced, it is unlikely that water would be retained in the reservoir behind the FRS. This would reduce the requirement for debris removal at the FRS over time and revegetation would gradually occur. The steep embankment would need continued maintenance for erosion control.

UC staff at LANL would continue annual inspections and the special periodic inspections to evaluate the structural safety, stability, and operational adequacy of the FRS. If structural or stability problems of the FRS are detected, DOE would make a decision on repair or disposition of the FRS at that time and additional NEPA compliance review would be needed.

2.4.2 Low-head Weir and Detention Basin

Under the No Action Alternative, the low-head weir and detention basin would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action.

2.4.3 Road Reinforcements

Under the No Action Alternative, road reinforcements would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action.

2.4.4 Steel Diversion Wall

Under the No Action Alternative, the steel diversion wall would be left in place. Routine inspections and maintenance activities would be continued.

2.5 Alternatives Considered but not Analyzed

As described in Section 2.1.1 and Figure 6, the FRS below ground level consists of RCC to a depth of 50 ft (15 m). Below the spillway is a 5-ft- (1.5-m-) thick slab that forms the floor to the stilling basin. Removal of the below ground features as part of the Proposed Action is not necessary as the restoration of the stream channel flow is possible without the removal of these structures.

2.6 Related Actions

2.6.1 Special Environmental Analysis

As described in Section 1.2, NNSA prepared a special environmental analysis (DOE/SEA-03) (DOE 2000a) that documents its assessment of impacts associated with emergency activities conducted at LANL in response to major disaster conditions caused by the Cerro Grande Fire. NNSA would normally have prepared an EIS in compliance with NEPA to analyze potentially significant beneficial or adverse impacts that could occur if a proposed action was implemented. However, because of the urgent nature of the actions required to address the effects of the Cerro

Grande Fire as it burned over LANL and the need for immediate post-fire recovery and protective actions, NNSA had to act immediately and was therefore unable to comply with NEPA in the usual manner. NNSA invoked the CEQ's emergencies provision of its NEPA Implementing Regulations (40 CFR Part 1506.11) and the emergency circumstances provision of DOE's NEPA Implementing Regulations (10 CFR Part 1021.343[a]). Pursuant to those provisions, NNSA consulted with CEQ about alternative arrangements for NEPA compliance for its emergency action. Consistent with agreements reached during those consultations, NNSA prepared the DOE/SEA-03 (DOE 2000a) of known and potential impacts from wildfire suppression, post-fire recovery, and flood control actions. The DOE/SEA-03 can be found in DOE Reading Rooms in Albuquerque (at the Government Information Department, Zimmerman Library, University of New Mexico), and in Los Alamos (at the Community Relations Office located at 1619 Central Avenue).

2.6.2 Relocation of TA-18 Operations

TA-18 is the current location of facilities that support research in and design, development, construction, and application of experiments on nuclear criticality. These experiments involve the use of special nuclear material and require strict national security measures. NNSA has issued a draft EIS (DOE/EIS-D0319; DOE 2001) to support a decision on the future location of these operations. The preferred alternative is to relocate the TA-18 criticality experimental facilities to a site at TA-55 in order to consolidate security measures for the TA-18 operations with those of TA-55. Three other NNSA sites for receiving these operations have also been analyzed, including Sandia National Laboratories in Albuquerque, New Mexico; Argonne West at Idaho National Engineering and Environmental Laboratory in Idaho Falls, Idaho; and the Nevada Test Site, Nevada. Upgrading the existing facilities at TA-18 was also analyzed in the EIS as well as the No Action Alternative of retaining the current facilities at TA-18. NNSA expects to issue the Final EIS in calendar year 2002.

2.6.3 Site-Wide Environmental Impact Statement

The final LANL SWEIS (DOE/EIS-0238; DOE 1999), dated January 1999, was issued in February of that year. A Record of Decision (ROD) was issued in September 1999 and a MAP was issued in October 1999. In the ROD, DOE decided to continue operating LANL at the Expanded Operations Alternative Level. The SWEIS annual yearbook includes information on LANL operations and data on emissions and waste generation.

Part of the accident analysis in the SWEIS examined the potential effects of a wildfire at LANL. A special edition of the SWEIS yearbook (LANL 2000) compared this postulated accident in the SWEIS with the actual wildfire. Future issues of the LANL SWEIS yearbook will include information and updates on the impacts of the fire and changes to the ecological setting at LANL, as well as cumulative fire effects information. This EA will tier from the broader scope SWEIS.

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3.0 AFFECTED ENVIRONMENT

This chapter describes the natural and human environment that could be affected by the Proposed Action and the alternatives. Table 1 identifies the subsection where potential environmental issues are discussed or notes why they are not addressed in this document.

Table 1. Potential Environmental Issues Applicable to this EA

Environmental Category	Applicability	Subsection
Waste Management	Yes	3.2
Air Quality	Yes	3.3
Floodplains and Wetlands	Yes	3.4
Biological Resources	Yes	3.5
Cultural Resources	Yes	3.6
Geology	Yes	3.7
Water Resources (Ground and Surface)	Yes	3.8
Human Health	Yes	3.9
Noise	Yes	3.10
Traffic and Transportation	Yes	3.11
Visual Resources	Yes	3.12
Land Use	No. Land uses and land use designations would not be affected as a result of the Proposed Action or alternatives.	N/A
Utilities and Infrastructure	No. Utilities and infrastructure would not be affected as a result of the Proposed Action or alternatives.	N/A
Socioeconomic	No. Demolition activities would employ only 20 new workers at the peak activity and would have little noticeable effect on local economy.	N/A
Environmental Justice	No. Populations that are subject to environmental justice considerations are not located within the area of influence of the Proposed Action or alternatives.	N/A

3.1 Regional Setting

The Proposed Action would be located within the area of Santa Fe and Los Alamos Counties that include LANL. LANL comprises a large portion of Los Alamos County and extends into Santa Fe County. LANL is situated on the Pajarito Plateau along the eastern flank of the Jemez Mountains and consists of 49 technical areas. The Pajarito Plateau slopes downward towards the Rio Grande along the eastern edge of LANL and contains several fingerlike mesa tops separated by relatively narrow and deep canyons.

The FRS is constructed within Pajarito Canyon about 800 ft (240 m) below the joining of Two-Mile Canyon with Pajarito Canyon (Figure 17). The structure is approximately 2 mi (3.2 km) above the TA-18 facilities, which house the criticality experimental facilities, and about 10 mi (16 km) above the community of White Rock. The bottom of the canyon is a 100-year floodplain. Pajarito Canyon contains core and buffer area of environmental interest (AEI) for the Mexican spotted owl (*Strix occidentalis lucida*); this is currently unoccupied foraging habitat.

The low-head weir is located at the eastern edge of LANL in Los Alamos Canyon (Figure 18). The road reinforcements are located in the western area of LANL in Two-Mile Canyon at SR 501 and Anchor Ranch Road, in Pajarito Canyon at SR 501, and in Water Canyon at SR 501 (Figure 19). The steel diversion wall is located in Pajarito Canyon approximately 2 mi (3.2 km) below the FRS just above CASA 1 in TA-18 (Figure 20).

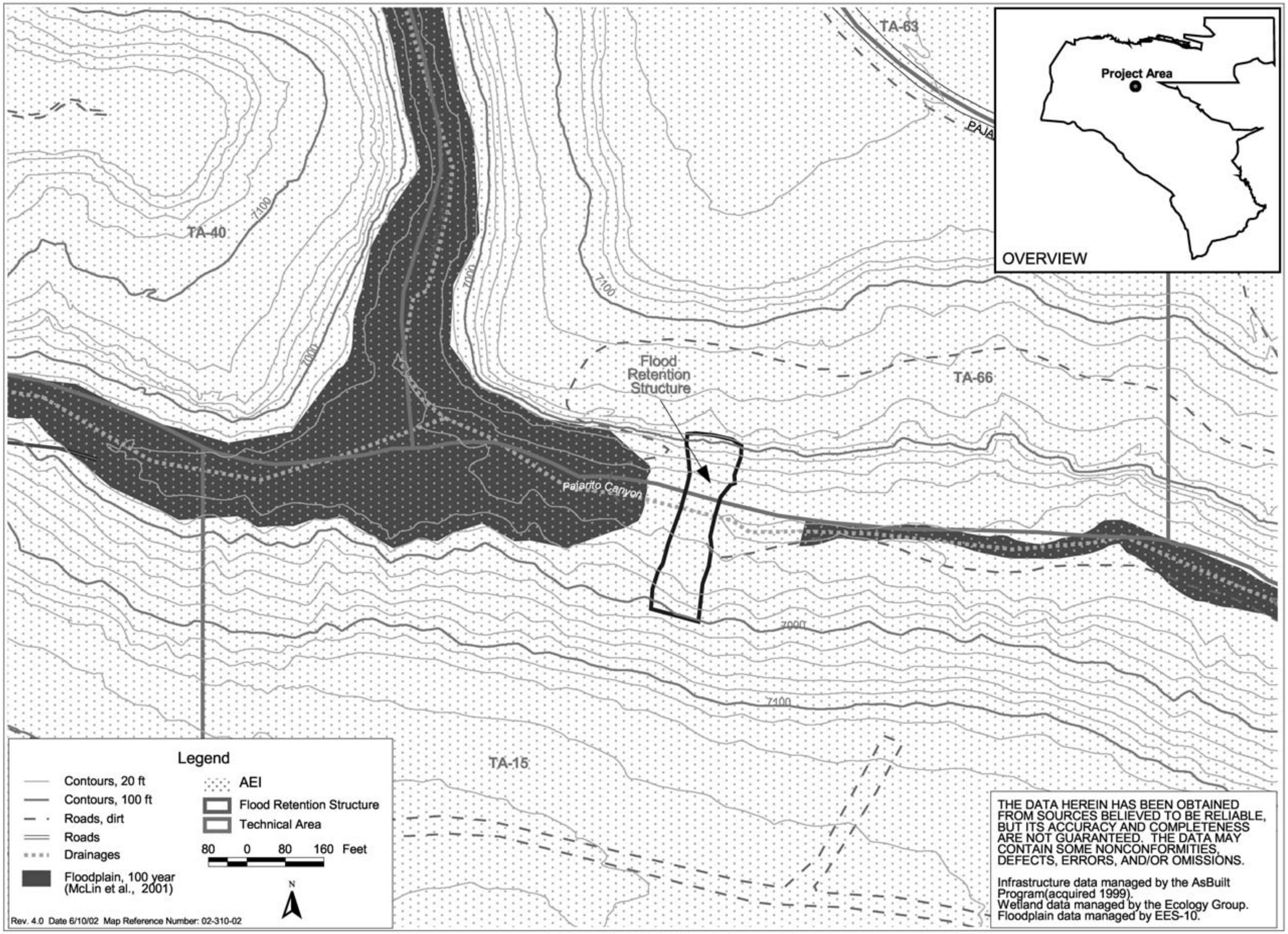

Figure 17. Location of FRS in Pajarito Canyon.

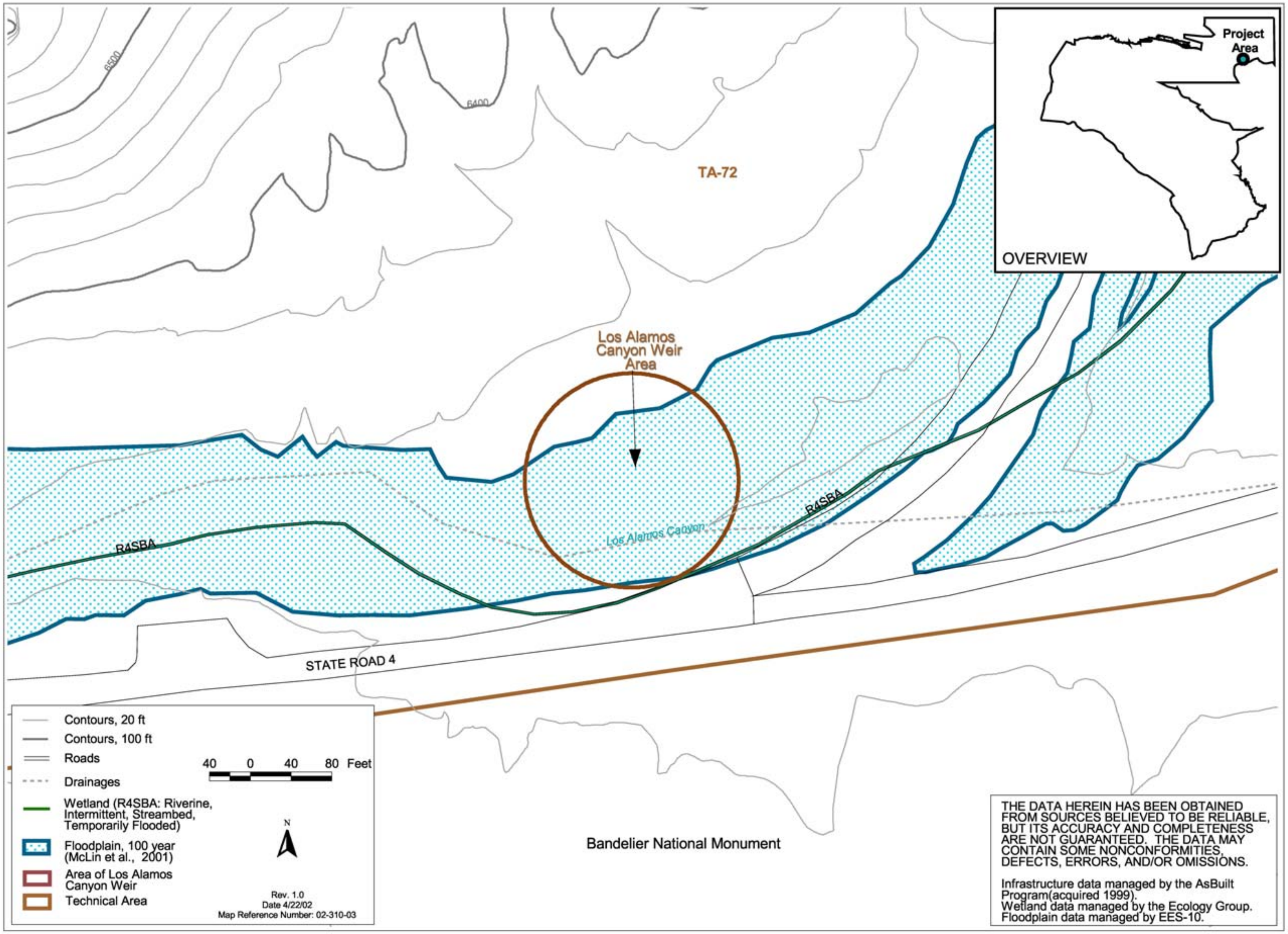

Figure 18. Location of low-head weir in Los Alamos Canyon.

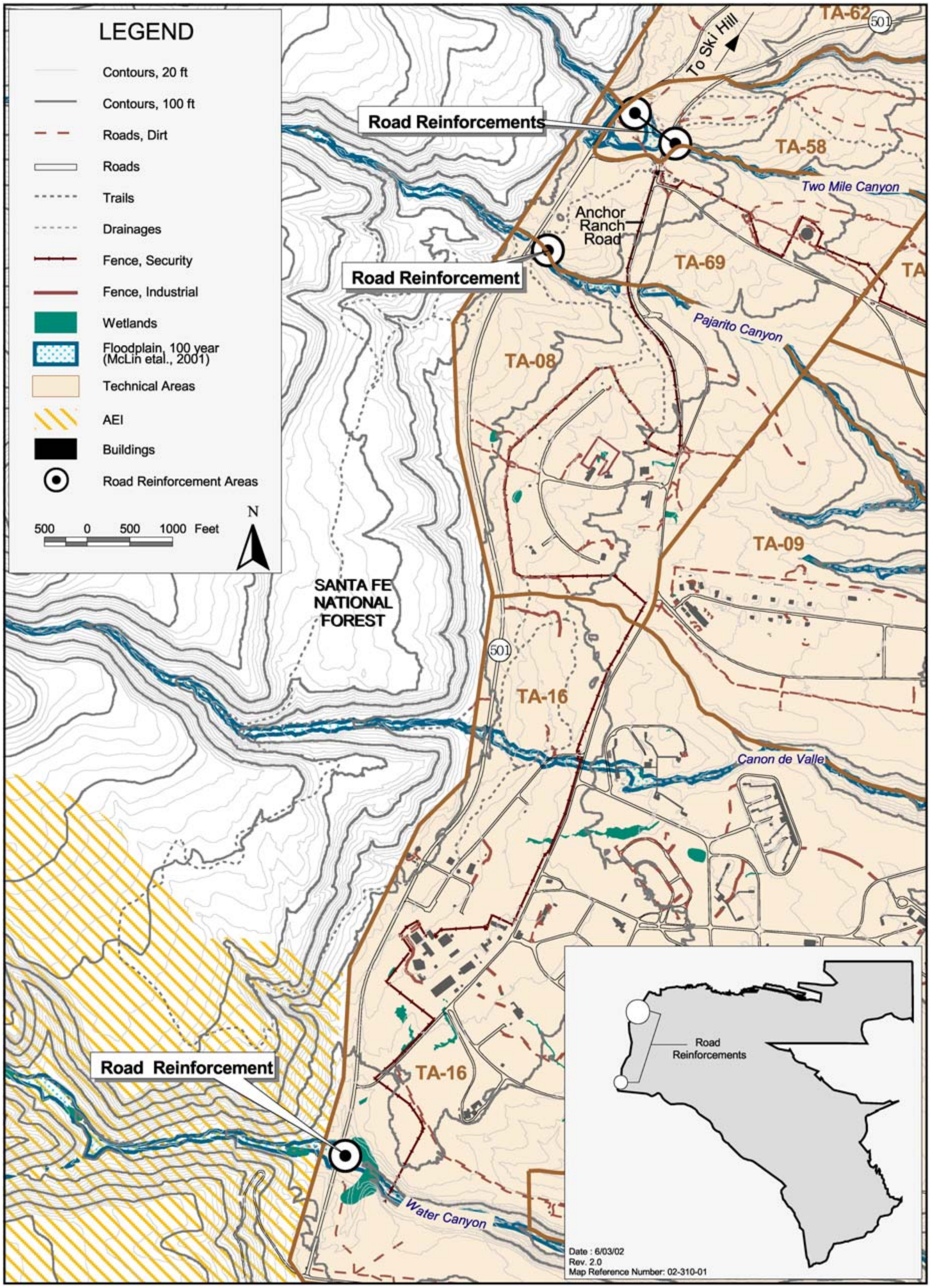

Figure 19. Location of road reinforcements in Two-Mile Canyon, Pajarito Canyon, and Water Canyon.

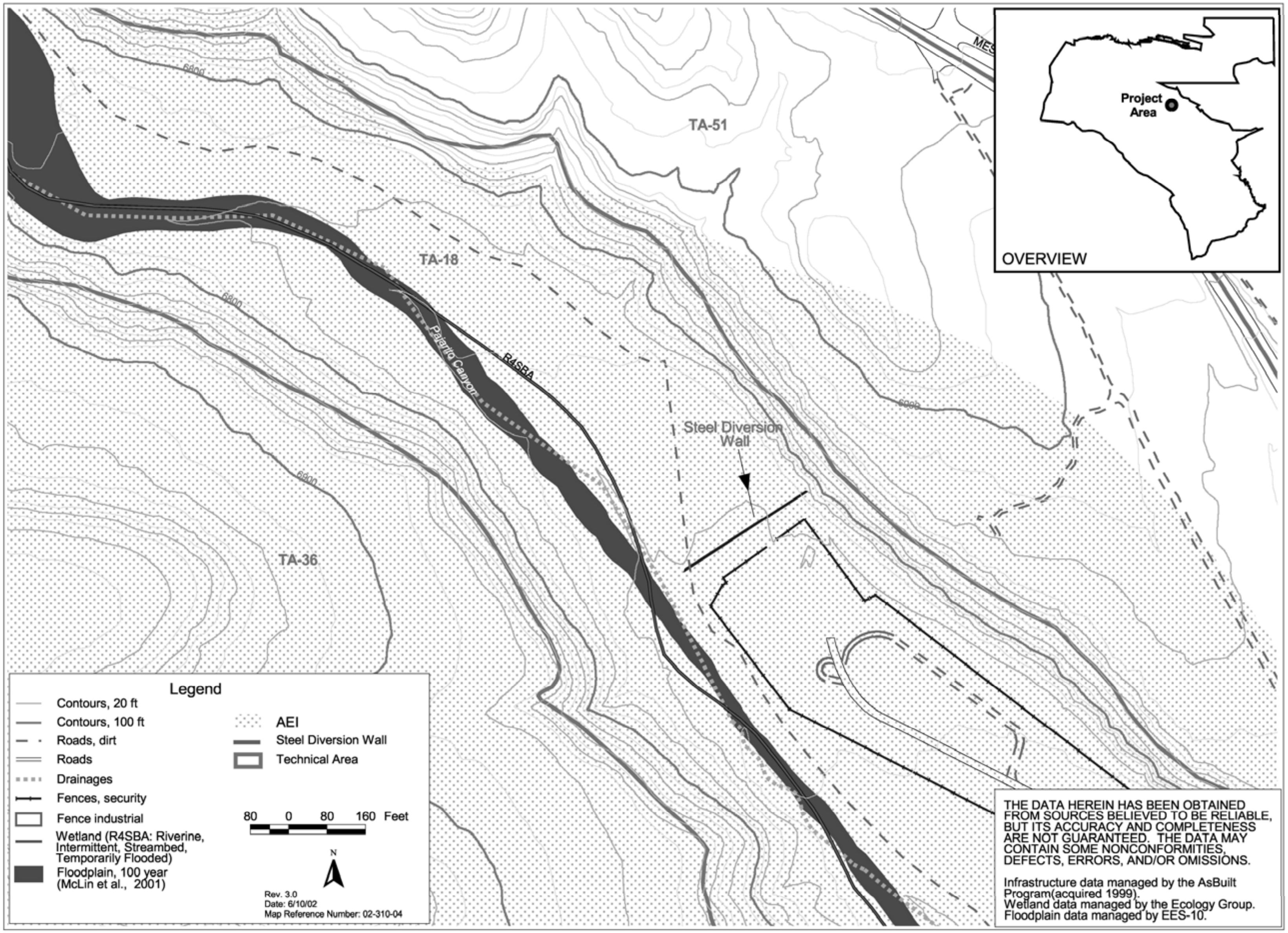

Figure 20. Location of steel diversion wall in Pajarito Canyon above TA-18.

3.2 Waste Management

LANL generates solid waste[5] from construction, demolition, and facility operations. These wastes are managed and disposed of at appropriate solid waste facilities. Both LANL and Los Alamos County use the same solid waste landfill located within LANL boundaries on DOE land. The Los Alamos County Landfill also accepts solid waste from other neighboring communities. The Los Alamos County Landfill receives about 52 tons per day (47 metric tons per day), with LANL contributing about 8 tons per day (7 metric tons per day), or about 15 percent of the total. Current plans are to close the Los Alamos County Landfill by June 30, 2004. Several landfill locations within New Mexico could be used after 2004.

Building-debris storage yards on Sigma Mesa (TA-60) or other approved areas are used at LANL to store concrete rubble, soil, and asphalt debris for future use at LANL. Low-level radioactive waste is disposed of at LANL, in Area G at TA-54, or is shipped to appropriate permitted facilities. Hazardous waste[6] and mixed wastes are treated and disposed of offsite because LANL has no onsite disposal capability for these waste types. The offsite disposal locations are located across the U.S. and are audited for regulatory compliance before being used by UC.

Ash and sediments resulting from post-fire runoff have been used by the U.S. Forest Service to raise the roadbed of its road in Los Alamos Canyon. The remaining sediments have been stockpiled in borrow-pits at TA-16 to be used for future construction and fire roads. Sediment accumulated at the FRS is not expected to be contaminated. PRSs located upstream of the FRS in Two-Mile Canyon and Pajarito Canyon have been stabilized. In addition, PRSs that formerly discharged into Pajarito Canyon have been stabilized. These include outfalls, surface runoff, and dispersion from firing sites.

3.3 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air[7]. Air surveillance at Los Alamos includes monitoring emissions to determine the air quality effects of LANL operations. UC staff calculates annual actual LANL emissions of regulated air pollutants and reports the results annually to the New Mexico Environment Department (NMED). The ambient air quality in and around LANL meets all Environmental Protection Agency (EPA) and DOE standards for protecting the public and workers (LANL 2001a).

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[5] Solid waste, as defined in the Code of Federal Regulations (40 CFR 261.2) and in the New Mexico Administrative Code (20 NMAC 9.1), is any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.

[6] Hazardous waste, as defined in 40 CFR 261.3, which addresses Resource Conservation and Recovery Act regulations, and by reference in 20 NMAC 4.1, is waste that meets any of the following criteria: a) waste exhibits *any* of the four characteristics of a hazardous waste: ignitability, corrosivity, reactivity, or toxicity; b) waste is specifically *listed* as being hazardous in one of the four tables in Subpart D of the CFR; c) waste is a mixture of a *listed* hazardous waste item and a nonhazardous waste; d) waste has been *declared* to be hazardous by the generator.

[7] Ambient air is defined in 40 CFR 50.1 as "that portion of the atmosphere external to buildings, to which the public has access." It is defined in the New Mexico Administrative Code (20 NMAC 2.72) as "the outdoor atmosphere, but does not include the area entirely within the boundaries of the industrial or manufacturing property within which the air contaminants are or may be emitted and public access is restricted within such boundaries."

Both EPA and NMED regulate nonradioactive air emissions. NMED does not regulate dust from excavation construction, but UC would take appropriate steps to control fugitive dust and particulate emissions. Annual dust emissions from daily windblown dust are generally higher than short-term construction-related dust emissions.

Excavation and construction activities are not considered stationary sources of regulated air pollutants under the New Mexico air quality requirements. Mechanical equipment associated with the construction phase of this project, including bulldozers, trenchers (trackhoes), excavators, side booms, tamper compactors, forklifts, and backhoes are exempt from permitting. Mobile sources, such as automobiles and construction vehicles, are additional sources of air emissions such as nitrogen oxide (NO_x); however, mobile sources and diesel emissions from conveyance vehicles are not regulated by NMED.

3.4 Floodplains and Wetlands

Wetlands are transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have the following attributes: at least periodically, the land supports primarily hydrophytes (plants adapted to abundant water such as cattails [*Typha* spp.] and willows [*Salix* spp.]), the substrate is predominantly undrained hydric soil (e.g., marshes, wet meadows); and is saturated with water or covered by shallow water at some time during the growing season of each year. LANL has wetlands that were identified by the National Wetlands Inventory, conducted by the U.S. Fish and Wildlife Service in 1990, as well as other wetlands that have been identified subsequent to the 1990 inventory. There are a total of 77 ac (31 ha) of wetlands at LANL, with more than 95 percent of these located in the Sandia, Mortandad, Pajarito, and Water Canyon watersheds. During the Cerro Grande Fire, 20 percent or 16 ac (6.5 ha) of the wetlands identified were burned at a low or moderate intensity; none of the wetlands within LANL was severely burned (DOE 2000a).

The DOE/SEA-03 (DOE 2000a) discusses cumulative effects due to erosion, contaminant transfer and flooding in the wetland areas due to actions taken after the Cerro Grande Fire. Wetlands in Mortandad, Pajarito and Water Canyons received increased amounts of ash and hydro mulch runoff as a result of the fire (LANL 2001d).

DOE's regulations (10 CFR 1022) define a flood or flooding as " . . a temporary condition of partial or complete inundation of normally dry land areas from . . . the unusual and rapid accumulation of runoff of surface waters. . . ." The base floodplain is the area inundated by a flood having a 1.0 percent chance of occurrence in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area of inundated by a flood having a 0.2 percent chance of occurrence in any given year (referred to as the 500-year floodplain). DOE had delineated all 100-year floodplains within LANL boundaries before the Cerro Grande Fire; review of these delineations is part of the post-fire recovery effort. The results of this review have recently been published (McLin 2001).

The FRS is located above TA-18 within the floodplain of Pajarito Canyon 800 ft (240 m) downstream of the confluence of Two-Mile and Pajarito Canyons. The steel diversion wall is located outside the Pajarito Canyon floodplain. The floodplain covers the entire extent of the canyon from the headlands to White Rock. Small wetlands exist in Pajarito Canyon from below TA-18 to above White Rock that provide limited wetland functions. These wetlands have been degraded recently through construction activities and as a result of the Cerro Grande Fire.

The low-head weir is located in Los Alamos Canyon. The entire length of Los Alamos Canyon is considered a floodplain. There are no existing wetlands in this canyon, although there are areas of hydrophilic (water-loving) plants along the stream channel. Wetland characteristics may form in the sediment behind the low-head weir. Currently, cottonwoods (*Populus* spp.) and willows planted in late 2000 are growing in this area. Further sedimentation is expected to occur and, if there is adequate moisture, this area may become a fully established wetland. However, if runoff does not occur, the wetland plants are not expected to thrive and the potential wetland would likely disappear. The size of this potential wetland makes it unlikely that it would provide more than very limited wetland functions should it survive over time.

3.5 Biological Resources

LANL is located in a region of diverse landform, elevation, and climate—features that contribute to producing diversified plant and animal communities. Plant communities range from urban and suburban areas to grasslands, wetlands, shrublands, woodlands, and mountain forest. These plant communities provide habitat for a variety of animal life. Animal life includes herds of elk (*Cervus elychus nelsoni*) and deer (*Odocileus hemionus*), bear (*Ursus americanus*), mountain lions (*Felis concolor*), coyotes (*Canis latrans*), rodents, bats (*Euderma* spp.), reptiles, amphibians, invertebrates, and a myriad of resident, seasonal, and migratory bird life. In addition, threatened and endangered species of concern, and other sensitive species occur at LANL. Because of restricted access to certain LANL areas, lack of permitted hunting, and management of contiguous Bandelier National Monument and Forest Service lands for natural biological systems, much of the region functions as a refuge for wildlife.

A number of regionally protected and sensitive (rare or declining) species have been documented in the LANL region. These include three Federally listed endangered species: the whooping crane (*Grus americana*), the southwestern willow flycatcher (*Empidonax trailii extimus*), and the black-footed ferret (*Mustela nigripes*), and two Federally listed threatened species: the bald eagle (*Haliaeetus leucocephalus*) and the Mexican spotted owl (*Strix occidentalis lucida*). Under the *Endangered Species Act of 1973* (16 USC 1531), government agencies are required to consider the potential effects of all its activities on Federally listed threatened or endangered species and their critical habitat.

The LANL Threatened and Endangered Species Habitat Management Plan (HMP) establishes AEIs that are being managed and protected because of their significance to biological or other resources (LANL 1998). Habitats of threatened or endangered species that occur or may occur at LANL are designated as AEIs. In general, an AEI consists of a core area that contains important breeding or wintering habitat for a specific species and buffer area around the core area. The buffer protects the area from disturbances for certain activities, including construction, in the AEI. For instance, activities are restricted in a core and buffer area during breeding season until it is determined that the habitat is not occupied for that year. LANL UC personnel perform annual surveys of the AEI early in the breeding season to determine the presence of breeding pairs. If the habitat is occupied, the restrictions remain in place until the completion of the breeding season. Any activities that cannot operate within the guidelines of the HMP require further consultation with the U.S. Fish and Wildlife Service.

The FRS is located 800 ft (240 m) downstream from the confluence of Two-Mile and Pajarito Canyons. The area immediately surrounding the FRS is mixed conifer (ponderosa pine [*Pinus ponderosa* P. & C. Lawson], Douglas fir [*Pseudotsuga menziesii* (Mirbel) Franco], and white fir

[*Abies concolor* (Gord. & Glend.) Lind. Ex Hildebr.]). The north-facing slope has numerous trees, which were severely burned during the Cerro Grande Fire. At the time the FRS was constructed, many of these burned trees were downed and left perpendicular to the slope to slow down storm water runoff and soil wash from the slope areas. At the canyon bottom on the upstream side of the FRS, the vegetation has been completely removed and only the steep banks with hydromulching remain along the walls surrounding the utility road. These walls were cut too steep and, despite erosion control measures taken after the structure was constructed (hydromulching), the walls are beginning to erode. These steep banks continue upstream ending near the confluence of the two canyons where live native vegetation remains. About one-half of the trees at this juncture are burned. The burned trees in this area tend to follow Pajarito Canyon. Further up Two-Mile Canyon, the number of burned trees becomes less.

Downstream from the FRS, the first 100 ft (30 m) of the canyon bottom consists of deposited sediment. Most of this appears to have come from the FRS structure itself. The visibility of this sediment starts to fade away after about 200 to 300 ft (60 to 90 m). The slopes on this side of the structure are also showing erosion problems despite the initial hydromulching. These erosion problems will be corrected on both sides of the structure in the near future.

The steel diversion wall is located at TA-18 approximately 2 mi (3.2 km) downstream of the FRS. The area surrounding the steel diversion wall is mixed conifer. This area of the canyon was also burned in the Cerro Grande Fire and evidence of that still remains.

Both the FRS and the steel diversion wall are located in potential habitat AEIs for the Mexican spotted owl, although at this time this potential habitat is not occupied by individuals of the species. If the habitat should be occupied, restrictions on activities within the AEI may be extended to the end of the breeding season (late August).

The vegetation in the areas along SR 501 where road reinforcements have been installed is mainly ponderosa pine with some native grasses. All of the sites of road reinforcements are in areas that were burned during the Cerro Grande Fire.

The low-head weir is located at the junction of SR 502 and SR 4. This area is mainly piñon-juniper (*Pinus* spp. and *Juniperus* spp.) habitat; however, since this weir was constructed, a wetland has started forming on the west, or upstream side. Vegetation consists of cottonwoods and willows planted in the detention base following the fire to help prevent erosion and retain sediment. Over time, this wetland may continue to develop and mature if there is adequate soil moisture. The developing wetland is approximately one-quarter acre in size.

3.6 Cultural Resources

Cultural resources include any prehistoric sites, buildings, structures, districts, and other places or objects considered to be important to a culture or community for scientific, traditional, religious, or any other reason. They combine to form the human legacy for a particular place (DOE 1999). To date, over 2,000 archaeological sites and historic properties have been recorded at LANL.

The criteria used for evaluating cultural resources depends upon their significance as sites eligible for listing to the National Register of Historic Places (NRHP) as described in the *National Historic Preservation Act* (16 United States Code 470). These determinations of significance are met by evaluating each cultural resource based on its meeting any one or more of the following criteria:

1. Associated with events that have made a significant contribution to the broad pattern of our history.
2. Associated with the lives of persons significant in our past.
3. Illustrates a type, period, or method of construction.
4. Yields, or may be likely to yield, information important in prehistory or history.

There are three prehistoric sites located in the area of the FRS. These sites consist of an Ancestral Pueblo petroglyph panel and two rock shelters of an unidentified affiliation. The petroglyph panel is upstream of the FRS, whereas the two rock shelters are downstream of the FRS. All three sites are approximately 30 ft (9 m) above the canyon floor on the north side of Pajarito Canyon. The petroglyph panel is eligible for preservation on the NRHP. One of the rock shelters is potentially eligible and the other rock shelter is not eligible for preservation on the NRHP.

There are no cultural sites located within the area disturbed by construction of the low-head weir and detention basin. There are several artifact scatters from the Coalition/Classic Periods downstream of the weir; however, these are not within the streambed.

There is one historic site located within approximately 200 ft (60 m) of the road reinforcements at Anchor Ranch Road. However, this site consists of a Homestead Period artifact scatter, such as broken bottles, dishes, cans, and glass, and is not eligible for preservation.

There are several prehistoric sites located in the area of the steel diversion wall. These sites consist of a rock shelter and several cavates. These sites are located along the cliff faces above the canyon floor.

3.7 Geology

The Jemez Mountains volcanic field (JMVF) is located in northern New Mexico at the intersection of the western margin of the Rio Grande Rift and the Jemez Lineament (Figure 21; Gardner et al. 1986, Heiken et al. 1996). The Jemez Lineament is a northeast-southwest trending alignment of young volcanic fields ranging from the Springerville volcanic field in east-central Arizona to the Raton volcanic field of northeastern New Mexico (Heiken et al. 1996). The JMVF is the largest volcanic center along this lineament (ERP 1992). Volcanism in the JMVF spans a roughly 16-million-year period beginning with the eruptions of numerous basaltic lava flows. Various other eruptions of basaltic, rhyolitic, and intermediate composition lavas and ash flows occurred sporadically during the next 15 million years with volcanic activity culminating in the eruption of the Bandelier Tuff (Figure 22) at 1.79 and 1.23 million years ago (Self and Sykes 1996). All of LANL property is within the JMVF and is sited along the western edge of the Rio Grande Rift. Most of the bedrock on LANL property is composed of the salmon-colored Bandelier Tuff.

The geologic structure of the LANL area is dominated by the north-trending Pajarito Fault system. The Pajarito Fault system forms the western structural boundary of the Rio Grande Rift, along the western edge of the Española Basin, and the eastern edge of the JMVF. The Pajarito Fault system consists of three major fault zones (Pajarito, Guaje Mountain, and Rendija Canyon fault zones) and numerous secondary faults with vertical displacements ranging from 80 to 400 ft (24 to 120 m). Estimates of the timing of the most recent surface rupturing paleoearthquakes along this fault range from 3,000 to 24,000 years ago (Gardner et al. 1999, Gardner et al. 2001).

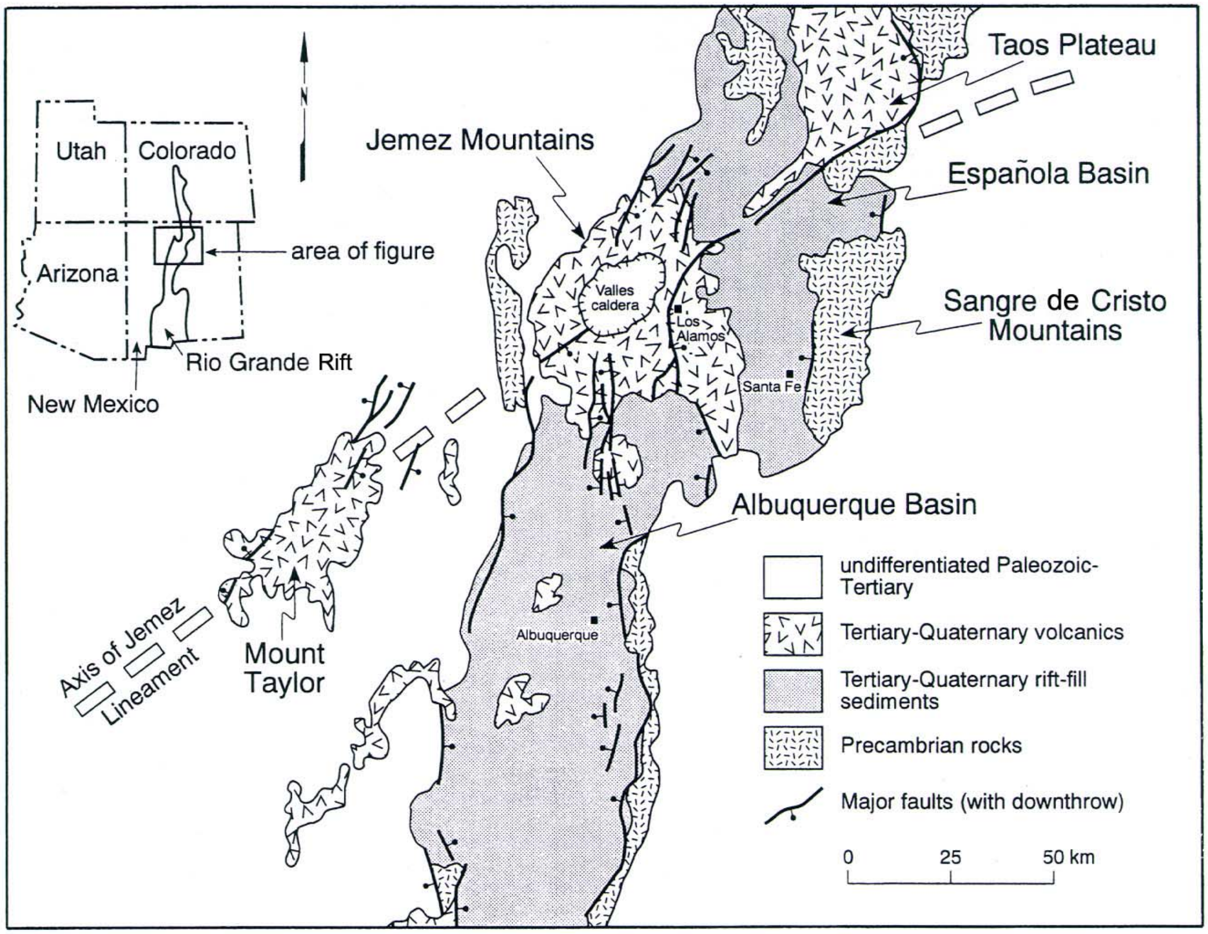

Figure 21. Generalized geologic map of the Rio Grande Rift in northern New Mexico (Self and Sykes 1996).

Results of seismic hazards studies (Wong et al. 1995, Gardner et al. 1999, Gardner et al. 2001) indicate that the Pajarito Fault system represents the greatest potential seismic risk to LANL, with an estimated maximum earthquake magnitude of about 7 on the Richter Scale. Although large uncertainties exist, an earthquake with a Richter magnitude of 6 is estimated to occur once every 4,000 years; an earthquake of magnitude 7 is estimated to occur once every 100,000 years (DOE 1999).

The FRS is constructed within Pajarito Canyon 800 ft (240 m) downstream of the confluence with Two-Mile Canyon. This canyon has been carved into the upper member of the Bandelier Tuff which is known as the Tshirege Member. The Tshirege Member was erupted at 1.23 million years ago during the Quaternary Period. It consists of five “cooling units” of varying thickness (Figure 22). Each “cooling unit” represents a separate, but closely spaced in time, eruption(s) of ash that came to rest and then cooled as a unit and lithified into rock. The FRS is anchored into units 1v and 2 along the sides of the canyon and into units 1v and 1g at the base (see Figure 22). The Tshirege Member is characterized by numerous joints (most related to cooling of the ash) and variable degrees of welding. Unit 3 makes up the upper portions of the canyon walls and the mesa tops in this area. It consists of a lower non-welded portion (slopes)

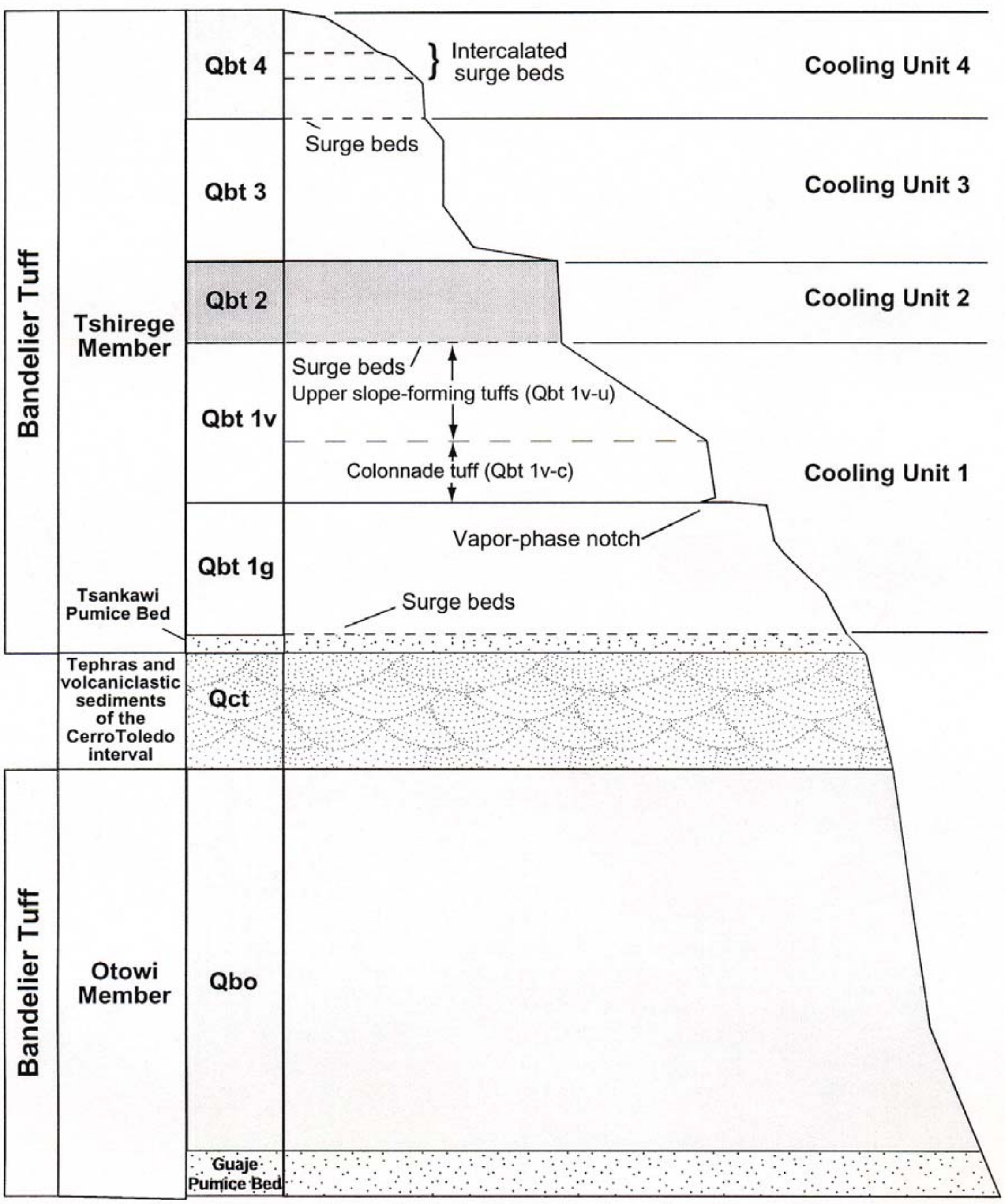

Figure 22. Stratigraphy of the Bandelier Tuff (from Broxton and Reneau 1995).

and an upper welded portion (cliffs). The underlying unit 2 is also a variably welded cliff-former. The lower part of this unit is gradational into the underlying unit 1v. The amount of welding of the units generally increases upwards from non-welded at the base of unit 1g to densely welded at the top of unit 2. In general, the rock is less competent and more friable at the base of Pajarito Canyon and becomes more competent about halfway up the canyon wall near the top of the FRS. This is then repeated in unit 3 to the top of the mesa.

Rockfalls, landslides, and slope instability are triggered by any process that might destabilize supporting rocks. These are the most likely geo-hazards that could affect the proposed action and alternatives. The natural jointing (cooling cracks) mentioned above provides pathways for water, increasing the likelihood of freeze-thaw cycles or excessive rainfalls contributing to rockfalls. Preferential erosion of less welded portions of the tuffs (by streams or rainfall) could undermine the overlying, more densely welded layers (Figure 22) resulting in rockfalls or landslides. Construction activity (creating roads, etc.) could also contribute to slope instability. A study on potential mesa-edge stability at Pajarito Mesa (Reneau 1995) indicates that north rims display large-scale mass movement features in a zone typically 100 ft to 200 ft (30 m to 60 m) wide. In contrast, mass wasting on south rims is dominated by infrequent failure of narrow fracture-bounded tuff blocks. The frequency of failure is unknown but seismic shaking may provide a triggering mechanism. The southern end of the Guaje Mountain Fault Zone has been projected to cross Pajarito Canyon (within the Bandelier Tuff) where Two-Mile Canyon enters (Reneau et al. 1995). However, the projection of the southern end of the Guaje Mountain Fault Zone across Pajarito Canyon is inconclusive. If in fact the fault zone does cross Pajarito Canyon less than 1,000 ft (300 m) upstream of the FRS, the FRS should be considered to be within a zone of increased seismic risk.

The low-head weir and detention basin is constructed within Los Alamos Canyon near the intersection of SR 4 and SR 502. In the vicinity of the weir, this canyon has been carved through the upper and lower members of the Bandelier Tuff (Tshirege and Otowi Members, respectively; see Figure 22) and into the underlying Cerros del Rio basalts. The canyon floor is covered by varying amounts of alluvium (stream sediments) and colluvium (landslide deposits). The low-head weir is constructed upon these unconsolidated sands and gravels. The underlying basalt is fractured in this area, which could provide pathways for ground water to migrate into the regional aquifer.

In the vicinity of the Anchor Ranch Road where it crosses Two-Mile Canyon, the local geology consists of uppermost Bandelier Tuff (Tshirege Member) and fan deposits just to the west of SR 501. The ash flows in this area are stratigraphically higher than unit 4 in Figure 22 (Figure 22 is representative of Pajarito Mesa and not westernmost LANL). These ash flows are generally more densely welded than the ash flows at Pajarito Mesa and contain numerous sandy surge beds. The fan deposits to the west consist of stream-deposited, loose, pre-Bandelier Tuff rock-type material exposed as a result of movement in the Pajarito Fault Zone (Rogers 1995). This area lies directly within the Pajarito Fault Zone (Gardner et al. 1999, 2001) and the 400 ft (120 m) plus, nearly vertical fault scarp is located approximately 700 ft (210 m) to the west. The Pajarito Fault Zone is the western edge of the Rio Grande Rift (Figure 21). The location of these road reinforcements is less than 500 ft (150 m) from several active secondary faults of the Pajarito Fault Zone. As such, this location has an increased risk of seismic events relative to other areas further removed from the fault zone. The proximity of the steep fault scarp immediately to the west could result in high velocity flash floods with high contents of debris (rocks, gravel, trees, etc.) that could have significant erosion effects in the event of heavy rainfall.

The steel diversion wall is constructed within Pajarito Canyon downstream from the FRS near CASA 1 at TA-18. In this area the canyon has been carved into the upper member of the Bandelier Tuff (Tshirege Member; Figure 22). The diversion wall is constructed upon alluvium and volcanic tuff and is designed to divert water to the south of CASA 1.

3.8 Water Resources (Ground and Surface)

Surface water at LANL occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume has been insufficient to maintain surface flows across LANL. Runoff from heavy thunderstorms or heavy snowmelt can reach the Rio Grande. Effluents from sanitary sewage, industrial water treatment plants, and cooling tower blow-down enter some canyons at rates sufficient to maintain surface flows for varying distances (DOE 1999). Surface waters at LANL are monitored by LANL and the NMED to survey the environmental effects of LANL operations. Planned releases from industrial and sanitary wastewater facilities within LANL boundaries are controlled by NPDES permits. Construction, maintenance, and environmental activities conducted within water courses are carried out under *Clean Water Act* Section 404 permits certified per section 401 as regulated by NMED. The NMED also requires the application of BMPs to ensure compliance with New Mexico stream standards for activities conducted within or next to water courses.

The nature and extent of groundwater within the LANL region have not been fully characterized. Current data indicate that groundwater bodies occur near the surface in the canyon bottom alluvium, perched at deeper levels within the alluvium, and at still deeper levels in the regional aquifer (Purtymun 1995). Alluvial groundwater bodies have been identified primarily by drilling wells in locations where impacts from LANL operations are most likely to occur (DOE 1999). On LANL property, continually saturated alluvial groundwater bodies occur in Mortandad, Los Alamos, Pueblo, Sandia, and Pajarito Canyons. The depth to these alluvial groundwater bodies varies from approximately 90 ft (27 m) in the middle of Pueblo Canyon to 450 ft (135 m) in lower Sandia Canyon (LANL 1993). The main aquifer is separated from the alluvial groundwater bodies by 350 to 620 ft (105 to 186 m) of unsaturated volcanic tuff and sediments (Purtymun 1995). The aquifer is relatively insulated from the alluvial groundwater bodies and the perched groundwater bodies by these geologic formations. Recharge of the aquifer is not fully understood nor characterized. Groundwater within the LANL area is monitored to provide indications of the potential for human and environmental exposure from contaminants (DOE 1999). Groundwater protection and monitoring requirements are included in DOE Order 5400.1, General Environmental Protection Program (DOE 1988).

Data and analysis of LANL surface and groundwater quality samples taken from test wells indicate that LANL operations and activities have affected the surface water within LANL boundaries and some of the alluvial groundwater zones in the LANL region as well. Details on the surface and groundwater quality can be found in the annual LANL Environmental Surveillance and Compliance Report (LANL 2001d).

High- and moderate-severity fire increases the potential for surface runoff and soil erosion by removing vegetation and surface organic layers and increasing soil hydrophobicity. The Cerro Grande Fire increased the potential for storm water runoff through the canyons. For example, in Pueblo Canyon (one of the most severely burned areas), peak flows increased 16 times over pre-fire conditions. Details of flow rate increases can be found in DOE/SEA-03 (DOE 2000a). Studies are currently underway using data obtained from gaging stations, rainfall, vegetation regrowth, and other sources to model how water flows and sedimentation rates will change over the years as the forests recover from the fire. The data collected so far show little recovery. Peak flows observed in gauging stations in Los Alamos Canyon before the Cerro Grande Fire were usually less than 20 to 30 cubic feet per second (cfs). Peak flows modeled for the 100-year flood event after the fire can be as high as 1,300 cfs (Springer 2002). Similar studies have been done in Pajarito Canyon. At SR 501, observed flows before the Cerro Grande Fire were reported at 2.4 cfs. An estimated flow rate from a storm on June 28, 2000, was 1,020 cfs, and modeling of the 100-year flood event after the fire reports 2,063 cfs. With increased runoff and erosion, the potential for the migration of chemical, radiological, and heavy metal constituents throughout the canyons has also increased.

3.9 Human Health

The health of UC workers and non-UC demolition and maintenance workers is considered in this EA because each category of worker would be involved in the demolition or breeching of a portion of the FRS or the maintenance of other flood control structures under the Proposed Action. Members of the public are not considered because they are not likely to be affected by demolition activities, routine maintenance, or any credible accident scenarios that could result from the Proposed Action.

The health of UC workers is routinely monitored depending upon the type of work performed. Health monitoring programs for UC workers consider a wide range of potential concerns including exposures to radioactive materials, hazardous chemicals, and routine workplace hazards. In addition, UC workers involved in hazardous operations are protected by engineering controls and required to wear appropriate personal protective equipment (PPE). Training is also required to identify and avoid or correct potential hazards typically found in the work environment and to respond to emergency situations. Because of the various health monitoring programs and the requirements for PPE and routine health and safety training, UC workers are generally considered to be a healthy workforce with a below average incidence of work-related injuries and illnesses.

UC staff monitors environmental media for contaminants that could affect non-UC workers or members of the public. This information is reported to regulatory agencies, such as the NMED, and to the public through various permits and reporting mechanisms and it is used to assess the effects of routine operations at LANL on the general public. For detailed information about environmental media monitoring and doses to the public, see LANL's Environmental Surveillance and Compliance Report for 2000 (LANL 2001d). For those persons that work within the boundaries of LANL as subcontractors or demolition workers and could be exposed to radioactive or other hazardous materials, their exposures are monitored in the same manner as UC workers. In addition, site-specific training and PPE requirements would also apply to these workers.

3.10 Noise

Noise is defined as unwanted sound. Sound is a form of energy that travels as invisible pressure vibrations in various media, such as air. The auditory system of the human ear is particularly sensitive to sound vibrations. Noise is categorized into two types: *steady-state noise*, which is characterized as longer duration and lower intensity, such as a running motor, and *impulse or effect noise*, which is characterized by short duration and high intensity, such as the detonation of high explosives (HE). The intensity of sound is measured in decibel (dB) units. In sound measurements relative to human auditory limits, the decibel scale is modified into an A-weighted frequency scale (dBA).

Noise measured at LANL is primarily from occupational exposures. These measurements generally take place inside buildings and are made through the use of personal noise dosimeters and other noise monitoring instruments. Occupational exposure data are compared against an established occupational exposure limit (OEL). At LANL, the OEL is administratively defined as noise to which a worker may be exposed for a specific work period without probable adverse effects on hearing acuity. The OEL for both steady-state and impulse or effect noise is based on U. S. Air Force Regulation 161-35, *Hazardous Noise Exposure*, which has been adopted by DOE. The maximum permissible OEL for steady-state noise is 84 dBA for each 8-hour work period. The OEL for impulse and effect noise is not fixed because the number of effects allowed per day varies depending on the dBA of each effect. DOE also requires that Action Levels (levels of exposure to workplace hazards that are below the OEL but require monitoring or the use of PPE) be established for noise in the workplace. Action Levels at LANL for steady-state noise and impulse and effect noise are 80 dBA and 140 dBA for each 8-hour day, respectively.

Environmental noise levels at LANL are measured outside of buildings and away from routine operations. These sound levels are highly variable and are dependent on the generator. The following are typical examples of sound levels (dBA) generated by barking dogs (58), sport events (74), nearby vehicle traffic (63), aircraft overhead (66), children playing (65), and birds chirping (54). Sources of environmental noise at LANL consist of background sound, vehicular traffic, routine operations, and periodic HE testing. Measurements of environmental noise in and around LANL facilities and operations average below 80 dBA.

The averages of measured values from limited ambient environmental sampling in Los Alamos County were found to be consistent with expected sound levels (55 dBA) for outdoors in residential areas. Background sound levels at the White Rock community ranged from 38 to 51 dBA (Burns 1995) and from 31 to 35 dBA at the entrance of Bandelier National Monument (Vigil 1995). The minimum and maximum values for the County ranged between 38 dBA and 96 dBA, respectively. Because of the isolated locations of the FRS and the various other flood control structures, ambient noise levels in the vicinity of these structures is typical of undeveloped outdoor areas.

3.11 Traffic and Transportation

Section 4.10 of the LANL SWEIS (DOE 1999) describes transportation services at LANL before the Cerro Grande Fire. The impacts on transportation in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.10 of the SWEIS. Motor vehicles continue to be the primary means of transportation to LANL. Only two major roads, SR 502 and SR 4, access Los Alamos County (see Figure 3). Peak traffic volume on these two segments of highway is primarily associated with LANL activities. Commuter traffic to LANL from the east, mainly the Rio Grande Valley or Santa Fe, travels on SR 502 to the town sites, or exits SR 502 to SR 4, which passes near the Los Alamos Canyon low-head weir (Structure 2 on Figure 3) and then travels on East Jemez Road or Pajarito Road to various TAs within LANL. Commuters from White Rock also access East Jemez Road and Pajarito Road from SR 4. Pajarito Road runs past the access roads and lay-down areas proposed for the FRS. A small percentage of LANL employees commute to LANL from the west along SR 501, where the road reinforcements are located.

Hazardous and radioactive material shipments leave or enter LANL from East Jemez Road to SR 4 to SR 502, and thus pass near the Los Alamos Canyon low-head weir. On-site shipments take place on Pajarito Road, which runs past the access roads to the FRS and to TA-18 where the steel diversion wall is located above CASA I.

Traffic and transportation from construction and demolition activities at LANL result in increased trips by construction workers traveling to and from work. Transportation of construction materials and debris to and from the construction and demolition sites also result in additional trips.

3.12 Visual Resources

The visual environment of LANL is described in the SWEIS (DOE 1999). The natural setting of the Los Alamos area is panoramic and scenic. The mountain landscape, unusual geology, varied plant communities, and archaeological heritage of the area create a diverse visual environment. Portions of the viewshed underwent substantial changes as a result of the Cerro Grande Fire. The fire burned large areas of the mountain slopes that form the principal scenic background in the Los Alamos area. The resulting landscape is both more stark and less uniform than before the fire (DOE 2000a).

The FRS rises 72 ft (21.6 m) above the natural canyon floor and stretches 390 ft (117 m) across Pajarito Canyon. The FRS does not rise above the canyon walls and thus is not visible from nearby roadways or public access areas. The FRS is within an access-restricted area. It does not disrupt any vistas or affect any local recreational areas.

The low-head weir and sediment detention basin are visible from SR 4. Although they are not high enough to obscure scenic vistas, they do represent a small-scale visual disruption of an otherwise minimally developed area.

The road reinforcements represent local changes in the visual environment. These changes are similar to other engineered highway structures, such as culverts, slope stabilizing walls, and traffic barriers. None of the road reinforcements interferes with scenic vistas.

The steel diversion wall is located in a developed area with restricted access. It is not visible from nearby roadways.

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the probable consequences (effects) of each analyzed alternative on relevant environmental resources. Resources are discussed in the same sequence as they were discussed in Chapter 3.

4.1 Effects of the Proposed Action

4.1.1 Waste Management

Waste management effects would be minor because waste resulting from the Proposed Action would be disposed of in existing landfills, which have the capacity to accept the waste. Most of the debris generated by the Proposed Action would be recycled for future use in construction projects at LANL.

Flood Retention Structure A large part of the approximately 25,000 yd^3 (19,000 m^3) of reclaimed concrete rubble and 200 yd^3 (153 m^3) of gabion rock resulting from partial demolition of the FRS would be recycled for use in construction projects at LANL. Uncontaminated soil would either be reused onsite for site restoration after demolition was completed or would be staged at the building debris storage yards on Sigma Mesa (TA-60) or another approved material management area for future use at LANL. Uncontaminated sediments and concrete rubble that cannot be recycled would be disposed of at the Los Alamos County landfill or its replacement facility. Uncontaminated scrap metal generated by demolition activities would be recycled.

Final disposition of the approximately 48,400 yd^3 (36,785 m^3) of removed sediments would depend on sampling and characterization results. Sediment accumulated at the FRS is not expected to be contaminated. PRSs located upstream of the FRS in Two-Mile Canyon and Pajarito Canyon have been stabilized. In addition, PRSs that formerly discharged into Pajarito Canyon have been stabilized. These include outfalls, surface runoff, and dispersion from firing sites. Sediments could be stockpiled in borrow pits at TA-16 to be used for planned construction and fire roads at LANL. Sediments could also be disposed of through the LANL waste management program. If analyses indicate that the sediments have to be managed as a waste type such as radioactive, hazardous, or mixed wastes, they would be disposed of as described in the 1999 LANL SWEIS (DOE 1999). Low-level radioactive waste would be disposed of at LANL, TA-54, Area G. Hazardous or mixed waste would be treated and disposed of offsite at appropriate DOE or commercial disposal sites. Wastes disposed of either onsite or offsite would contribute to filling the receiving landfill to their capacity limits.

Low-head Weir and Detention Basin There would be no change in waste management activities associated with implementing this action over that of the No Action Alternative. The structure would remain in place with continued routine inspection and maintenance including sampling of sediments and periodic sediment removal and disposal as required.

Road Reinforcements As with the No Action Alternative, there would be inconsequential waste generation under the Proposed Action at this structure from the repair of the ACMs and shotcrete surfaces. Road reinforcements would remain in place with continued routine inspection and maintenance activities.

Steel Diversion Wall Removal of this structure would have a minimal effect on waste management resources. About 25 yd^3 (19 m^3) of steel panels and beams generated by the demolition would be removed and shipped offsite for recycling.

4.1.2 Air Quality

Air quality would be unchanged as a result of implementing the Proposed Action. During demolition, there would be a short-term, temporary increase in localized particulate emissions (dust). Use of heavy equipment and vehicles would also cause an increase in NO_x emissions for short-term temporary periods. If controlled blasting were to be used during demolition, materials and equipment used to blast the concrete may contain or emit air pollutants or toxic chemicals reportable under the *Emergency Planning and Community Right-to-Know Act* (EPCRA). Control measures would be in place to control dust generated during demolition activities, and site revegetation would occur.

Flood Retention Structure This demolition activity would cause a temporary increase in localized dust and NO_x emissions at the FRS site, along the roadways used to transport the concrete debris, at the 3-ac staging area along Pajarito Road, and at LANL's storage location (currently Sigma Mesa). These short-term air emissions would be reduced through the use of site dust suppression measures. The site would be revegetated to reduce long-term wind-caused erosion.

Low-head Weir and Detention Basin Routine maintenance procedures may produce temporary, localized dust and NO_x emissions, which could be the same under the Proposed Action as for the No Action Alternative. Dust would be generated short term during any silt removal activities; these would be temporary and infrequent in nature.

Road Reinforcements Routine maintenance procedures may produce temporary, localized particulate emissions, which would be the same under the Proposed Action as for the No Action Alternative. Maintenance activities are expected to be periodic and infrequent in nature.

Steel Diversion Wall Removal of this structure would cause a temporary increase in localized particulate and NO_x emissions at the demolition site and along the LANL roadways. The removal activities would be short term in nature.

4.1.3 Floodplains and Wetlands

The Proposed Action could have short-term effects on the floodplains in Pajarito Canyon. BMPs would be placed to prevent or minimize any adverse effects, however. Wetlands in lower Pajarito Canyon would not be adversely affected. A floodplain/wetland assessment is included as an appendix in this EA.

Flood Retention Structure The downstream wetland area east of TA-18 would not likely be adversely affected due to the BMPs that would be employed at the site and the distance to the wetlands. Work conducted in Pajarito Canyon could contribute to an increase in the potential for sediment movement. If large quantities of sediment were moved downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume after the conclusion of the project. The area would be reseeded to stabilize the site.

Low-head Weir and Detention Basin Implementing the Proposed Action would leave this structure in place with routine inspection and maintenance. There would be no adverse effect on the floodplains. Depending on available moisture, the one-quarter acre potential wetland area could continue to develop and become established or it may fail to become established. If removal of sediments were necessary during maintenance of the structure under this alternative, as would be the case for the No Action Alternative, appropriate permitting and regulatory compliance measures would be undertaken. As the Los Alamos Canyon ecosystem recovers over time, the amount of runoff reaching the detention basin is expected to decrease. Either this decrease in available surface moisture or the disruption to the area from silt removal activities could result in the reduction or elimination of the potentially developing wetland area.

Road Reinforcements Effects to the floodplain would be the same as for the No Action Alternative, namely, no effects would result except from maintenance activities. Maintenance activities could potentially result in a minor temporary increase in localized erosion. BMPs would be used to minimize soil erosion into the floodplains

Steel Diversion Wall Removal of the steel diversion wall would disturb vegetation in the floodplain. BMPs would be used during demolition. Reseeding of the area would occur after site work was completed.

4.1.4 Biological Resources

There could be a minor effect on biological resources, although these effects would be short term and temporary in nature. Timing of site work could be altered to avoid breeding seasons and migration periods, if necessary, to avoid adverse biological effects to sensitive species.

Flood Retention Structure Under the Proposed Action, disturbance of the potential Mexican spotted owl habitat is possible and this may affect, but is not likely to adversely affect, the habitat. Some overstory and understory vegetation would be disturbed along the mesa top and partially down into the canyon. If TA-18 facilities and capabilities remain in their present location, the use of a continuous conveyor belt to transport debris out of Pajarito Canyon would potentially increase the amount of disturbed vegetation and generate noise. At the end of the demolition and removal of concrete debris and sediment, the streambed would be graded and the remaining sides of the FRS would be stabilized. To replace the vegetation loss, the banks would be reseeded and potentially planted with sapling trees. If TA-18 capabilities and facilities are relocated and the road below the FRS used for transportation and staging of the concrete debris, there would be disturbed vegetation. Reseeding would be required once clean up has been completed. Constraints on the timing of activities and noise levels allowed may be required if Mexican spotted owls occupy habitat in the area; these constraints would be necessary to avoid any adverse effects to the AEI use by individual owls. Noise and activities associated with the demolition activities and post-demolition site revegetation activities may temporarily disperse animals that use the area or modify their migration patterns. These would be short-term effects and the animals would be expected to reoccupy the area.

Low-head Weir and Detention Basin The low-head weir and detention basin are not located in any AEI and are not major features of the site ecology. There would be no effect on threatened or endangered species from the Proposed Action, as would be the case for the No Action Alternative, and no effect to other animals in the area would be expected either. Routine siltation removal could periodically disrupt plants growing in the detention basin.

Road Reinforcements The road reinforcements are not located in any AEI. There would be no effect on threatened and endangered species or other animals or plants in the area from the Proposed Action, as would be the case for the No Action Alternative.

Steel Diversion Wall Temporary, short-term effects to animals and plants could result from demolition of the steel diversion wall. Noise and activity constraints during the breeding season of the Mexican spotted owl would avoid any adverse effects to the nearby AEI if the area were to become occupied by that species. The area would be reseeded after all demolition activities.

4.1.5 Cultural Resources

Prehistoric archaeological sites were identified at the sites before construction of the structures occurred and were avoided during construction. Implementation of the Proposed Action would not affect known cultural resources.

Flood Retention Structure The demolition of part of the FRS could potentially affect prehistoric archaeological sites near the structure; however, these resources would be marked with flagging or temporary fencing during demolition activities so that they could be avoided. No adverse effects would be likely to occur to these cultural resources.

Low-head Weir and Detention Basin The Proposed Action, as would be the case for the No Action Alternative, would not affect the recorded prehistoric archaeological sites that occur near the weir. Cultural resource artifacts, objects, or fragments of objects may wash downstream into the detention basin over time; however, it would not be possible to identify the original location of these objects to place them in context.

Road Reinforcements A single recorded historic cultural site is located near one of the road reinforcement sites. Leaving the road reinforcements in place with routine maintenance activities would not affect the recorded historic cultural site that occurs just downstream of the road reinforcements as it would be flagged or fenced and avoided. Implementing the Proposed Action would result in no different type or level of effects from those of the No Action Alternative.

Steel Diversion Wall Cultural resources are present near the steel diversion wall along the cliff walls above the canyon floor. These resources would be adequately flagged or fenced before demolition activities commenced and avoided so there would be no expected effects. Removal of this structure would have no effect on cultural resources in the area.

4.1.6 Geology

Proper engineering design and controls to ensure slope stability would be employed during demolition activities. No effect on the geology of the structure sites would be expected to occur from implementing the Proposed Action.

Flood Retention Structure Partial removal of the FRS would leave "wings" of RCC attached to the walls of Pajarito Canyon. Continued erosion and enlargement of grooves already formed in the RCC could reduce the overall stability of the "wings" over time; these grooves and cracks could also become enlarged by freeze-thaw cycles and rainfall. Additionally, the wings of the FRS would be susceptible to any seismic vibrations and ground movements resulting from an earthquake (possible proximity to the Guaje Mountain Fault Zone may increase this risk) should one occur in the area. No effects are expected from implementing the Proposed Action on geology due to the use of BMPs and the design of the structure's below-surface portions, which would remain intact.

The construction, maintenance, grading, and other activities related to access roads to Pajarito Canyon are not anticipated to have an effect on local geology. Access road enhancement activities would be performed to engineering specifications that should eliminate or minimize effects to the overall stability of the north side of the canyon. If TA-18 relocates, improvements and road maintenance of the unimproved existing road in the bottom of Pajarito Canyon, from TA-18 to the FRS, could increase need for additional BMPs to control erosion.

Low-head Weir and Detention Basin The Proposed Action, as for the No Action Alternative, is to leave the low-head weir in place and provide periodic maintenance. Some accumulation of sediments behind the weir is expected; periodic maintenance would include silt removal. No other effects on local geology would be expected.

Road Reinforcements Under the Proposed Action, the road reinforcements would be left in place. Regular inspections and periodic maintenance would be performed to ensure that outlet structures do not become blocked. No effects to local geology would be expected from implementing either the Proposed Action or the No Action Alternative.

Steel Diversion Wall Total removal of the above ground portions of the steel diversion wall would be a part of the Proposed Action. No effects to local geology would be expected.

4.1.7 Water Resources (Ground and Surface)

Minor effects to surface and subsurface water quality would be expected in Pajarito Canyon from implementing the Proposed Action. Controlled demolition and proper removal actions, including BMPs, would be put in place to preserve water quality during actual demolition activities. Long-term site stabilization at each of the subject structures would help protect surface water quality. Site remediation actions would be required if contamination were present to prevent surface water quality downstream and to preserve subsurface water quality conditions.

Flood Retention Structure Demolition of the FRS would be performed in a controlled manner to ensure containment of potentially contaminated sediments so that there would be no adverse effect to water quality. If the contamination levels in Pajarito Canyon were to be below action limits established by regulators, the accumulation of sediments behind the FRS would have no effect, or only a small effect, on either surface or groundwater quality. If the sediments were to be contaminated at levels above which remediation would be required, contamination of surface and shallow groundwater could result. Periodic sampling and proper remediation actions, if needed, would preserve water quality within Pajarito Canyon and points downstream of the FRS. The installation of BMPs during demolition activities would protect surface water quality from siltation; revegetation and stabilization of the sides of the canyon would protect surface-water quality long term. Excavation or demolition debris would not be placed in or near drainages or on the floodplain. Excavated materials would be properly disposed of at an appropriate receiving site. If sediments were to be contaminated, they would be disposed of appropriately (see Section 4.1.1 on Waste Management).

No adverse effects to surface or groundwater quality would be expected from improving the road down the north slope of Pajarito Canyon from Pajarito Road or the road up the canyon floor from TA-18. BMPs would prevent effects to water quality by controlling the streambed and decreasing erosion and sediment load in the streams.

Low-head Weir and Detention Basin If the low-head weir and detention basin were to remain in place under the Proposed Action, water resource effects would be the same as for the No Action Alternative. The weir would provide some containment of sediments washing down Los Alamos Canyon. Elevated constituents present within the sediments could affect water quality in surface waters, shallow groundwater, and, potentially, the regional aquifer. Routine sampling and periodic removal of sediment would occur based on the levels of constituents in the silt in the detention basin.

Road Reinforcements There would be no measurable effect on water resources or quality by allowing the road reinforcements to remain in place under the Proposed Action as would be the case for the No Action Alternative. Periodic inspection would occur and routine maintenance activities would be conducted with BMPs in place.

Steel Diversion Wall Total removal of the above ground portions of the steel diversion wall would be conducted under the Proposed Action. There would be no placement of excavation or demolition debris in or near drainages or on the floodplain. Excavated materials would be properly recycled or taken to an appropriate receiving site. If sediments at the diversion wall were contaminated, they would be disposed of appropriately (see Section 4.1.1 on Waste Management).

4.1.8 Human Health

The Proposed Action would not be expected to affect the health of demolition and maintenance workers or the public. Routine demolition activities and maintenance activities would be conducted according to site-specific work plans.

Flood Retention Structure The Proposed Action is not expected to result in an adverse effect on the health of demolition and maintenance workers who would be actively involved in potentially hazardous activities such as heavy equipment operations and removal of waste concrete from the FRS. Potentially serious exposures to various hazards or injuries are possible during the breeching of the FRS under the Proposed Action. Adverse effects could range from relatively minor incidents (such as respiratory irritation, cuts, or sprains) to major injuries (such as lung damage or broken bones). To prevent serious injuries, all site construction contractors would be required to adhere to a Construction Safety and Health Plan (Plan) as described in the Proposed Action. Adherence to an approved Plan, use of PPE and engineered controls, and completion of appropriate hazards training would be expected to prevent adverse health effects on construction workers performing work to implement the Proposed Action.

Routine maintenance of flood control structures would be performed along with occasional removal of debris or repair of site features. For maintenance that requires the removal of large amounts of debris or performance of structural repairs, heavy equipment and the application of concrete to perform repairs may be needed. Hazards associated with the operation of heavy equipment and the application of concrete could pose a minimal health risk to maintenance workers.

Low-head Weir and Detention Basin Under the Proposed Action, as for the No Action Alternative, injuries to workers and members of the public would be unlikely from leaving the low-head weir and detention basin in place. No exposures to waste concrete and debris would occur because no demolition activities would take place. Ongoing routine maintenance activities would continue. Potential health risks to workers from maintenance activities, such as repair of gabions, would be minimal.

Road Reinforcements Road reinforcements would stay in place under the Proposed Action. There would be little potential for injuries to workers and members of the public under this alternative, as would be the case for the No Action Alternative. No exposures to waste concrete and debris would occur because no demolition activities would take place. Ongoing routine maintenance activities would continue. Potential health risks to maintenance workers would be minimal.

Steel Diversion Wall Removal of the steel diversion wall would have similar potential health risk issues as those described above in the FRS section, because heavy equipment would be used. However, as described in the Proposed Action, all site construction contractors would be required to adhere to a Construction Safety and Health Plan, and to use PPE and engineer controls. Therefore, this action is not expected to result in an adverse effect on the health of demolition workers.

4.1.9 Noise

Noise generated by the Proposed Action would not be expected to affect workers or members of the public. Work would be performed according to site-specific work plans and workers would wear hearing protection as required.

Flood Retention Structure No adverse effects on workers, the public, or the environment would be expected from noise levels generated by routine maintenance operations under the Proposed Action. Noise generated by these activities would be very short-term in duration and highly localized in remote and unoccupied areas at LANL. The Proposed Action would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels.

The breeching of the FRS would require the use of heavy equipment and possibly the use of large conveyor belts for removal of waste concrete and debris. Heavy equipment such as front-end loaders and backhoes would produce intermittent noise levels at around 73 to 94 dBA at 50 ft (15 m) from the work site under normal working conditions (Canter 1996, Magrab 1975). Truck traffic would occur frequently but would generally produce noise levels below that of the heavy equipment. Continuous noise levels generated by sources such as large conveyor belt systems used for debris removal could exceed 80 dBA depending on the design and operating condition of the system. Workers located in proximity to such a system may be required to wear hearing protection. Based upon a number of physical features that can attenuate noise, noise levels should return to background levels within about 200 ft (66 m) of the noise source (Canter 1996). Since sound levels would be expected to dissipate to background levels before reaching publicly accessible areas or undisturbed wildlife habitats, they should not be noticeable to members of the public or adversely disturb local wildlife. Traffic noise from 30 commuting workers would not be expected to cause a noticeable increase in the present traffic noise level on roads at LANL. The vehicles of demolition workers would remain parked during the day and would not contribute to the background noise levels during this time. Noise levels would not be expected to exceed the established OEL during site activities and would return to existing levels after the site work was completed.

Low-head Weir and Detention Basin The low-head weir would remain in place under the Proposed Action as would be the case under the No Action Alternative. Therefore, ambient noise levels would remain unchanged in the vicinity of the low-head weir and detention basin. Ongoing routine maintenance activities would continue; these have the potential for creating low levels of noise that would be temporary and short-term in nature.

Road Reinforcements Road reinforcements would remain in place under the Proposed Action as would be the case for the No Action Alternative. Ambient noise levels would remain unchanged in the vicinity of the road reinforcements. Ongoing routine maintenance activities would continue; these have the potential for creating short-term increases in noise levels.

Steel Diversion Wall Removal of the above ground portions of the steel diversion wall would have the same noise issues as those described previously in this section. Total removal of the steel panels would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels.

4.1.10 Traffic and Transportation

Demolition and debris removal activities at the FRS and the steel diversion wall would cause a temporary increase in traffic on Pajarito Road. This would be short term and would have an imperceptible effect on traffic at LANL.

Flood Retention Structure Partial removal of the FRS would have a short-term, temporary effect on traffic on Pajarito Road during the demolition phase when material from the FRS and sediments that have accumulated behind the structure are removed. Approximately 1,250 loads would be required to remove an estimated 25,000 yd^3 (19,000 m^3) of concrete debris out of the canyon along the existing access road to the staging area on Pajarito Road. Approximately 10 loads would be required to remove about 200 yd^3 (153 m^3) of gabion rocks out of Pajarito Canyon. An additional 2,420 loads may be required to remove accumulated sediment out of the canyon. This would result in about an additional 7,360 truck trips on LANL roads over the seven-month anticipated duration period, which would be within the expected carrying capacity of the transportation conditions.

Low-head Weir and Detention Basin Allowing the low-head weir and detention basin to remain in place under the Proposed Action, as for the No Action Alternative, would not affect traffic or transportation in the area. No changes in the traffic rate or patterns would occur at LANL.

Road Reinforcements Allowing the road reinforcements to remain in place would not affect traffic or transportation in the areas of the road reinforcements. No changes in the traffic rate or pattern would occur at LANL

Steel Diversion Wall Total removal of the above ground portions of the steel diversion wall would not likely affect local traffic along roads at TA-18. Approximately two truckloads would be required to move the steel panels offsite for recycling, resulting in an increase of four truck trips on LANL roads. No perceptible changes in traffic rate or patterns would occur at LANL.

4.1.11 Visual Resources

Demolition and debris removal under the Proposed Action would have a temporary effect on visual resources if the staging areas for the concrete removal were to be located near Pajarito Road. The actual demolition of the FRS and the steel diversion wall would take place in access-restricted areas. The low-head weir and the road reinforcements would remain in place, with no change in visual resources.

Flood Retention Structure Partial removal of the FRS would take place in an access-restricted area and would not be visible from the road. A staging area for crushing concrete and loading trucks would be visible to traffic passing on Pajarito Road; this would be temporary.

Low-head Weir and Detention Basin Under the Proposed Action, the low-head weir and detention basin would remain in place, with routine maintenance and sediment removal if necessary. Maintenance activities would be visible to passers-by on SR 4.

Road Reinforcements Under the Proposed Action, the road reinforcements would remain in place. There would be no change in the visual environment.

Steel Diversion Wall Removal of the steel diversion wall would result in a temporary disruption. The demolition would take place in an access-restricted area and would not be visible to the public.

4.2 Effects of the Disassembly of All Structures Alternative

4.2.1 Waste Management

Waste management effects would be minor because waste resulting from this alternative would be disposed of in existing landfills that have the capacity to accept the waste. Most of the debris generated by the Disassembly Alternative would be recycled for future use in construction projects at LANL.

Flood Retention Structure A large part of the approximately 50,000 yd^3 (38,000 m^3) of reclaimed concrete rubble and 300 yd^3 (230 m^3) of gabion rock resulting from demolition of the FRS would be recycled for use in construction projects at LANL. Uncontaminated soil would either be reused onsite for site restoration after demolition was completed or would be staged at the building debris storage yards on Sigma Mesa (TA-60) or another approved material management area for future use at LANL. Uncontaminated sediments and concrete rubble that cannot be recycled would be disposed of at the Los Alamos County landfill or its replacement facility. Uncontaminated scrap metal generated by demolition activities would be recycled.

Final disposition of the approximately 48,400 yd^3 (36,785 m^3) of removed sediments would depend on sampling and characterization results. Sediment accumulated at the FRS is not expected to be contaminated. PRSs located upstream of the FRS in Two-Mile Canyon and Pajarito Canyon have been stabilized. In addition, PRSs that formerly discharged into Pajarito Canyon have been stabilized. These include outfalls, surface runoff, and dispersion from firing sites. Sediments could be stockpiled in borrow pits at TA-16 to be used for planned construction and fire roads at LANL. Sediments could also be disposed of through the LANL waste management program. If analyses indicate that the sediments have to be managed as a waste type such as radioactive, hazardous, or mixed wastes, they would be disposed of as described in the 1999 LANL SWEIS (DOE 1999). Low-level radioactive waste would be disposed of at LANL, TA-54, Area G. Hazardous or mixed waste would be treated and disposed of offsite at appropriate DOE or commercial disposal sites. Wastes disposed of either onsite or offsite would contribute to filling the receiving landfill to their capacity limits.

Low-head Weir and Detention Basin An estimated 1,700 yd^3 (1,300 m^3) of gabion rocks would be removed and stockpiled for further use at LANL. Sediments that have collected would be analyzed for elevated constituents and disposed of appropriately. Approximately 17,000 yd^3 (12,900 m^3) of sediment could be removed. Approximately 11,900 yd^3 (9,044 m^3) of soil and rock excavated and banked along the sides of the canyon during construction of the low-head weir and detention basin would be returned to the site to fill the basin area.

Road Reinforcements Approximately 500 yd^3 (380 m^3) of concrete rubble resulting from total removal of the road reinforcements would be staged at the building debris storage yards on Sigma Mesa (TA-60) or another approved material management area for future use at LANL.

Steel Diversion Wall Removal of this structure would have a minimal effect on waste management resources. Approximately 25 yd^3 (19 m^3) of steel panels and beams generated by the demolition would be recycled.

4.2.2 Air Quality

Air quality would be unchanged as a result of implementing the Disassembly Alternative. During demolition, there would be a temporary increase in localized particulate emissions (dust). Use of heavy equipment and vehicles would also cause an increase in NO_x emissions for short-term temporary periods. Control measures would be in place to suppress dust generated during demolition activities.

Flood Retention Structure This demolition activity would cause a temporary increase in localized particulate and NO_x emissions at the demolition site, along the roadways used to transport the concrete debris, at the 3-ac (1.2-ha) staging area along Pajarito Road, and at LANL's storage location (currently Sigma Mesa). If controlled blasting is used during demolition, materials and equipment used to blast the concrete may contain or emit air pollutants or toxic chemicals reportable under EPCRA. Particulate emissions would be reduced through the use of dust suppression activities.

Low-head Weir and Detention Basin Demolition of this structure would produce temporary, localized particulate and NO_x emissions (dust and vehicle exhaust). Dust would be generated short term during any sediment removal activities. Emissions would be reduced through the use of control measures.

Road Reinforcements Air quality effects would be minor. Removal activities would have the potential for generating small amounts of dust over a few days duration; truck and equipment exhaust would be similar. Emissions would be temporary and localized and would be reduced by dust suppression activities.

Steel Diversion Wall Removal of this structure would cause a temporary increase in localized particulate emissions at the demolition site and along the roadways used to transport the concrete debris. Removal activities would be short term in nature.

4.2.3 Floodplains and Wetlands

The Disassembly Alternative could have short-term effects on the floodplains. BMPs would be in place to prevent or minimize any adverse effects to floodplains. Effects to wetlands could occur and adverse effects to a potentially developing wetland could result. A floodplain/wetland assessment is included as an appendix in this EA.

Flood Retention Structure The downstream wetland area east of TA-18 would not likely be adversely affected due to BMPs that would be employed at the site and the distance to the wetlands. With total removal of the FRS, there would be a proportional increase in erosion potential of the canyon walls since the sides of the FRS structures would be completely removed. Work conducted in Pajarito Canyon could contribute to an increase in potential for sediment movement. If large quantities of sediment move downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume at the conclusion of the project. It is not likely that potential siltation to the Pajarito Canyon wetlands would reduce or eliminate their functional capabilities.

Low-head Weir and Detention Basin If the sediment in the detention basin and the weir were to be removed, demolition work would be taking place within an area that might be the site of a developing wetland. Removing the sediment that allowed the wetland to develop could destroy the wetland itself if it becomes established over time as discussed for the Proposed Action and No Action Alternatives.

Road Reinforcements Total removal of these structures would cause a slight increase in erosion potential because the roads would be left without any reinforcements; rehabilitation work performed after the Cerro Grande Fire replaced the original reinforcements on these roads and enhanced them. BMPs would be in place to minimize or prevent any adverse short-term effects. Reseeding of the area would also help minimize or prevent long-term adverse effects.

Steel Diversion Wall Removal of the steel diversion wall could disturb vegetation in the floodplain. BMPs would be used during demolition and reseeding of the area.

4.2.4 Biological Resources

There could be a minor effect on biological resources, although these effects would be short term and temporary in nature. Timing of site work could be altered to avoid breeding seasons and migration periods, if necessary, to avoid adverse biological effects to sensitive species.

Flood Retention Structure Under this alternative, to completely remove the FRS, disturbance of Mexican spotted owl habitat is possible and this may affect but is not likely to adversely affect the habitat. There would be noise and activity constraints during the breeding season of the Mexican spotted owl. Vegetation disturbance would be the same as identified for the Proposed Action. At the end of demolition and removal of debris and sediment, the streambed would be graded and the canyon sides would be stabilized. To replace the vegetation loss, the banks would be reseeded and potentially planted with sapling trees.

Low-head Weir and Detention Basin The low-head weir and detention basin are not located in any AEI and are not major features of the site ecology. There would be no effect on threatened and endangered species from any of the alternatives and no effect to other animals or plants in the area. Plants growing within the detention basin may be removed along with the detention basin.

Road Reinforcements The road reinforcements are not located in any AEI. There would be no effect on threatened and endangered species from of this alternative and no effect to other animals or plants in the area.

Steel Diversion Wall Temporary, short-term effects to animals and plants could result from demolition of the steel diversion wall. Noise and activity constraints during the breeding season of the Mexican spotted owl would lessen any adverse effects to the nearby AEI if the area were to become occupied by that species. The area would be reseeded after all demolition activities.

4.2.5 Cultural Resources

Prehistoric archaeological sites were identified at the sites before construction of the structures occurred and avoided. Implementation of the Disassembly Alternative would not affect known cultural resources.

Flood Retention Structure Removal of the entire FRS would have the same potential effects as removal of a part of the FRS. See discussion above for Proposed Action.

Low-head Weir and Detention Basin The Disassembly Alternative would not affect the recorded prehistoric archaeological sites that occur near the weir. It is possible that traditional cultural properties and cultural artifacts moving downstream could be trapped in the silt and would be removed along with the detention structure.

Road Reinforcements There would be no effect on cultural resources with the Disassembly Alternative. The only historic cultural site located near one of the road reinforcements would be flagged and fenced.

Steel Diversion Wall There would be no effect on cultural resources with the Disassembly Alternative. Cultural resources near the steel diversion wall would be adequately flagged and fenced before the initiation of any demolition activities.

4.2.6 Geology

Proper engineering design and controls would be employed to ensure slope stability during demolition activities. No adverse effect on the geology of the structure sites would be expected to occur from implementing the Disassembly Alternative.

Flood Retention Structure Total removal of the FRS would result in exposure of the canyon sides to accelerated and increased sloughing or erosion. Road upgrades necessary for removal of the structure may have some effect on slope stability or erosion and sedimentation rates as discussed above.

Low-head Weir and Detention Basin Total removal of the low-head weir would essentially return this portion of Los Alamos Canyon to its natural state. There would be no effects on local geology.

Road Reinforcements Removal of the road reinforcements would not effect the geology in the vicinity of the individual reinforcements. Soil would be exposed that could, until revegetation occurred, be slightly more susceptible to erosion. BMPs would be installed to reduce adverse erosion effects.

Steel Diversion Wall Total removal of the steel diversion wall would essentially return this portion of Pajarito Canyon to its natural state. No effects to local geology would be expected.

4.2.7 Water Resources (Ground and Surface)

Minor effects to surface and subsurface water quality would be expected from implementing the Disassembly Alternative. Controlled demolition and proper removal actions, including BMPs, would preserve water quality during actual demolition activities. Long-term site stabilization at each of the subject structures would help protect surface water quality. Site remediation actions would be required if contamination were to be present to prevent surface water quality downstream and to preserve subsurface water quality conditions.

Flood Retention Structure The Disassembly Alternative would have the same issues as the Proposed Action described above. BMPs would prevent effects to water quality by controlling the streambed and decreasing erosion and sediment load in the streams.

Low-head Weir and Detention Basin Total removal of the low-head weir would return the streambed to its natural state. The demolition of the weir would be performed in a controlled manner to ensure containment of possible elevated constituents (in sediments) so that no adverse effect to water quality would likely occur. No placement of excavation or demolition spoils in or near drainages or on the floodplain would occur. Excavated materials would be properly disposed of at an appropriate receiving site. If sediments were contaminated, they would be dealt with as radioactive low level or mixed waste as previously described in Section 4.1.1. BMPs derived from the SWPP Plan would be implemented to prevent erosion and migration of disturbed soil from the site caused by storm water or other water discharges.

Road Reinforcements Activities involved in removal of road reinforcement structures would be similar to those described above for removal of the low-head weir and detention basin. BMPs would control storm water runoff effects during demolition activities to protect surface water quality.

Steel Diversion Wall Total removal of the diversion wall would return the streambed to its natural state. Issues involved in removal of this structure would be the same as those described above for removal of the low-head weir and detention basin.

4.2.8 Human Health

The Disassembly Alternative would not be expected to affect the health of demolition and maintenance workers. Routine demolition activities would be conducted according to site-specific work plans.

Flood Retention Structure The Disassembly Alternative would have the same issues as the Proposed Action described above. Approximately the same number of demolition workers and debris removal vehicles would be required; however, the duration of demolition and site remediation activities would be extended by three months. This alternative would not be expected to result in an adverse effect on the health of demolition workers.

Low-head Weir and Detention Basin This alternative would have the same issues as those described previously in the Proposed Action for the FRS because heavy equipment would be used. A crew of five would be required to work for approximately three weeks to accomplish total removal of the low-head weir and detention basin. This alternative would not be expected to result in an adverse effect on the health of demolition workers.

Road Reinforcements This alternative would have the same issues as those described previously in the Proposed Action for the FRS because heavy equipment would be used. A crew of 10 would be required to work for approximately six weeks to accomplish the removal. This alternative is not expected to result in an adverse effect on the health of demolition workers.

Steel Diversion Wall This alternative would have the same issues as those described previously in the Proposed Action for the FRS because heavy equipment would be used. A crew of eight would be required to work for approximately six weeks to accomplish removal of the steel diversion wall. This alternative would not be expected to result in an adverse effect on the health of demolition workers.

4.2.9 Noise

Noise generated by the Disassembly Alternative would not be expected to affect workers or members of the public. Work would be performed according to site-specific work plans and workers would have hearing protection as required.

Flood Retention Structure The Disassembly Alternative would have the same issues as the Proposed Action for the FRS described in Section 4.1.9 above; however, the duration of demolition and site remediation activities would be extended by about three months. The Disassembly Alternative would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels. Noise generated by this alternative would not be expected to have an adverse effect on workers.

Low-head Weir and Detention Basin This alternative would have the same issues as those described previously in Section 4.1.9, the Proposed Action for the FRS. A crew of five would be required to work for approximately three weeks to accomplish the removal. The Disassembly Alternative would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels. Noise generated by this alternative would not be expected to have an adverse effect on workers.

Road Reinforcements This alternative would have the same issues as those described previously in Section 4.1.9, the Proposed Action for the FRS. A crew of 10 would be required to work for approximately six weeks to accomplish the removal. The Disassembly Alternative would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels. Noise generated by this alternative would not be expected to have an adverse effect on workers.

Steel Diversion Wall Removal of the steel diversion wall would have the same issues as those described previously in this section. A crew of eight would be required to work for approximately six weeks to accomplish the removal. Total removal would result in limited short-term increases in noise levels associated with various demolition activities. Following the completion of these activities, noise levels would return to existing levels.

4.2.10 Traffic and Transportation

Demolition and debris removal activities would cause a temporary increase in traffic on Pajarito Road. This would be short term and temporary and would have an imperceptible effect on traffic at LANL.

Flood Retention Structure Total removal of the FRS could affect traffic on Pajarito Road during the demolition phase when material from both the FRS and the sediments that have accumulated behind the structure would be removed. It is estimated that approximately 2,500 loads would be required to remove about 50,000 yd^3 (38,000 m^3) of concrete debris out of the canyon along the existing access road and along Pajarito Road. Approximately 48,400 yd^3 (36,785 m^3) of removed sediments could require an additional 2,420 loads to remove this material. Approximately 10 loads would be required to remove about 200 yd^3 (153 m^3) of gabion rocks from the canyon bottom. This would result in about an additional 9,860 truck trips on LANL roads over the ten-month duration period, which would be within the expected carrying capacity of the transportation corridors.

Low-head Weir and Detention Basin Total removal of the weir could have a minor effect on adjacent roads during the demolition phase when materials or sediments would be transported elsewhere. Approximately 1,700 yd^3 (1,300 m^3) of gabion rocks and 17,000 yd^3 (12,900 m^3) of sediment would be removed, resulting in 935 truckloads and 1,870 trips on LANL roads.

Road Reinforcements Removal of road reinforcements would have a minor temporary effect on traffic during demolition activities. Approximately 500 yd^3 (380 m^3) would be removed resulting in 25 truckloads and 50 trips on LANL roads.

Steel Diversion Wall Total removal of the steel diversion wall would not likely affect local roads at TA-18. Approximately two truckloads would be required to move the steel panels and beams offsite for recycling, resulting in an increase of four truck trips on LANL roads.

4.2.11 Visual Resources

Disassembly of the subject structures would cause disruption lasting for several days to as long as several months for the FRS. Both the FRS and the steel diversion wall are located in access-restricted areas and demolition of these structures would not be visible to the public. The low-head weir and detention basin and the road reinforcements are visible to passers-by, and their removal would have a temporary effect on visual resources. None of these would disrupt any vistas.

Flood Retention Structure Total disassembly of the FRS would take place in an access-restricted area and would not be visible from the road. A staging area for crushing concrete and loading trucks would be visible to traffic passing on Pajarito Road; this would be temporary.

Low-head Weir and Detention Basin Disassembly of the low-head weir would be visible from SR 4. This would be a temporary disruption in the visual environment to traffic passing on this road.

Road Reinforcements Removal of the road reinforcements would be visible to passers-by. This would have a temporary effect on the visual environment.

Steel Diversion Wall Removal of the steel diversion wall would result in a temporary disruption. The demolition would take place in an access-restricted area and would not be visible to the public.

4.3 Effects of the No Action Alternative

4.3.1 Waste Management

A small amount of debris from routine maintenance procedures would require appropriate disposal. Waste management effects from the No Action Alternative would be minor because this waste would be disposed of in existing landfills that have the capacity to accept the waste.

Flood Retention Structure There would be minimal waste management effects associated with implementing the No Action Alternative. On the yearly maintenance plan, debris such as brush, sticks, and branches, would continue to be removed and disposed of in accordance with applicable laws, regulations, and DOE Orders. Contaminated sediment would be removed and disposed of appropriately. Sediment accumulated at the FRS is not expected to be contaminated. PRSs located upstream of the FRS in Two-Mile Canyon and Pajarito Canyon have been stabilized. In addition, PRSs that formerly discharged into Pajarito Canyon have been stabilized. These include outfalls, surface runoff, and dispersion from firing sites.

Low-head Weir and Detention Basin There would be minimal waste management associated with implementing the No Action Alternative. Routine inspection and maintenance would continue. Contaminated sediment would be removed and disposed of appropriately.

Road Reinforcements There would be minimal waste management associated with implementing the No Action Alternative. Routine inspection and maintenance would continue.

Steel Diversion Wall There would be minimal waste management associated with implementing the No Action Alternative. Routine inspection and maintenance would continue.

4.3.2 Air Quality

Air quality would be unchanged from ongoing conditions as a result of the No Action Alternative. Routine maintenance procedures may produce temporary, localized particulate emissions. Control measures would be put in place to minimize emissions during maintenance activities.

Flood Retention Structure Routine maintenance procedures may produce temporary, localized particulate emissions. There would be no change from ambient air quality effects associated with this alternative.

Low-head Weir and Detention Basin Routine maintenance procedures may produce temporary, localized particulate emissions. There would be no change from current air quality conditions.

Road Reinforcements Routine maintenance procedures may produce temporary, localized particulate emissions. There would be no change from current air quality conditions.

Steel Diversion Wall Routine maintenance procedures may produce temporary, localized particulate emissions. There would be no change from current air quality conditions.

4.3.3 Floodplains and Wetlands

The No Action Alternative would have minimal effects on the floodplain. Routine maintenance activities would not be expected to have any adverse effects on floodplains but could adversely affect a potential wetland area in Los Alamos Canyon. A floodplain/wetland assessment is included as an appendix in this EA.

Flood Retention Structure The No Action Alternative activities for maintenance and repair of the FRS would reduce the potential for crumbling of the structure and subsequent long-term release of construction materials that could affect the floodplain and wetlands downstream in TA-18. Routine maintenance is expected to remove vegetation growth in the sediment upstream of the structure. No adverse effect or change to the wetland and floodplain functions and values within Pajarito Canyon would likely occur from the No Action Alternative.

Low-head Weir and Detention Basin The No Action Alternative would have the same effects as the Proposed Action with regard to this structure. Leaving this structure in place and providing routine maintenance could allow the wetland to continue to either develop or it could decline and disappear. The No Action Alternative could have an adverse effect on the potential wetland area if sediment were removed periodically on an "as needed" basis should the small wetland area survive. No change to the floodplain would be expected from the No Action Alternative.

Road Reinforcements The No Action Alternative would result in leaving these structures in place. With maintenance, these structures would continue to provide reinforcement along the road. Maintenance would not likely have adverse effects to the floodplain or wetlands below the structures.

Steel Diversion Wall Leaving this structure in place would not affect the floodplains or wetlands. Routine maintenance would have no adverse effect on either floodplains or wetlands.

4.3.4 Biological Resources

Under the No Action Alternative, there would be no effect on threatened or endangered species or their potential critical habitat in the Los Alamos area. Other plants and animals would not be adversely affected long term, except for small-scale removal of vegetation associated with maintenance activities.

Flood Retention Structure Under the No Action Alternative, with the FRS staying in place, there would be no effect on the potential Mexican spotted owl habitat. Threatened or endangered species would therefore not be affected. Small-scale removal of vegetation within the sediment may occur periodically.

Low-head Weir and Detention Basin The low-head weir and detention basin are not located in any AEI. There would be no effect on threatened or endangered species from the No Action Alternative. No effect to animals in the vicinity of the structure would be likely but routine sediment removal on an “as needed” basis could remove small amounts of vegetation.

Road Reinforcements The road reinforcements are not located in any AEI. There would be no effect on threatened or endangered species or other animals and vegetation from the No Action Alternative.

Steel Diversion Wall Under the No Action Alternative, the steel diversion wall would remain in place. There would be no effect on the potential Mexican spotted owl habitat in the area or to other plants and animals in the vicinity of the structure.

4.3.5 Cultural Resources

There would be no effect on cultural resources with the No Action Alternative. Routine maintenance activities would not be expected to affect archaeological sites.

Flood Retention Structure There would be no effect on cultural resources with the No Action Alternative. Routine maintenance activities would not be expected to affect archaeological sites.

Low-head Weir and Detention Basin There would be no effect on cultural resources with the No Action Alternative. Routine maintenance activities would not be expected to affect archaeological sites.

Road Reinforcements There would be no effect on cultural resources with the No Action Alternative. Routine maintenance activities would not be expected to affect archaeological sites.

Steel Diversion Wall There would be no effect on cultural resources with the No Action Alternative. Routine maintenance activities would not be expected to affect archaeological sites.

4.3.6 Geology

Inspections would take into consideration slope stability, erosion, excessive rainfall, flooding events, and seismic events. Routine maintenance would include stabilizing slopes and reducing erosion, which could threaten the stability of the various structures. There would be no adverse effects to the geology of the subject structure areas as a result of the No Action Alternative

Flood Retention Structure Under the No Action Alternative, if the FRS were maintained and inspected on a regular basis, it should continue to retain floodwaters and release them slowly as designed for the life of the structure. However, slope stability would still be subject to natural processes such as erosion, landslides, rockfalls, rainfalls, freezing and thawing, and seismic events. Erosion deemed to be a threat to the stability of the FRS would need to be dealt with in an appropriate manner and timeframe. No adverse effect to the geology in the vicinity of the FRS would be likely as a result of implementing the No Action Alternative.

Low-head Weir and Detention Basin The No Action Alternative is the same as the Proposed Action for this structure. Some accumulation of sediments behind the weir would be expected; periodic maintenance would include sampling and silt removal as appropriate. No adverse effect to the geology of the weir site would be expected from implementing the No Action Alternative.

Road Reinforcements The No Action Alternative would not be expected to result in adverse effects to the geology of the reinforcement areas. Regular inspections and periodic maintenance would be performed to ensure that outlet structures do not become blocked.

Steel Diversion Wall The No Action Alternative would not be expected to result in adverse effects to the geology in the vicinity of the steel diversion wall. Periodic inspections and routine maintenance would not be expected to have an adverse effect on local geology.

4.3.7 Water Resources (Ground and Surface)

If accumulated sediments were contaminated, they could adversely affect surface water and shallow groundwater quality. Long-term site stabilization at each of the subject structures would help to protect surface and groundwater quality, as would routine maintenance and removal of sediment at the subject sites. There would be no adverse effect to water quality as a result of the No Action Alternative.

Flood Retention Structure With the No Action Alternative, sediment would continue to accumulate behind the FRS (as designed). As such, studies would be conducted to determine if the sediments are contaminated as this could have a detrimental effect on water quality of surface water and shallow groundwater. Proper remediation actions would be conducted to preserve water quality within Pajarito Canyon and points downstream of the FRS. BMPs would also be in place during maintenance activities to protect surface water quality from erosion effects. No adverse effect to water quality would be expected as a result of implementing the No Action Alternative.

Low-head Weir and Detention Basin The No Action Alternative is the same as the Proposed Action. The low-head weir and detention basin would provide some containment of sediments washing down Los Alamos Canyon. Routine sampling and periodic removal of sediments would occur based on the levels of constituents in the silt in the detention basin. No adverse effect would be expected to water quality as a result of implementing the No Action Alternative

Road Reinforcements The No Action Alternative is the same as the Proposed Action. There would be no adverse effect on water resources or quality by allowing the road reinforcements to remain in place.

Steel Diversion Wall Under the No Action Alternative, the steel diversion wall would remain in place. No adverse effect to water quality would be expected as a result of implementing this alternative.

4.3.8 Human Health

Potential health risks to maintenance workers would be minimal. Routine maintenance activities would not be expected to affect workers if the No Action Alternative were implemented.

Flood Retention Structure Under the No Action Alternative, there would be no potential for injuries to demolition workers and members of the public from the breeching of the FRS. No exposures to waste concrete and debris would occur because no demolition activities would take place. However, routine maintenance of the existing FRS would continue. Potential health risks to maintenance workers would be minimal and adverse health effects would be unlikely to occur under the No Action Alternative.

Low-head Weir and Detention Basin Under the No Action Alternative, there would be no potential for injuries to demolition workers and members of the public. No exposures to waste concrete and debris would occur because no demolition activities would take place. Ongoing routine maintenance activities would continue. Potential health risks to maintenance workers would be minimal and adverse health effects would be unlikely to occur under the No Action Alternative.

Road Reinforcements Under the No Action Alternative, there would be no potential for injuries to demolition workers and members of the public. There would be no exposures to waste concrete and debris because no demolition activities would take place. Ongoing routine maintenance activities would continue. Potential health risks to maintenance workers would be minimal and adverse health effects would be unlikely to occur under the No Action Alternative.

Steel Diversion Wall Under the No Action Alternative, the steel diversion wall would remain in place and be maintained. Potential health risks to maintenance workers would be minimal. No exposures to waste concrete and debris would occur because no demolition activities would take place. No adverse health effects would be likely to occur under the No Action Alternative

4.3.9 Noise

Ambient noise levels would remain unchanged in the vicinities of the flood control structures. Environmental noise levels in and around the flood control and erosion reduction structures would be expected to remain below 80 dBA on average.

Flood Retention Structure Under the No Action Alternative, ambient noise levels would remain unchanged in the vicinity of the FRS. Potential noise from demolition activities associated with the Proposed Action would not occur, but ongoing routine maintenance activities would continue. Environmental noise levels in and around the FRS and facilities or operations at LANL would be expected to remain below 80 dBA on average with no resulting adverse effects.

Low-head Weir and Detention Basin Under the No Action Alternative, ambient noise levels would remain unchanged in the vicinity of the low-head weir and detention basin. Ongoing routine maintenance activities would continue. Environmental noise levels in and around the low-head weir and detention basin and facilities or operations at LANL would be expected to remain below 80 dBA on average with no resulting adverse effects.

Road Reinforcements Under the No Action Alternative, ambient noise levels would remain unchanged in the vicinity of the road reinforcements. Ongoing routine maintenance activities would continue. Environmental noise levels in and around the road reinforcements and facilities or operations at LANL would be expected to remain below 80 dBA on average with no resulting adverse effects.

Steel Diversion Wall Under the No Action Alternative, ambient noise levels would remain unchanged in the vicinity of the steel diversion wall. Potential noise from demolition activities associated with the Proposed Action would not occur, but ongoing routine maintenance activities would continue. Environmental noise levels in and around the road reinforcements and facilities or operations at LANL would be expected to remain below 80 dBA on average with no resulting adverse effects.

4.3.10 Traffic and Transportation

The No Action Alternative would not affect traffic and transportation. Routine maintenance would not be expected to affect roads in the vicinity of the flood control and erosion reduction structures.

Flood Retention Structure The No Action Alternative would leave the FRS in place and would not affect Pajarito Road traffic. No changes in traffic patterns or rates would occur.

Low-head Weir and Detention Basin The No Action Alternative is the same as the Proposed Action. No changes in the traffic rate or pattern would occur at LANL.

Road Reinforcements The No Action Alternative is the same as the Proposed Action. No changes in the traffic rate or pattern would occur at LANL.

Steel Diversion Wall The No Action Alternative would leave the steel diversion wall in place and would not affect Pajarito Road traffic. No changes in the traffic rate or pattern would occur at LANL.

4.3.11 Visual Resources

The No Action Alternative would not affect visual resources. Routine maintenance would only temporarily affect the area near the structures and would not affect vistas near the subject structures.

Flood Retention Structure Under the No Action Alternative, the FRS would remain in place with routine maintenance. There would be no change to the visual environment.

Low-head Weir and Detention Basin Under the No action Alternative, the low-head weir and detention basin would remain in place, with routine maintenance and sediment removal if necessary. Maintenance activities would be visible to passers-by on SR 4.

Road Reinforcements Under the No Action Alternative, the road reinforcements would remain in place. There would be no change in the visual environment.

Steel Diversion Wall Under the No Action Alternative, the steel diversion wall would remain in place. There would be no change in the visual environment. Removal of the steel diversion wall would result in a temporary disruption. The demolition would take place in an access-restricted area and would not be visible to the public.

5.0 ACCIDENT ANALYSIS

5.1 FRS Structural Failure Hazards

The Pajarito Canyon FRS was designed and built to withstand a range of environmental loading conditions and not fail or cause a major accident to occur. The structure is constructed of RCC on volcanic tuff. Its primary function is to provide retention and controlled release of water associated with the 100-year, six-hour storm. It was evaluated for four loading conditions:

- Loading conditions 1, normal, reservoir empty;
- Loading conditions 2, unusual, floodwaters from 100-year, six-hour storm;
- Loading conditions 3, extreme, floodwaters from probable maximum flood; and
- Loading conditions 4, extreme, reservoir empty subjected to 0.22 g peak ground acceleration earthquake.

The evaluation also looked at available information on the geological and subsurface features at or near the structure and the construction records. The conclusions from this evaluation are as follows.

1. For all loading conditions, the structure can be considered stable against overturning.
2. For sliding through or separating RCC sections, the analysis indicates that major factors of safety in excess of target levels exist for all loading conditions using the RCC strength assumed in the design of the structure.
3. For sliding through or shifting the FRS on the foundation materials, the factors of safety are much greater than the target factors of safety for three of the four loading conditions evaluated. For the probable maximum flood loading condition, the factor of safety is at the target level.

In summary, an evaluation of the design parameters of the FRS and the limited amount of geological information for the site did not reveal any serious or potential problems concerning the integrity of the structure. Therefore, a catastrophic collapse or failure of the FRS would not be expected to occur under various normal, unusual, or extreme conditions.

5.2 Demolition (Construction) Hazards

Potential accidents associated with the Proposed Action and Disassembly Alternative are most likely to occur in relation to demolition activities. Demolition is considered in national statistics on construction accidents and, so, can be considered by comparing national statistics on construction with project worker information for the Proposed Action and Disassembly Alternative. Hazards for the Proposed Action (partial removal of the FRS) and the Disassembly Alternative can be grouped into construction hazards and transportation hazards. No fatalities are likely to result from any demolition (construction) or transportation accident scenarios.

To estimate the potential number of fatalities that might occur from demolition-related activities of the Proposed Action, the estimated number of workers was compared to recent risk rates of occupational fatalities. Although fewer than 20 workers would be employed during the non-peak period of work activity over the duration of the project (7 months), 20 workers for the duration of the project was used in the risk calculations as a conservative measure. The average fatality rate in the U.S. is 3.9 deaths per 100,000 workers per year (Saltzman 2001). No deaths (0.0005) would be expected from implementing the Proposed Action demolition- (construction-) related activities from causes that include falls, exposure to harmful substances, fires and explosions, and being struck by objects, equipment, or projectiles.

Based upon calculations of risks for 20 workers over 10 months for the Disassembly Alternative, no deaths (0.0007) would be expected from causes that include falls, exposure to harmful substances, fires and explosions, and being struck by objects, equipment, or projectiles as based on the average fatality rate in the U.S. for this type of work (Saltzman 2001). The risk of death for the Disassembly Alternative is only slightly higher than for the Proposed Action.

5.3 Transportation Hazards

Transportation activities could involve the transport of debris (mostly concrete, gabion rock, and sediment) that would result from FRS demolition activities up to the 3-ac (1.2 ha) staging area located along Pajarito Road. Depending on which alternative is selected, between approximately 3,680 and 5,892 loads could be transported. Part (up to 2,505 loads) of this total could be hazardous waste if any accumulations of chemicals or radionuclides in the sediment were to occur; however, the dilution factor would likely be so great within the sediments that it is unlikely that the sediment would be considered hazardous or radioactive wastes requiring special management and disposal. Of the different types of transportation occupations nationwide, truck drivers of all types of trucks experience the highest fatality rate (26 deaths per 100,000 full-time workers per year) (Saltzman 2001). The chance of a fatality occurring to a driver of a medium or heavy truck hauling hazardous waste is about three in one million (2.7×10^{-6} per driver per year) based on 1993 nationwide statistics (NSC 1994). No statistics were found for trucks hauling waste on special roads such as the access road described in Chapter 2; however, the long distances and higher speeds that are included in the national statistics would not occur in this project and the number of driver-years would be very low; therefore, no transportation fatalities are expected for this project under any of the alternatives considered.

6.0 CUMULATIVE EFFECTS

Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes them. These effects can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

The Proposed Action and alternatives addressed in this EA are expected to take place by 2010. As discussed in Chapter 2.0, these alternatives are based on the continuance of LANL mission support activities and capabilities for the foreseeable future and on the recovery of the area watersheds to pre-fire conditions or to conditions that approximate the pre-fire conditions within the next eight years. The analysis of effects is based on an estimate of conditions at LANL at that time.

NNSA has issued a draft EIS on the proposed relocation of TA-18 capabilities and materials to TA-55 or to another DOE NNSA site (DOE 2001). Because NNSA has not issued the final EIS and a Record of Decision for the EIS, this EA includes two options for the FRS disposition alternatives. For each of the alternatives, Option A describes disposition if the TA-18 capabilities or materials are not relocated, and Option B describes disposition if the TA-18 capabilities or materials are relocated. If NNSA decides to relocate the capabilities and materials to TA-55 or to upgrade the facilities at TA-18, there is potential for a major construction project along Pajarito Road. Construction of a new facility at TA-55 would last 24 months and would involve a peak construction employment level of 300 workers. Construction would generate about 108 yd^3 (83 m^3) of solid waste, which would be disposed of in the Los Alamos County Landfill or its replacement. Demolition of the TA-18 facilities was not addressed in the TA-18 EIS, because this is not ripe for decision; when NNSA is ready to make a decision about the disposition of these facilities, further NEPA review will be performed.

Other actions that would likely occur at LANL that might cause cumulative effects in the area of the Proposed Action would include any construction projects that would affect traffic in the demolition area. DOE is considering some construction at TA-55 that could increase traffic in that area. Within the next year, DOE will prepare an EIS on replacing the Chemistry and Metallurgy Research (CMR) Building; one of the alternatives would be to construct a new CMR Building at TA-55. If construction of this building were to take place in the same timeframe as the Proposed Action for this EA, additional construction traffic could affect traffic flow on Pajarito Road.

There have been studies on the traffic patterns on Pajarito Road, including controlling access on the road and rerouting traffic from Pajarito Road around TA-3 for security reasons. DOE has issued a predecisional draft EA to address the environmental effects of restrictions on Pajarito Road traffic and a bypass road around TA-3 (DOE 2002). In addition, LANL is proposing to widen Pajarito Road to include turning lanes and access and egress lanes near the technical area entrances. If implemented, these measures should improve the traffic flow on Pajarito Road, so that truck traffic would have less effect.

In conclusion, there are some proposals in the physical area of the Proposed Action that could affect its implementation. However, it is unlikely that there would be significant cumulative impacts associated with these proposals.

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7.0 AGENCIES CONSULTED

Informal consultation required under section 7 of the *Endangered Species Act of 1973* (42 U.S.C. § 1531) (ESA), as amended, has been initiated for the disposition of the subject structures. Given the dynamic nature of habitat use and nesting occupancy, together with the uncertainty regarding the commencement date of demolition activities, it is premature to finalize compliance with the ESA. Activities at LANL are subject to the LANL Threatened and Endangered Species Habitat Management Plan (HMP) provisions. As the site conditions return to pre-fire conditions, the ecology of the Pajarito Plateau stabilizes, or additional species are classified as threatened and endangered, any disposition activities associated with the subject structures would be reviewed for conformance with the HMP or for the need of additional ESA compliance consultation actions. The area of the Proposed Action and alternatives has been surveyed for threatened and endangered species for the prior four years and continued surveys before the action would help determine the level of consultation necessary under the ESA. If additional informal consultation were required it would be undertaken then (informal consultation would be appropriate for actions that are not likely to result in adverse effects to critical habitat); if circumstances change such that formal consultation were required because of anticipated adverse effects, it would be undertaken and the adequacy of NEPA compliance may need to be reviewed as well. If the area continues to be unoccupied during the formal threatened and endangered surveys, the U.S. Fish and Wildlife Service could be notified by letter that year-round removal of the structure would be undertaken with surveys before the beginning of the action. All other habitat alteration actions associated with the removal of the FRS would be subject to compliance with the LANL HMP.

No consultation with the State Historic Preservation Officer is required. Activities would avoid cultural sites identified during demolition. If any new sites are identified during demolition or revegetation, they would be evaluated and consultation would be undertaken as required.

In accordance with DOE regulations regarding floodplain/wetlands environmental review requirements (10 CFR 1022) has been published and is included as an appendix.

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REFERENCES

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APPENDIX: A FLOODPLAINS AND WETLANDS ASSESSMENT OF THE PROPOSED FUTURE DISPOSITION OF CERTAIN CERRO GRANDE FIRE FLOOD AND SEDIMENT RETENTION STRUCTURES AT LOS ALAMOS NATIONAL LABORATORY

LA-UR-02-3919

Title

A Floodplains and Wetlands Assessment of the Proposed Future Disposition of Certain Cerro Grande Fire Flood and Sediment Retention Structures at Los Alamos National Laboratory

Prepared by

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August 7, 2002

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Figures

Assessment Decision

No adverse effect: proposal effects on floodplains and wetlands would be short-term and temporary in nature.

Executive Summary

The Department of Energy proposes future disposition of certain structures installed to mitigate potential flooding after the Cerro Grande fire, including the Flood Retention Structure, the Los Alamos Canyon weir and detention basin, road reinforcements, and a steel diversion wall. This assessment documents potential impacts of the floodplains and wetlands associated with the areas. General best management practices are included to ensure that impacts do not occur to floodplains and wetlands that may exist in the area of the proposed projects. No potential loss of life or property has been identified with respect to the floodplains and wetlands for the proposed project. Concerns about siltation, erosion, and excessive storm water runoff will be addressed with specific mitigation implemented as part of careful project planning. Although there may be some effect to floodplains and wetlands, the potential impacts from these projects are expected to be minor.

1.0 Introduction

In May 2000, a prescription burn, started on Federally administered land to the northwest of Los Alamos National Laboratory (LANL), blew out of control and was designated as a wildfire. This wildfire, which became known as the Cerro Grande Fire (CGF), burned over 17,200 ha (43,000 ac) of forest along the eastern flank of the Pajarito Plateau before it was extinguished. Approximately 7,650 ac (3,061 ha) within the boundaries of LANL were burned; nearly 10 percent (over 200 residential units occupied by over 400 families) of the Los Alamos townsite nearby was also burned. During the fire a number of emergency actions were undertaken by the National Nuclear Security Administration (NNSA) to suppress and extinguish the fire within LANL; immediately thereafter, NNSA undertook additional emergency actions to address the post-fire conditions.

The CGF resulted in the creation of areas of hydrophobic soils, which are non-permeable soil areas created as a result of very high temperatures often associated with wildfires. These hydrophobic soils, combined with the loss of vegetation from steep canyon sides as a result of high- and moderate-severity fires, greatly affected the hydrologic functions of the watersheds in the LANL area. Surface runoff and soil erosion on the hillsides above LANL were greatly increased over pre-fire levels. The danger to LANL facilities and structures and homes located down-canyon from the burned area was magnified. Decisions to install storm water and flood control and erosion damage reduction features were made during the summer following the CGF based on the perceived increased risk of damages to LANL and offsite facilities, structures, and homes. Computer modeling was used to estimate the risks using data collected on the amount of rain that fell and subsequent runoff generated in June, July, and August 2000. Storm water and flood damage control actions undertaken included the placement of sand bags, rocks, logs, straw bales and wattles, silt fences, and concrete barriers at numerous locations throughout LANL and the installation of trash racks at several locations. In addition, the U.S. Army Corps of Engineers (USACE) or LANL contractors constructed certain flood and sediment retention structures. These certain constructed flood and sediment retention structures and their watershed canyon locations are as follows:

1. A flood retention structure (FRS) constructed of roller compacted concrete (RCC) located in Pajarito Canyon.
2. A low-head weir, constructed of rectangular rock-filled wire cages (gabions), and associated detention basin in Los Alamos Canyon.
3. Reinforcements of several road crossings;
   a. a land bridge along Anchor Ranch Road in Two-Mile Canyon,
   b. State Road (SR) 501 embankment reinforcements in Two-Mile Canyon,
   c. SR 501 reinforcements in Pajarito Canyon, and
   d. SR 501 reinforcements in Water Canyon.
4. A steel diversion wall upstream of Technical Area (TA) 18 in Pajarito Canyon.

5. A downstream access road to the Los Alamos Reservoir and reinforcement of the reservoir embankment[1].

[1] The disposition of reinforcements to the Los Alamos Reservoir and the access road will not be considered in this document because they are no longer under the administrative control of DOE, NNSA.

These structures are identified by number in Figure 1.

The construction of these structures and other activities taken by NNSA in the wake of the CGF, and their impacts, were analyzed in the *Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration, Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/SEA-03) (DOE 2000a) issued by NNSA in September 2000.

Subsequent modeling performed in 2001 based on additional site information shows little recovery (Springer 2002). However, many of the areas that were reseeded as part of the recovery efforts have new vegetative cover because of favorable growing conditions experienced over the past year. This vegetation coverage as it grows, matures, and spreads and is augmented by the germination and growth of native species, will begin to moderate the flood threat substantially over the next two to five years, depending on the severity and onset of drought, which may prolong recovery. A return to pre-fire conditions, or at least stabilization of the regional ecosystem, is expected to occur over the next three to eight years (2005 to 2010). The need for protection afforded by the placement of the flood and sediment retention structures will diminish accordingly.

While the impacts of constructing the identified flood and sediment retention structures were included in the analysis provided in DOE/SEA-03, the future disposition of these structures, some of which were designed to last for decades, was not considered. Mitigation measures listed in DOE/SEA-03 include the following commitment: "Removal of the constructed flood control and erosion damage reduction features and the FRS when storm water flows have returned to pre-fire levels as denoted by vegetation recovery and annual modeling estimates will be considered. Additional NEPA [National Environmental Protection Act] and other regulatory compliance would be necessary when these actions become ripe for consideration. If structures are removed, re-contouring and reseeding of these areas with appropriate site-specific seed mixtures would be conducted until these construction sites have been completely revegetated." DOE is preparing an environmental assessment (DOE 2002) to evaluate the effects of the disposition of the FRS, the low-head weir and detention basin, road reinforcements, and the steel diversion wall.

2.0 Proposed Action

The Proposed Action is to remove part of the above ground portion of the FRS and the entire above ground portions of the steel diversion wall; the other subject structures would remain in place with continued performance of routine maintenance activities. However, until NNSA determines that site conditions have returned to pre-fire status or the local ecosystem has recovered enough to approximate pre-fire conditions, the various subject structures will be maintained as described in the Flood Retention Structure Environmental Assessment (FRS EA) (DOE 2002); this may be the case for the next several years. The exact duration for the continuance of the status quo cannot be established at this time because of the unpredictability of weather patterns, revegetation rates, changes in soil structure, and the possibility of other events that would affect revegetation and flows, such as other fires in the watersheds above where the subject structures are located. In addition, there may be changes in NNSA missions, land

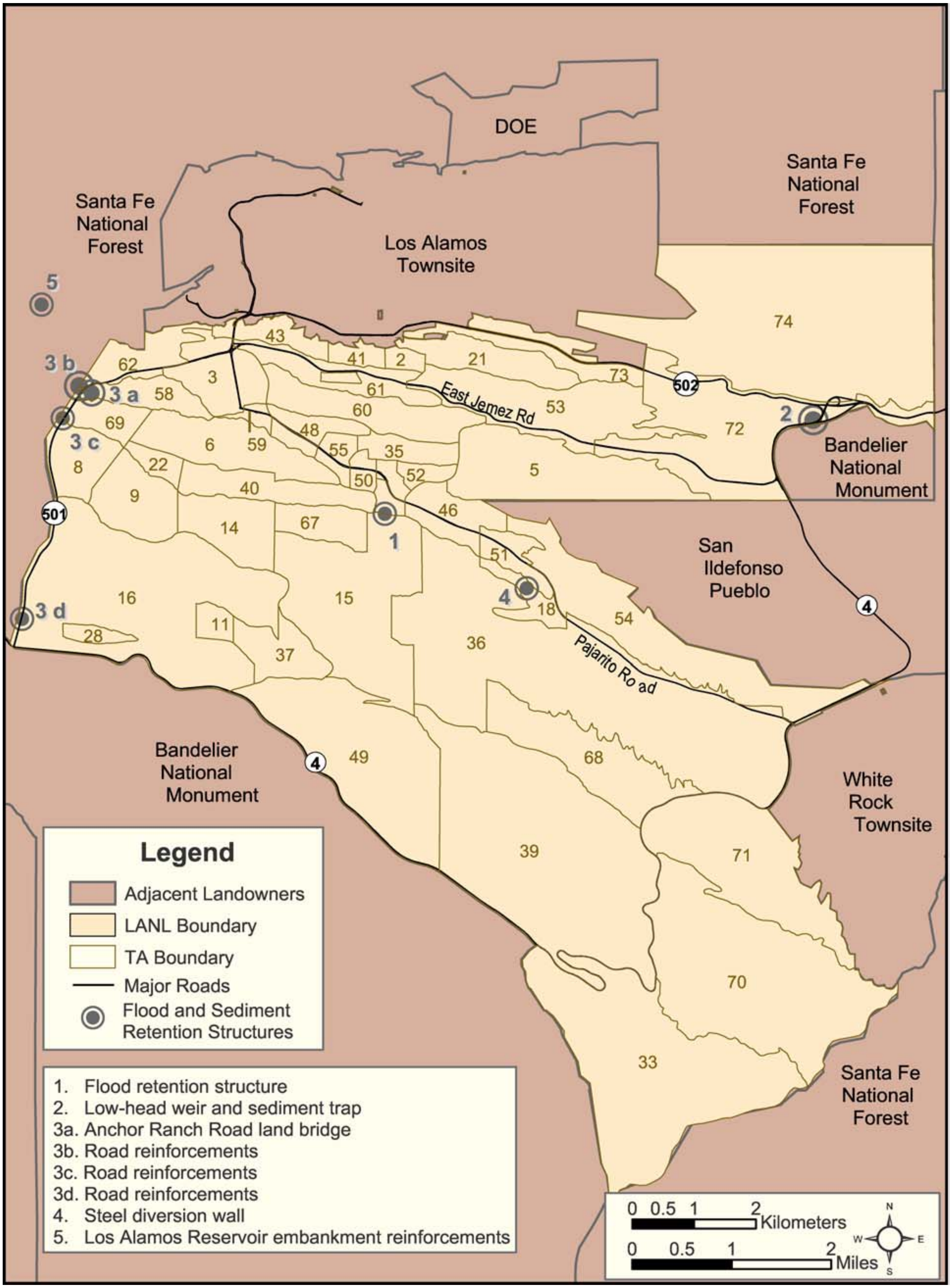

Figure 1. Locations of certain flood and sediment retention structures.

management policies, and environmental stewardship policies that might affect when disposition of the subject structures should occur. The Proposed Action and alternatives described in this document are based on the continuance of LANL mission support activities and capabilities for the foreseeable future, as described in LANL's Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999) and other DOE NEPA documents and planning documents. If changes in mission support activities or policies occur such that these alternatives are no longer suitable, further NEPA analysis might be required. Additionally, the Proposed Action and alternatives are based on the projection of adequate recovery of the ecosystem at LANL within the next eight years (by 2010) (DOE 2000b). Proposed activities under each alternative would occur by the end of 2010. For full details see DOE 2002.

2.1 Flood Retention Structure

Implementing the Proposed Action would result in the removal of part of the FRS above ground level and in the removal of sediments sufficient to allow resumption of the natural flow in the streambed without future floodwater retention. Currently, the volume of sediment that has accumulated behind the FRS is estimated to be about 4,330 m^3 (5,700 yd^3) of material at a depth of 3 ft (0.9 m) at the base of the FRS. This volume of sediment represents two years accumulation. With continuing revegetation in the watershed above the FRS, sediment is likely to be deposited and accumulate at a diminishing rate. As part of the DOE/SEA-03 MAP, the sediment is tested annually for chemical, radiological, and heavy metal constituents. Removal of sediment volumes under the Proposed Action would be based on the sediment composition as well as on the amount of accumulation over the next several years. A bounding volume of 21,660 m^3 (28,500 yd^3) of sediment material would need to be removed from the FRS site; this is the amount estimated to accumulate over 10 years based on the accumulation in the two years following the Cerro Grande Fire.

2.2 Low-head Weir and Detention Basin

The low-head weir and detention basin would be left in place as part of the Proposed Action; routine maintenance activities would be performed. As described in the corresponding environmental assessment (DOE 2002), a wetland could be forming in the detention basin. If present, the wetland would remain in place. Current maintenance activities would be carried out, including the replacement of wire mesh containers as they rust or fail. Sampling of sediments would be performed to evaluate potential chemical radiological and heavy metal constituent concentrations in the detention basin, and sediments would be removed as required and disposed of appropriately through the LANL waste management program.

2.3 Road Reinforcements

Road reinforcements would be left in place as part of the Proposed Action. Routine inspection and maintenance activities would continue to be conducted when required.

2.4 Steel Diversion Wall

Under either option for the TA-18 facilities, the steel diversion wall above TA-18's CASA I would be removed. The pilings would be removed down to ground level with a cutting torch or similar tool. The 19 m^3 (25 yd^3) of panels and beams generated by the demolition would be removed and shipped off site for recycling. A crew of eight would be required to work for approximately six weeks to accomplish removal of this structure.

3.0 Environmental Baseline

3.1 Regional Description

3.1.1 Location within the State

LANL and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County, north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 2). The 11,596-ha (28,654-ac) LANL site is situated on the Pajarito Plateau. This plateau is a series of fingerlike mesas separated by deep east-to-west-oriented canyons cut by intermittent streams. Mesa tops range in elevation from approximately 2,400 m (7,800 ft) on the flanks of the Jemez Mountains to about 1,900 m (6,200 ft) at their eastern termination above the Rio Grande.

Most LANL and community developments are confined to mesa tops. The surrounding land is largely undeveloped. Large tracts of land north, west, and south of the LANL site are held by the Santa Fe National Forest, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County. The Pueblo of San Ildefonso borders LANL to the east.

3.1.2 Geologic Setting

Most of the fingerlike mesas in the Los Alamos area are composed of Bandelier Tuff, which consists of ash fall, ash fall pumice, and rhyolite tuff. The tuff, ranging from nonwelded to welded, is more than 300 m (1,000 ft) thick in the western part of the plateau and thins to about 80 m (260 ft) eastward above the Rio Grande (Broxton et al., 1995). Tuff was deposited after major eruptions in the Jemez Mountains Volcanic Field about 1.2 to 1.6 million years ago (Self and Sykes 1996).

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps onto the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains (Self and Sykes 1996). The conglomerate of the Puye Formation underlies the tuff in the central plateau and near the Rio Grande. Chino Mesa basalts interfinger with the conglomerate along the river. These formations overlay the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 1,000 m (3,300 ft) thick. LANL is bordered on the east by the Rio Grande, within the Rio Grande rift. Because of the faulting associated with the rift, the area experiences frequent minor seismic disturbances.

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the LANL site before they are depleted by evaporation, transpiration, and infiltration (DOE 1999). Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages. Effluents from sanitary sewage, industrial waste treatment plants, and

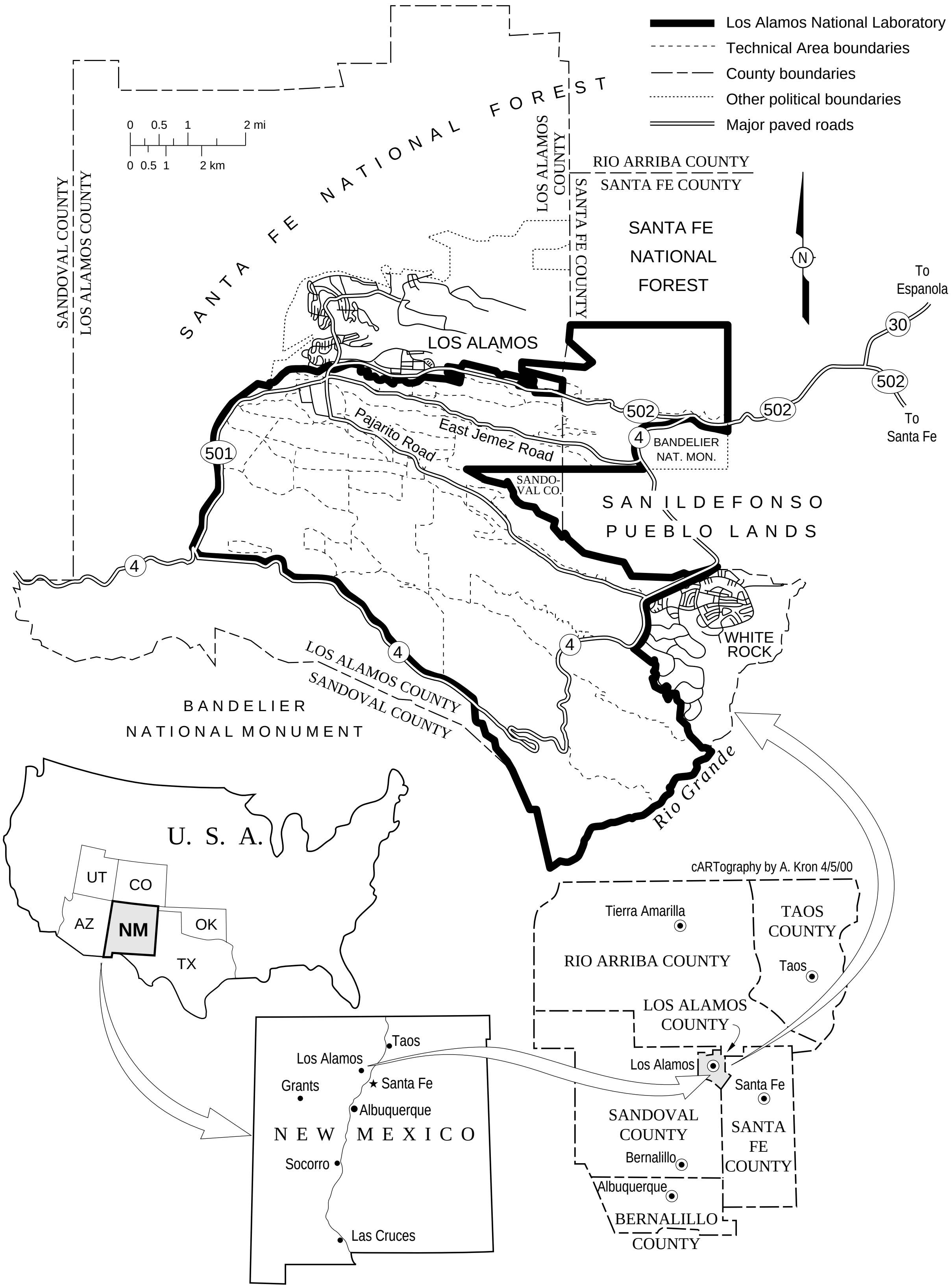

Figure 2. Location of Los Alamos National Laboratory.

cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

Groundwater in the Los Alamos area occurs in three forms: (1) water in shallow alluvium in canyons, (2) perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the main aquifer of the Los Alamos area. Ephemeral and intermittent streams have filled some parts of canyon bottoms with alluvium that ranges from less than 1 m (3 ft) to as much as 30 m (100 ft) in thickness. Runoff in canyon streams percolates through the alluvium until its downward movement is impeded by layers of weathered tuff and volcanic sediment that are less permeable than the alluvium. This process creates shallow bodies of perched groundwater that move downgradient within the alluvium. As water in the alluvium moves down the canyon, it is depleted by evapotranspiration and movement into underlying volcanics (Purtymun et al., 1977). The chemical quality of the perched alluvial groundwaters shows the effects of discharges from LANL.

In portions of Pueblo, Los Alamos, and Sandia canyons, perched groundwater occurs beneath the alluvium at intermediate depths within the lower part of the Bandelier Tuff and within the underlying conglomerates and basalts. Perched groundwater has been found at depths of about 37 m (120 ft) in the midreach of Pueblo Canyon to about 137 m (450 ft) in Sandia Canyon near the eastern boundary of LANL (Purtymun 1995a). This intermediate-depth perched water discharges at several springs in the area of Basalt Spring in Los Alamos Canyon. These intermediate-depth groundwaters are formed in part by recharge from the overlying perched alluvial groundwaters and show evidence of radioactive and inorganic contamination from LANL operations (Purtymun 1995a).

Perched water may also occur within the Bandelier Tuff in the western portion of LANL, just east of the Jemez Mountains. The source of this perched water might be infiltration from streams discharging from the mouths of canyons along the mountain front and underflow of recharge from the Jemez Mountains. Industrial discharges from LANL operations may also contribute to perched groundwater in the western portion of LANL. Perched groundwater in the Tschicoma Formation is the source of water supply for the ski area located just west of the LANL boundary in the Jemez Mountains.

The main aquifer of the Los Alamos area is the only aquifer in the area capable of serving as a municipal water supply (Griggs 1964). The surface of the aquifer rises westward from the Rio Grande within the Tesuque Formation (part of the Santa Fe Group) into the lower part of the Puye Formation beneath the central and western part of the plateau. Depth to the main aquifer is about 300 m (1,000 ft) beneath the mesa tops in the central part of the plateau. The main aquifer is separated from alluvial and perched waters by about 110 to 190 m (350 to 620 ft) of tuff and volcanic sediments with low (less than 10 percent) moisture content (Griggs 1964).

Water in the main aquifer is under artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande (Purtymun and Johnson 1974). The source of recharge to the aquifer is presently uncertain. Early research studies concluded that major recharge to the main aquifer is probably from the Jemez Mountains to the west because the piezometric surface slopes downward to the east, suggesting easterly groundwater flow beneath the Pajarito Plateau

(Purtymun 1995b). However, the small amount of recharge available from the Jemez Mountains relative to water supply pumping quantities, along with differences in isotopic and trace element composition, appear to rule this out. Further, isotopic and chemical composition of some waters from wells near the Rio Grande suggest that the source of water underlying the eastern part of the Pajarito Plateau may be the Sangre de Cristo Mountains (Blake et al. 1995).

Groundwater flow along the Rio Grande rift from the north is another possible recharge source. The main aquifer discharges into the Rio Grande through springs in White Rock Canyon. The 18.5-km (11.5-mi) reach of the river in White Rock Canyon between Otowi Bridge and the mouth of Rito de los Frijoles receives an estimated 5.3 to 6.8×10^6 m^3 (4,300 to 5,500 acre-ft) annually from the aquifer (Griggs 1964).

3.1.3 Topographic Setting

LANL and its surrounding environments encompass a wide range of environmental conditions. This is due in part to the prominent elevational gradient in the east-west direction. This is also attributable to the complex, local topography that is found throughout much of the region.

The spectacular scenery that is a trademark of the Los Alamos area is largely a result of this regional gradient. The difference between its lowest elevation in the eastern extremities and its highest elevation on the western boundaries represents a change of approximately 1,568 m (5,146 vertical feet). At the lowest point along the Rio Grande, the elevation is approximately 1,631 m (5,350 ft) above mean sea level. At the opposite elevational extreme, the Sierra de los Valles, which is part of the more extensive Jemez Mountains, forms a continuous backdrop to the landscapes of the region being studied. The tallest mountain peaks in the Sierra include Pajarito Mountain at 3,182 m (10,441 ft), Cerro Rubio at 3,185 m (10,449 ft), and Caballo Mountain at 3,199 m (10,496 ft).

In addition to the prominent elevational gradient, the Los Alamos region is also topographically complex. Within Los Alamos County, there are three main physiographic systems (Nyhan et al., 1978). From east to west, these systems are the White Rock Canyon, the Pajarito Plateau, and the Sierra de los Valles. White Rock Canyon is 1,890 m (6,200 ft) above mean sea level. This rugged canyon is approximately 1.6 km (1 mi) wide and extends to a depth of nearly 275 m (900 ft). White Rock Canyon occupies about 5 percent of Los Alamos County. The Pajarito Plateau is the largest of the three physiographic systems, occupying nearly 65 percent of Los Alamos County. The Pajarito Plateau is a broad piedmont that slopes gently to the east and southeast. At a more localized scale, the Pajarito Plateau is also topographically complex. The surface of the plateau is dissected into narrow mesas by a series of east-west-trending canyons. Above 2,377 m (7,800 ft), the Sierra de los Valles rises to the western extremity of the study region. These mountains occupy approximately 30 percent of Los Alamos County. The Sierra is also dissected into regularly spaced erosional features, although these canyons in the mountains are not so prominent as the canyons on the Pajarito Plateau.

3.1.4 Weather and Climate

Los Alamos has a temperate, semiarid mountain climate. However, its climate is strongly influenced by elevation, and large temperature and precipitation differences are observed in the area because of the topography.

Los Alamos has four distinct seasons. Winters are generally mild, but occasionally winter storms produce large amounts of snow and below-freezing temperatures. Spring is the windiest season of the year. Summer is the rainy season in Los Alamos, when afternoon thunderstorms and associated hail and lightning are common. Fall marks the end of the rainy season and a return to drier, cooler, and calmer weather. The climate statistics discussed below summarize analyses given in Bowen (1990 and 1992).

Several factors influence the temperature in Los Alamos. An elevation of 2,256 m (7,400 ft) helps to counter its southerly location, making for milder summers than nearby locations with lower elevations. The sloping nature of the Pajarito Plateau causes cold-air drainage, making the coolest air settle into the valley. The Sangre de Cristo Mountains to the east act as a barrier to arctic air masses affecting the central and eastern United States. The temperature does occasionally drop well below freezing, however. Another factor affecting the temperature in Los Alamos is the lack of moisture in the atmosphere. With less moisture, there is less cloud cover, which allows a significant amount of solar heating during the daytime and radiative cooling during the nighttime. This heating and cooling often causes a wide range of daily temperature.

Winter temperatures range from 30°F to 50°F (-1°C to 10°C) during the daytime to 15°F to 25°F (-9°C to -4°C) during the nighttime. The record low temperature recorded in Los Alamos (as of 1992) is -18°F (-28°C). Winter is usually not particularly windy, so extreme wind chills are uncommon at Los Alamos. Summer temperatures range from 70°F to 88°F (21°C to 31°C) during the daytime to 50°F to 59°F (10°C to 15°C) during the nighttime. Temperatures occasionally will break 90°F (32°C). The highest temperature ever recorded (as of 1992) in Los Alamos is 95°F (35°C).

The average annual precipitation in Los Alamos is 47.57 cm (18.73 in.). The average snowfall for a year is 149.6 cm (58.9 in.). Freezing rain and sleet are rare at Los Alamos. Winter precipitation in Los Alamos is often caused by storms entering the United States from the Pacific Ocean, or by cyclones forming or intensifying in the lee of the Rocky Mountains. When these storms cause upslope flow over Los Alamos, large snowfalls can occur. The snow is usually a dry, fluffy powder, with an average equivalent water-to-snowfall ratio of 1:20.

The summer rainy season accounts for 48 percent of the annual precipitation. During the July–September period, orographic thunderstorms form when moist air from the Gulf of Mexico and the Pacific Ocean moves up the sides of the Jemez Mountains. These thunderstorms can bring large downpours, but sometimes they only cause strong winds and lightning. Hail frequently occurs from these rainy-season thunderstorms.

Winds in Los Alamos are also affected by the complex topography, particularly in the absence of a large-scale disturbance. There is often a distinct daily cycle of the winds around Los Alamos. During the daytime, upslope flow can produce a southeasterly wind on the plateau. In the evening, as the mountain slopes and plateau cool, the flow moves downslope, causing light westerly and northwesterly flow. Cyclones moving through the area disturb and override the cycle. Flow within the canyons of the Pajarito Plateau can be quite varied and complex.

3.1.5 Plant Communities

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. This diversity of ecosystems is due partly to the dramatic 1,500-m (5,000-ft) elevation gradient from the Rio Grande on the east to the Jemez Mountains 20 km (12 mi) to the west, and partly to the many steep canyons that dissect the area. Five major vegetative cover types are found in Los Alamos County: juniper (*Juniperus monosperma*)-savanna, piñon (*Pinus edulis*)-juniper, ponderosa pine (*Pinus ponderosa*), mixed conifer, and spruce-fir. All of the communities and their distribution are described in Balice (1998). The juniper-savanna community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons at elevations between 1,700 to 1,900 m (5,600 to 6,200 ft). The piñon-juniper cover type, generally in the 1,900- to 2,100-m (6,200- to 6,900-ft) elevation range, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pines are found in the western portion of the plateau in the 2,100- to 2,300-m (6,900- to 7,500-ft) elevation range. These three cover types predominate, each occupying roughly one-third of the LANL site. The mixed conifer cover type, at an elevation of 2,300 to 2,900 m (7,500 to 9,500 ft), overlaps the ponderosa pine community in the deeper canyons and on north-facing slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. Spruce-fir is at higher elevations of 2,900 to 3,200 m (9,500 to 10,500 ft). Twenty-seven wetlands and several riparian areas enrich the diversity of plants and animals found on LANL lands.

3.1.6 Post-Fire Plant Communities

In May 2000, the CGF burned over 17,200 ha (43,000 ac) of forest on and around LANL. Most of the habitat damage occurred on Forest Service property to the west and north of LANL. An assessment of fire-induced vegetation mortality was made by the Burned Area Emergency Rehabilitation Team (BAER 2000). As a result of the fire, approximately 3,110 ha (7,684 ac) or 28 percent of the vegetation at LANL was burned in some fashion. However, few areas on LANL were burned severely. Additionally, some vegetation was burned in floodplains, but very little in wetlands.

3.1.7 Pre- and Post-Fire Hydrology

McLin (1992) modeled all major 100-year floodplains for LANL using USACE Hydrologic Engineering Center HEC-1 and HEC-2 computer-based models. These data represent pre-fire flow rates for all of the floodplains on LANL. Post-fire analyses have been completed (McLin et al., 2001, 2002). These new models show increases in peak flow of one to two orders of magnitude per unit drainage basin area.

4.0 Description and Effects on Floodplains and Wetlands

Pursuant to Executive Order 11988, Floodplain Management, each Federal agency is required, when conducting activities in a floodplain, to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. DOE's 10 CFR Part 1022.4 defines a flood or flooding as ". . . a temporary condition of partial or complete inundation of normally dry land areas from . . . the unusual and rapid accumulation of runoff of surface waters . . . ." DOE's 10 CFR Part 1022.4 identifies floodplains that must be considered in a floodplain assessment as the base floodplain and the critical-action floodplain. The base floodplain is the area inundated by a flood having a 1.0 percent chance of occurrence in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area inundated by a flood having a 0.2 percent chance of occurrence in any given year (referred to as the 500-year floodplain). Critical action is defined as any activity for which even a slight chance of flooding would be too great. Such actions could include the storage of highly volatile, toxic, or water-reactive materials.

Pursuant to Executive Order 11990, Protection of Wetlands, each Federal agency is to avoid, to the extent practicable, the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands if a practicable alternative exists. DOE regulations define wetlands as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mudflats, and natural ponds" (10 CFR Section 1022.4[v]).

According to 10 CFR 1022.12(a)(2), a floodplain/wetland assessment is required to discuss the positive and negative, direct and indirect, and long- and short-term effects of the Proposed Action on the floodplain and/or wetlands. In addition, the effects on lives and property and on natural and beneficial values of floodplains must be evaluated. For actions taken in wetlands, the assessment should evaluate the effects of the Proposed Action on the survival, quality, and natural and beneficial values of the wetlands. If DOE finds no practicable alternative to locating activities in floodplains or wetlands, DOE will design or modify its actions to minimize potential harm to or in the floodplains and wetlands. The floodplains and wetlands that are assessed herein are those areas in canyons or drainages that are seasonally inundated with perennial or intermittent streams from runoff during 100-year floods.

4.1 General

Wetland functions are naturally occurring characteristics of wetlands such as food web production; general nesting, resting, or spawning habitat; sediment retention; erosion prevention; flood and runoff storage; retention and future release; groundwater discharge or recharge; and land-nutrient retention and removal. Wetland values are ascribed by society based on the perception of significance and include water-quality improvement, aesthetic or scenic value, experiential value, and educational or training value. These values often reflect concerns regarding economic values; strategic locations; and, in arid regions, the location relative to other landscape features. Thus, two wetlands with similar size and shape could serve the same function but have different values to society. For example, a wetland that retains or changes flood-flow timing of a flood high in the mountains might not be considered as valuable as one of similar size that retains or changes flood-flow timing of a flood near a developed community. Wetlands were addressed in the LANL SWEIS as follows (DOE 1999):

"Wetlands in the general LANL region provide habitat for reptiles, amphibians, and invertebrates and potentially contribute to the overall habitat requirements of the peregrine falcon, Mexican spotted owl, southwestern willow flycatcher, and spotted bat. Wetlands also provide habitat, food, and water for many common species such as deer, elk, small mammals, and many migratory birds and bats. The majority of the wetlands in the LANL region are associated with canyon stream channels or are present on mountains or mesas as isolated meadows containing ponds or marshes, often in association with springs."

Wetlands within LANL have been broadly mapped by the U.S. Fish and Wildlife Service. This information is available in the National Wetlands Inventory in a Geographic Information System-based format. This hierarchical system follows Cowardin et al. (1979) and is based entirely on aerial photography. Small wetlands, or those in steep canyons, may not be detected using this method. Additional onsite surveys and internal University of California databases were also used to gather information regarding these resources.

4.2 Canyon Area Issues and Concerns

The canyon areas on LANL land are comprised primarily of mixed conifer and ponderosa pine. Areas outside of Habitat Management Plan (LANL 1998) areas for threatened and endangered species will be treated according to the mitigation detailed within this document and DOE/SEA-03. In all cases, erosion, sediment transfer, and movement of contaminants are a concern, from work on mesa tops as well as within floodplains, particularly during rain events and the rainy season. Cumulative erosion of ash and soils from severely burned headlands above project sites is also a potential concern. The potential for downstream floodplain and wetland values to be impacted by the proposed project exists for the canyons.

4.3 Potential Effects of the Proposed Projects

The proposed actions of partial removal of the FRS and full removal of the above-ground section of the steel diversion wall are subject to various impacts described below. After ten years of growth, the vegetation in all of the structure sites will likely be mature. This includes potential establishment of a wetland in the Los Alamos weir detention basin area.

In all cases where the projects take place within a canyon, personnel are subject to maintaining the integrity of all natural and beneficial floodplain values. In those floodplains that also have wetlands, survival, quality, natural and beneficial wetland values also must be maintained. In carrying out activities described above for these projects, as per Executive Order 11988 and Executive Order 11990 all impacts to public health, safety, and welfare including water supply, quality, recharge and discharge, pollution, flood and storm hazards, sediment, and erosion will be evaluated. Additionally, the corresponding environmental assessment for this document includes extensive discussion of suggested BMPs (DOE 2002).

Possible direct effects of the proposed projects are a reduction in vegetation cover and exposure of mineral soils. If heavy equipment is used directly within the floodplain, soil compaction and increased surface impermeability may occur. General indirect effects of these efforts are the potential for the increase of erosion and storm water runoff.

Primary indirect effects (within identified canyons) to floodplains and wetlands resulting from the removal effort may include movement or ponding of water or sediment within the project area. For instance, if work conducted in Pajarito Canyon contributed to increased sediment movement, there may be some retention of those sediments by the wetlands downstream. There will likely be a great deal of soil and sediment disturbance, including the removal of any growth that may have established in the 10 or more years prior. For all proposed structures facing removal or partial removal, all materials would have to be removed from the floodplain (parts of the structure, debris, soils, and vegetation) such that normal flows could continue after removal.

Secondary indirect effects (outside of the project area) resulting from the removal effort would result in possible impacts to floodplains and wetlands not associated with the project area (e.g., downstream to the Rio Grande). Downstream floodplain/wetland values potentially affected by the project could include a slight alteration of flood-flow retention times, a slight alteration of nesting, foraging, or resting habitat, and a slight redistribution of sediments and sediment-retention time changes. These secondary indirect impacts are anticipated to come from both changes in timing of storm water runoff (speed) and increases in storm water runoff (volume) from increased impermeable surfaces within the tract from the use of heavy equipment compacting the soil.

5.0 Specific Assessments for the Proposed Projects

5.1 Flood Retention Structure

The FRS, located 240 m (800 ft) downstream of the confluence of Two-Mile and Pajarito Canyons, rises 21.6 m (72 ft) above the natural ground surface and stretches 117 m (390 ft) across Pajarito Canyon (Figure 3). The slopes of the canyon are showing signs of revegetation with upland species.

5.1.1 Floodplains

The floodplain covers the entire extent of the canyon from the headlands to White Rock. The 100-year floodplain near the FRS is shown in Figure 3.

5.1.2 Wetlands

Wetlands exist in Pajarito Canyon below TA-18. They range in size from 0.09 ha (0.23 ac) to 5.3 ha (13.2 ac) on either side of the road beginning at Potrillo Drive (the entrance to TA-18). These wetlands are hydrologically maintained by storm water and natural springs. The headlands of the Pajarito Canyon watershed were severely burned in the CGF. Ash deposits from storm water runoff were measured between 46 and 61 cm (18 to 24 in.) in the upper most wetland (Marsh 2001). Non-wetland species washed down from the hydromulch were also noted post-CGF.

5.1.3 Potential Effects of the Proposed Action and Alternatives

Implementing the Proposed Action would result in the removal of part of the FRS above ground level and in the removal of sediments sufficient to allow resumption of the natural flow in the streambed without future floodwater retention. There are two different options for removal of sediment, concrete and gabion rock resulting from the demolition of the FRS, depending on the decisions made about the future disposition of the TA-18 capabilities and facilities that are currently located downstream from the FRS (see Related Actions discussion in section 2.6 of the FRS EA). Option A describes the Proposed Action under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS. Option B describes the Proposed Action under the condition that the TA-18 mission has been relocated and

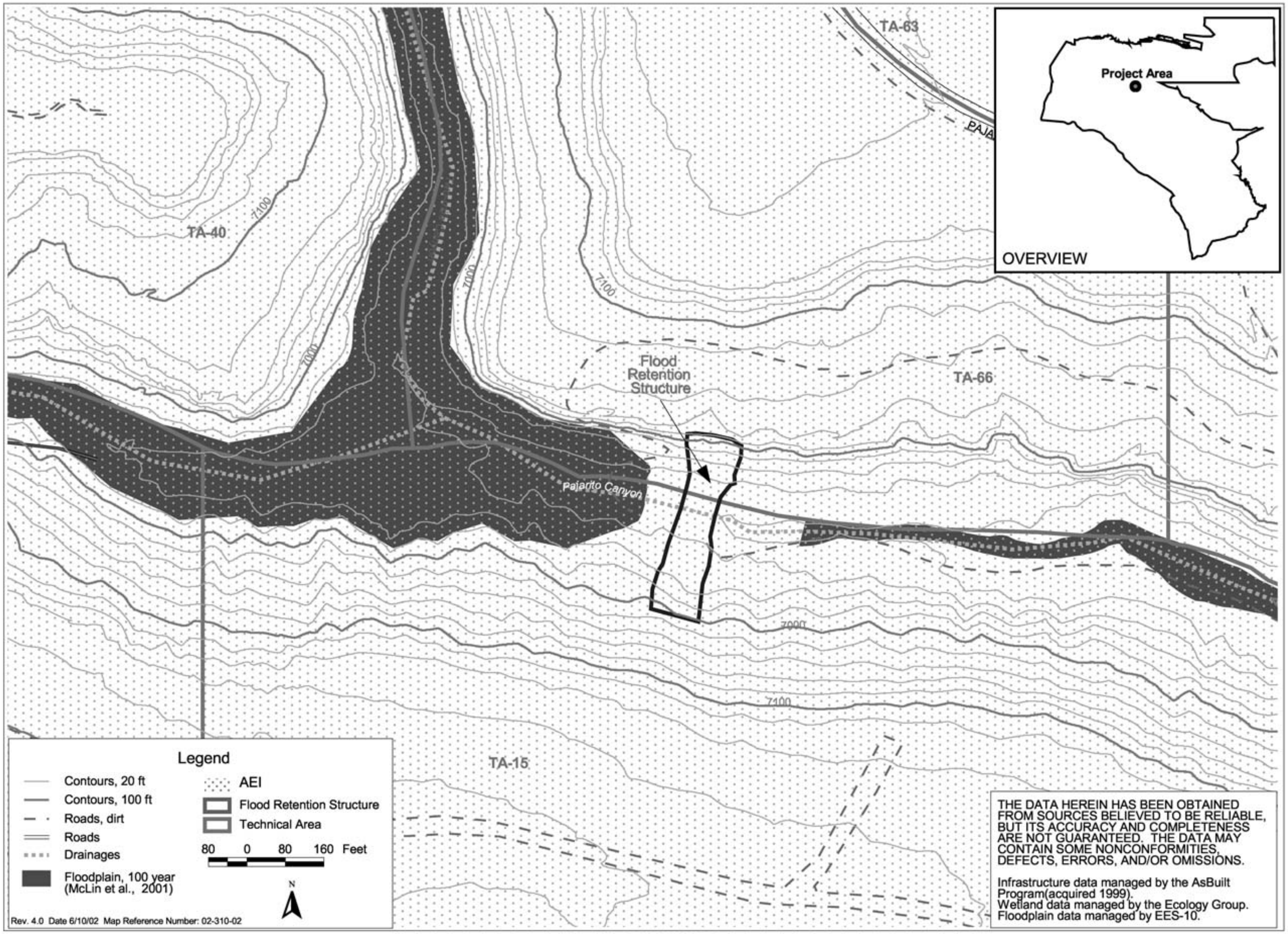

Figure 3. Location of FRS in Pajarito Canyon.

that the existing facilities are not subject to heightened national security measures, allowing construction equipment access through that site.

If TA-18 capabilities continue at their present location, the Proposed Action project would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade. If TA-18 capabilities continue at their present location, the Proposed Action would use the existing access road that connects Pajarito Canyon to Pajarito Road. The road may have to be modified to change the current steep grade to accommodate six-wheel-drive off-road vehicles to carry the concrete, rocks, and sediment up the road. Alternatively, DOE may decide to use a continuous generator conveyor belt, such as those that are used in the mining industry, to haul debris out of the canyon. This would minimize truck traffic in the canyon. The staging area for loading material into dump trucks to be moved to a long-term storage yard would be at the top of the canyon, near Pajarito Road and well away from the floodplain. At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. The access road would be removed and that part of the canyon wall would be recontoured and stabilized.

If the TA-18 capabilities and facilities are relocated away from TA-18, it is unlikely that NNSA would decide to use the existing site for any NNSA mission support activity that had the same level of national security requirements. Currently, access to the maintenance road below the FRS connecting to the TA-18 facilities is restricted because of enhanced security conditions. If this mission relocation occurs before the disposition of the FRS, the existing maintenance road below the FRS and the area occupied by the TA-18 facilities could be used for transportation and staging of the concrete, rock, and sediment. The road would be upgraded and erosion BMPs would be installed. Similar to Option A, the removal would require 6-wheel-drive off-road vehicles to carry the concrete, rocks, and sediment up the road. The truckloads and material quantities would be the same as for Option A. A new 3-ac (1.2-ha) staging area would be established and used in TA-18. The staging area would be located outside of the floodplain and would be sited so as to avoid any cultural resources and potential release sites (PRSs). At the staging area, the concrete would be loaded onto dump trucks for transportation to a long-term storage yard within LANL. At the end of demolition and removal of the gabions, concrete, and sediment, the streambed would be graded. The remaining sides of the FRS would be stabilized and the banks would be reseeded. The area would be monitored and maintained to prevent erosion of the slopes and damage to the floodplain and downstream wetlands. Unlike Option A, at the end of the FRS removal activities, both the maintenance road and the access road to the upstream side of the FRS would be retained as fire roads for vehicle access to the upper portion of Pajarito Canyon and the firing sites at TA-22.

The downstream wetland area east of TA-18 would not likely be adversely affected due to the BMPs that would be employed at the site and the distance to the wetlands. Work conducted in Pajarito Canyon could contribute to an increase in the potential for sediment movement. If large quantities of sediment were moved downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume after the conclusion of the project. The area would be reseeded to stabilize the site.

Implementing the Disassembly Alternative would result in the total removal of the FRS to ground level, along with sediments and gabion rocks, and restoration of the entire area of the FRS and reservoir surface to approximately preconstruction topographic conditions. As described in the Proposed Action, there would be two options for removal of the concrete, rock and sediments. Under the condition that the TA-18 capabilities and facilities remain located in facilities downstream from the FRS and that national security concerns would not allow use of the maintenance road below the FRS, the material would be removed as described in Option A under the Proposed Action. Should the TA-18 mission be relocated, material would be removed as described in Option B under the Proposed Action.

The downstream wetland area east of TA-18 would not likely be adversely affected due to BMPs that would be employed at the site and the distance to the wetlands. With total removal of the FRS, there would be a proportional increase in erosion potential of the canyon walls since the sides of the FRS structures would be completely removed. If large quantities of sediment move downstream, there could be some retention of those sediments by the wetlands downstream in Pajarito Canyon. All excess materials, including demolition debris, soils, and dead vegetation, would be removed from the area so that normal flows could resume at the conclusion of the project.

Under the No Action Alternative, the FRS would remain intact. UC staff at LANL would continue inspection and maintenance activities. However, because the ecosystem would have returned to pre-fire or to near pre-fire conditions and the danger of major flooding would be reduced, it is unlikely that water would be retained in the reservoir behind the FRS. The steep embankment would need continued maintenance for erosion control. The No Action Alternative activities for maintenance and repair of the FRS would reduce the potential for crumbling of the structure and subsequent long-term release of construction materials that could affect the floodplain and wetlands downstream in TA-18. Routine maintenance is expected to remove vegetation growth in the sediment upstream of the structure. No adverse effect or change to the wetland and floodplain functions and values within Pajarito Canyon would likely occur from the No Action Alternative.

5.2 Low-head Weir and Detention Basin

The low-head weir and detention basin are located in Los Alamos Canyon near the intersection of SR 4 and SR 501 within TA-72 (Figure 4). The weir provides sediment control and retention and decelerates storm water flow. The detention basin is located on the upland side of the weir where water may pool for several months, particularly in normal years with spring runoff and monsoon storm water events. The Los Alamos Reservoir is periodically drained during the rainy season, and the water collects at the low-head weir. The reservoir will continue to be periodically drained until flows return to “normal.”

5.2.1 Floodplains

The entire length of Los Alamos Canyon is considered a floodplain.

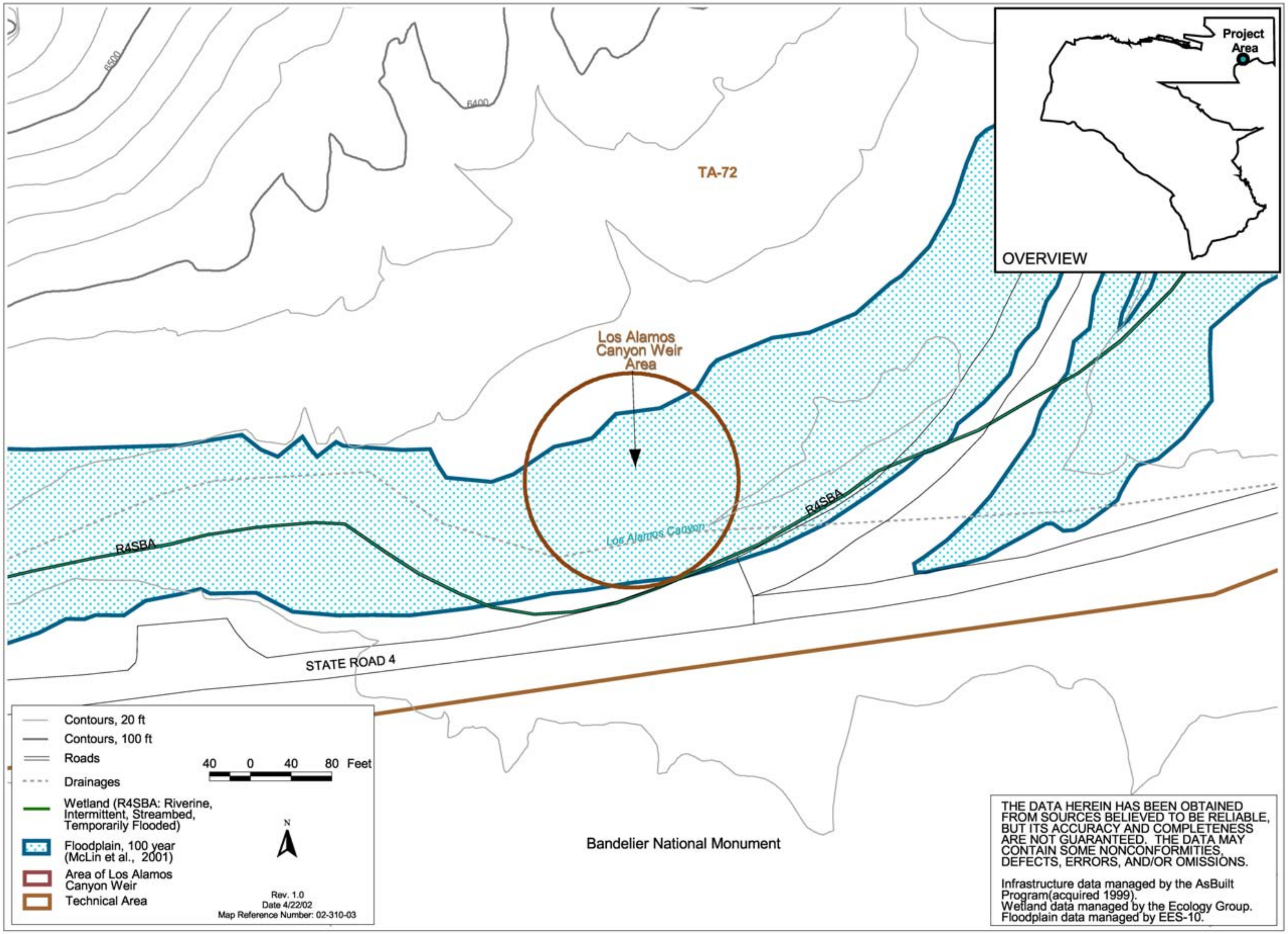

Figure 4. Location of low-head weir in Los Alamos Canyon.

5.2.2 Wetlands

One small wetland is located in this canyon approximately 1.12 km (0.7 mi) northwest of the weir and out of the proposed project area. There are associated scattered areas of hydric soils in the stream channel, but not within the project area. There are also hydrophilic plants along the stream channel, which maintain the streambed integrity.

Wetland characteristics have begun to form in the sediment behind the low-head weir as of summer 2001 (Marsh 2001). Willows (*Salix* spp.) and cottonwoods (*Populus* spp.) have been planted by LANL staff to decrease soil erosion. This area is being monitored for the continued formation of a wetland. If conditions continue as they have in the last two years, further sedimentation and water pooling may occur, and this area may become a fully established wetland by the time this project takes place. Even in severe drought conditions, there is likely some seasonal rain activity that will recharge this area to some extent.

5.2.3 Potential Effects of the Proposed Action and Alternatives

The low-head weir and detention basin would be left in place as part of the Proposed Action; routine maintenance activities would be performed. As described above, a wetland could be present in the detention basin, although this is uncertain. If present, the wetland would remain in place. Current maintenance activities would be carried out, including the replacement of wire mesh containers as they rust or fail. Sampling of sediments would be performed to evaluate potential chemical radiological and heavy metal constituent concentrations in the detention basin, and sediments would be removed as required and disposed of appropriately through the LANL waste management program.

There would be no adverse effect on the floodplains. Depending on available moisture, the one-quarter acre potential wetland area could continue to develop and become established or it may fail to become established. If removal of sediments were necessary during maintenance of the structure under this alternative, as would be the case for the No Action Alternative, appropriate permitting and regulatory compliance measures would be undertaken. As the Los Alamos Canyon ecosystem recovers over time, the amount of runoff reaching the detention basin is expected to decrease. Either this decrease in available surface moisture or the disruption to the area from silt removal activities could result in the reduction or elimination of the potentially developing wetland area.

The low-head weir and detention basin would be removed as part of the Disassembly Alternative. If the sediment in the detention basin and the weir were to be removed, demolition work would be taking place within an area that might be the site of the developing wetland. Removing the sediment that allowed the wetland to develop could destroy the wetland itself if it had become established over time as discussed above.

Under the No Action Alternative, the low-head weir and detention basin would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action. The No Action Alternative would have the same effects as the Proposed Action with regard to this structure. Leaving this structure in place and providing routine maintenance could allow the wetland to continue to either develop or it could decline and disappear. The No Action Alternative could have an adverse effect on the potential wetland area if sediment were removed periodically on an "as needed" basis should the small wetland area survive. No change to the floodplain would be expected from the No Action Alternative.

5.3 Road Reinforcements

Reinforcements were made to the areas just below SR 501, below the headlands, and above Pajarito, Two-Mile, Los Alamos (above SR 501), and Water canyons (Figure 5).

5.3.1 Floodplains

All reinforcements are associated with canyons that have associated floodplains (Figure 5).

5.3.2 Wetlands

Pajarito, Water, and Los Alamos canyons have wetlands. Section 5.1.2 describes wetlands in Pajarito Canyon. Section 5.2.2 describes wetlands in Los Alamos Canyon.

5.3.3 Potential Effects of the Proposed Action and Alternatives

Road reinforcements would be left in place as part of the Proposed Action. Routine inspection and maintenance activities would continue to be conducted when required. Effects to the floodplain would be the same as for the No Action Alternative, namely, no effects would result except from maintenance activities. Maintenance activities could potentially result in a minor temporary increase in localized erosion. BMPs would be used to minimize soil erosion into the floodplains.

The articulated concrete mattresses and shotcrete would be removed from the road under the Disassembly Alternative. The road banks would be re-graded. Demolition debris would be removed from the site and disposed of appropriately. This would leave these roads without any reinforcements because the work performed as part of the Cerro Grande Fire rehabilitation replaced reinforcements that already existed. Total removal of these structures would cause a slight increase in erosion potential because the roads would be left without any reinforcements; rehabilitation work performed after the Cerro Grande Fire replaced the original reinforcements on these roads and enhanced them. BMPs would be in place to minimize or prevent any adverse short-term effects. Reseeding of the area would also help minimize or prevent long-term adverse effects.

Under the No Action Alternative, road reinforcements would be left in place. Routine inspections and maintenance would be continued as described for the Proposed Action. With maintenance, these structures would continue to provide reinforcement along the road. Maintenance would not likely have adverse effects to the floodplain or wetlands below the structures.

5.4 Steel Diversion Wall

A 228-m-long (760-ft-long) steel diversion wall was constructed upstream of TA-18 facilities within Pajarito Canyon (Figure 6). The wall was installed quickly as an interim measure to protect TA-18 capabilities until the FRS could be built. The purpose of the wall was to divert storm water and debris to the south of Critical Assembly Storage Area I (CASA I) at TA-18. Steel panels attached to large metal beams were installed to form the wall.

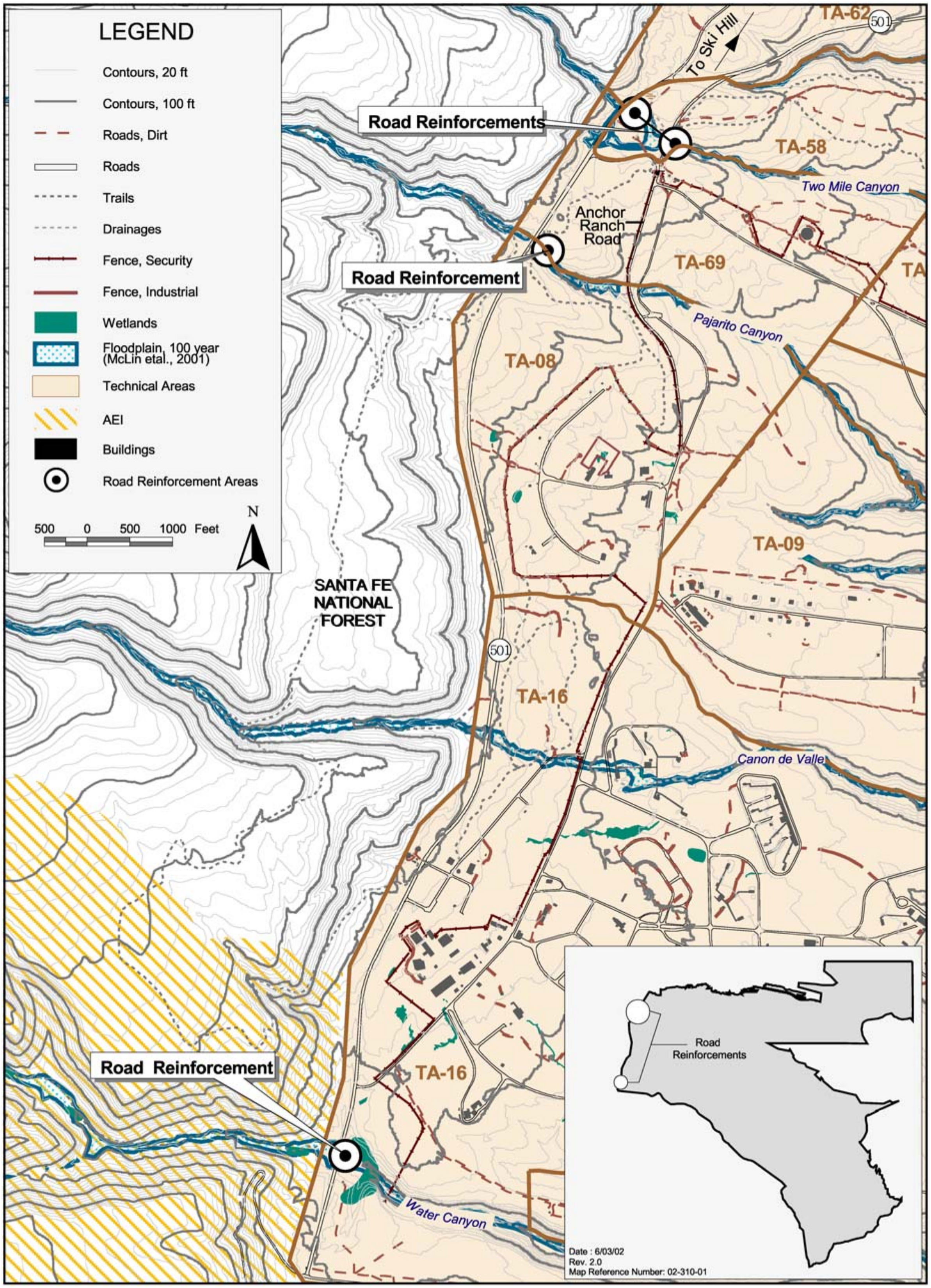

Figure 5. Location of road reinforcements in Two-Mile, Pajarito, and Water canyons.

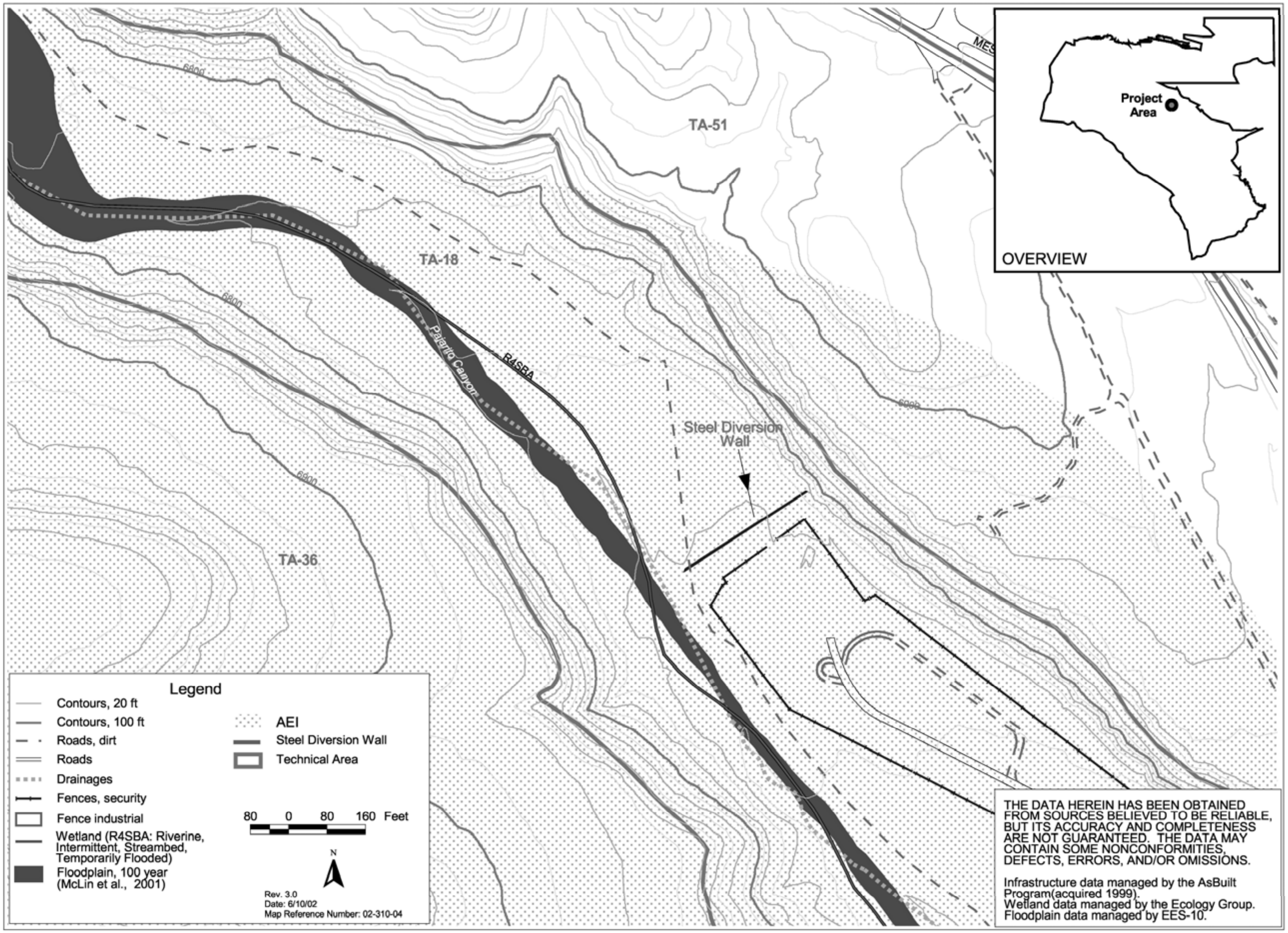

Figure 6. Location of steel diversion wall in Pajarito Canyon above TA-18.

5.4.1 Floodplains

Pajarito Canyon floodplain is described in Section 5.1.2. The steel diversion wall is located just outside the floodplain (Figure 6).

5.4.2 Wetlands

There are extensive wetlands downstream from this structure (935 m [3,068 ft] from the steel diversion wall to the wetlands at Pajarito Canyon). Pajarito Canyon wetlands are described in Section 5.1.2.

5.4.3 Potential Effects of the Proposed Action and Alternatives

Under the Proposed Action and the Disassembly Alternative, for either option for the TA-18 facilities, the steel diversion wall above TA-18's CASA I would be removed. The pilings would be removed down to ground level with a cutting torch or similar tool. The 19 m^3 (25 yd^3) of panels and beams generated by the demolition would be removed and shipped offsite for recycling. Removal of the steel diversion wall would disturb vegetation in the floodplain. BMPs would be used during demolition. Reseeding of the area would occur after site work was completed.

Under the No Action Alternative, the steel diversion wall would be left in place with continued inspections and maintenance when required. Leaving this structure in place would not affect the floodplains or wetlands. Routine maintenance would have no adverse effect on either floodplains or wetlands.

6.0 Mitigation for the Proposed Projects

Mitigation measures are set forth to protect floodplain and wetland values as stated in the Executive Orders. In addition to those values stated above, maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species and habitat diversity, stability, hydrologic utility, wildlife, timber, food and fiber sources, and recreational, scientific and cultural issues can be mitigated with the following recommendations.

At a minimum, BMPs for runoff control, such as silt barriers and stormwater retention ponds, would be in place to mitigate runoff effects during removal of the proposed structures. These BMPs would incorporate considerations of the NPDES permit program and Environmental Protection Agency requirements for a SWPP Plan.

In all cases, BMPs would be followed according to DOE/SEA-03, the corresponding environmental assessment for this project (DOE 2002), and any and all DOE and LANL BMPs for wetlands and floodplains. All sites should be monitored and improvements installed as needed. There may be some additional useful mitigation measures that are discussed below.

All work conducted for the proposed project that involves the disturbance of soils through road building, the continuous use of roads, off-road vehicle use, and dragging of debris potentially contributes to an increase in sediment movement during a 100-year storm event (which is still possible even after things return to "normal flows"). This, in turn, can possibly increase the amount of contaminants being removed to downstream areas, particularly if soils are disturbed in canyons. Careful planning of road placement and use can minimize overall damage to the floodplain and any stream channels (Colorado State Forest Service 1998). If fill areas are established within canyons, all effort to remain off the floodplain and out of water courses should be practiced. Additionally, care should be taken to maintain trees and shrubs growing at the base of fill slopes.

Mitigation actions associated with activities in floodplains will, in part, depend upon BMPs already in place for potential release sites (PRSs), erosion control, and post-project mitigations found in the DOE/SEA-03 Mitigation Plan (DOE 2000b). In general, no debris would be left in the floodplains as defined by McLin et al. 2001. This includes all downed trees, prunings, and chipped material, as well as any cement or structural debris. If a tree is felled, care would be taken to keep it from landing in a water course. Leaving debris of any kind in a drainage, stream channel, or water course, even if it only runs seasonally, may invoke a penalty under Sections 401 and/or 404 of the Clean Water Act. Enough vegetation should remain along channel edges to stabilize the banks. BMPs suggestions from the Colorado Forest Stewardship Guidelines (Colorado State Forest Service 1998) include maintaining streamside management zones that are 15.24-m (50-ft) buffers on all sides of a perennial streambed, spring, seep, wetland, or any riparian-like area, including seasonal water channels where no disturbance would occur. This enhances stability of any potential water course.

BMPs would be employed when working in canyon bottoms as a planned part of the projects since these areas are considered potentially contaminated until proven otherwise through extensive further contaminant testing. Minimizing soil disturbance and contaminant movement is desired. Following the already prescribed method of using established roads only in canyon bottoms will help with this issue.

In addition, work conducted during rainy season within a canyon bottom may be restricted for safety issues even if pre-fire conditions return. This will be determined by Emergency Management Services for LANL. Reseeding and revegetating all disturbed surfaces should be completed once all proposed projects are completed. And finally, machine maintenance in the forest can result in water contamination. An effort should be made to prevent waste oil, gas, or antifreeze to drain onto the soil anywhere within the project area, but particularly within a floodplain (Colorado State Forest Service 1998).

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