DOE/SEA-03

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

September 2000
U.S. Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico

COVER SHEET

Responsible Agency:

U.S. Department of Energy (DOE), National Nuclear Security Administration

Title:

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

Contacts:

For further information on this Special Environmental Analysis (SEA) or to provide comments contact:
Ms. Elizabeth Withers
SEA Document Manager
Los Alamos Area Office,
U.S. Department of Energy
Los Alamos, New Mexico 87544
Call (505) 667-8690
Fax (505) 665-4872

For further information on the U.S. Department of Energy NEPA Process:
Leave message at 1-800-472-2756 or contact:
Ms. Carol Borgstrom
Director
Office of NEPA Policy and Compliance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-4600

Abstract:

The U.S. Department of Energy (DOE), National Nuclear Security Administration, is issuing this special environmental analysis (SEA) to document its assessment of impacts associated with emergency activities conducted at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico, in response to major disaster conditions caused by the recent wildfire known as the Cerro Grande Fire. This wildfire burned about 7,650 acres (ac) (3,061 hectares [ha]) within the boundaries of LANL and about an additional 35,500 ac (14,200 ha) in neighboring areas. As a result of this wildfire event, DOE identified the need to take actions on an emergency basis to protect human life and property. DOE considered that its actions should not just be protective of the lives of its employees, contractors, and subcontractors, but also the lives of all people living and working in the LANL region. DOE also considered that its actions should not just protect property belonging to the U.S. Government, but also the properties of neighboring and downstream landowners and residents. DOE would normally prepare an environmental impact statement (EIS) in compliance with the *National Environmental Policy Act of 1969* (NEPA), as amended, to analyze potentially significant beneficial or adverse impacts that could occur if a proposed action(s) was implemented. However, because of the urgent nature of the actions required of DOE 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, DOE had to act immediately. DOE was, therefore, unable to comply with NEPA in the usual manner. DOE thereby invoked the Council on Environmental Quality's (CEQ's) emergency circumstances clause of its NEPA Implementing Regulations (40 CFR Part 1506.11) and the emergency circumstances clause of DOE's own NEPA implementing regulations (10 CFR Part 1021.343). This SEA provides the reader with an assessment of the impacts that have resulted because of actions undertaken by DOE (or undertaken on the behalf of DOE by other parties at DOE's direction or with DOE funding) to address a major disaster emergency situation. The SEA includes descriptions of the actions, the resulting impacts from the actions, mitigation measures taken for these actions that render their impacts not significant or that lessen the adverse effect of the actions, and an analysis of cumulative impacts. Unlike an EIS produced in the course of routine NEPA compliance, this SEA does not include an impact assessment of alternative actions that DOE could have taken to meet its purpose and need for action. Nor does it include an assessment of the No-Action Alternative. Furthermore, DOE will not issue a formal record of decision based on this SEA analysis. Actions not included in this SEA analysis will be the subject of other NEPA reviews and analyses.

SUMMARY

The U.S. Department of Energy (DOE), National Nuclear Security Administration, is issuing this special environmental analysis (SEA) to document its assessment of impacts associated with emergency activities conducted at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico, in response to major disaster conditions caused by the recent wildfire known as the Cerro Grande Fire. This wildfire burned about 7,650[1] acres (ac) (3,061 hectares [ha]) within the boundaries of LANL and about an additional 35,500 ac (14,200 ha) in neighboring areas. DOE's emergency response to the threat of this fire began with certain preventative actions undertaken immediately before the wildfire entered LANL boundaries in early May 2000. DOE's subsequent actions include those taken to suppress the fire while it burned within LANL boundaries, as well as post-fire activities taken to address the extreme potential for erosion and flood damage at LANL and properties downstream from the facility.

As a result of this wildfire event, DOE identified the need to take actions on an emergency basis to protect human life and property. DOE considered that its actions should not just be protective of the lives of its employees, contractors, and subcontractors, but also the lives of all people living and working in the LANL region. DOE also considered that its actions should not just protect property belonging to the U.S. Government, but also the properties of neighboring and downstream landowners and residents. These end goals were approached through direct fire suppression and fire control actions; through the subsequent restoration of LANL facilities and structures to accommodate the resumption of human occupancy; and through a wide variety of actions undertaken to reduce the potential for significant storm water flood damage, including revegetation efforts and the development of constructed storm water control features. This SEA discusses all of these actions in detail in later sections.

DOE would normally prepare an environmental impact statement (EIS) in compliance with the *National Environmental Policy Act of 1969* (NEPA), as amended, to analyze potentially significant beneficial or adverse impacts that could occur if a proposed action(s) was implemented. However, because of the urgent nature of the actions required of DOE 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, DOE had to act immediately. DOE was, therefore, unable to comply with NEPA in the usual manner. DOE invoked the Council on Environmental Quality's emergencies provision of its NEPA Implementing Regulations (40 CFR Part 1506.11) and the emergency circumstances provision of DOE's own NEPA implementing regulations (10 CFR Part 1021.343(a)).

The time frame encompassed by this SEA is from the initiation of fire control measures in the first week of May 2000 until the end of November 2000. The reason for the

[1] This number of acres is an estimate based on data derived from the Burned Area Emergency Rehabilitation (BAER) Team Report (BAER 2000). It does not include DOE-administered lands in Rendija Canyon since these are not part of LANL. Any differences in acres affected among the BAER Report, other published sources, and this document are the result of data entry variations or rounding differences and are not intended to indicate significant differences.

extended time frame is that rain typically falls in Los Alamos County from about June through October, with over half of the annual rainfall amounts usually occurring during the months of July and August. Depending upon actual weather conditions, the completion of some of the activities planned for wetland and floodplain locations might be delayed until the rainy season has abated and site conditions allow the work to proceed to completion. Additionally, after review of actual rain conditions, some additional work may be required to prepare the LANL facility for subsequent seasonal precipitation.

Decisions to undertake actions have already been made by DOE through a working team known as the LANL Emergency Rehabilitation Team (ERT). The ERT consists of teams from both the University of California (UC) (as the management and operations contractor for LANL) and the U.S. Army Corps of Engineers (USACE), working jointly in support of DOE. USACE worked under an Interagency Agreement with DOE to construct engineer-designed storm water control structures in the field (DEAI04-00AL79799). The ERT evaluated and estimated the impacts from the Cerro Grande Fire; identified and designed appropriate mitigation measures for fire, increased erosion, storm water runoff, and potential flood conditions; and implemented these measures to prevent further damage to people, property, and the environment.

Unlike an EIS produced in the course of routine NEPA compliance, this SEA does not include an impact assessment of alternative actions that DOE could have taken to meet its purpose and need for action. Nor does it include an assessment of the No-Action Alternative. Furthermore, DOE will not issue a formal record of decision (ROD) based on this SEA analysis. Actions not included in this SEA analysis will be the subject of other NEPA reviews and analyses. Specifically, certain actions (such as replacement of experimental equipment and construction of a new emergency operations center building) are expected to be proposed soon that may in some way relate to the Cerro Grande Fire event, but which are not necessary for the immediate protection of human life or property. DOE has adequate time in which to undertake the routine NEPA compliance process for these proposals.

This SEA does not include an analysis of the impacts that resulted from the Cerro Grande Fire itself. Fire impacts at LANL are to be documented in other reports. This SEA also does not address the potential impacts that could result from erosion and floods at LANL should these occur beyond the design function of the engineered structures installed at LANL and analyzed herein. In the event of such a flood(s), DOE will undertake action and compliance with NEPA and other applicable environmental laws as appropriate. Documentation necessary will be prepared as needed at the time of that event.

This SEA provides the reader with an assessment of the impacts that have resulted because of actions undertaken by DOE (or undertaken on the behalf of DOE by other parties at DOE's direction or with DOE funding) to address a major disaster emergency situation. The SEA includes descriptions of the actions, the resulting impacts from the actions, mitigation measures taken for these actions that render their impacts not significant or that lessen the adverse effect of the actions, and an analysis of cumulative impacts.

Fire suppression and control actions included actions taken within LANL boundaries and within a DOE-administered tract located in Rendija Canyon. Actions were undertaken by firefighters specializing in both facility and wildland fires. These firefighters were from various local and regional areas and represented a wide variety of city, county, state, federal, and pueblo government organizations as well as small communities and other neighborhood organizations. Most of these actions occurred over large areas at LANL. Soil-disturbing activities are discussed later by watershed. Activities undertaken during the fire suppression period involved numerous LANL-wide locations. At the peak of the firefighting efforts, a total of about 1,600 firefighters and 100 pieces of firefighting equipment were present in the LANL vicinity performing fire suppression activities.

Firefighters felled trees to remove the fire's fuel sources near buildings, structures (including aboveground utility lines such as electric lines and pole structures and gas mains), access roadways, and other locations where fuel removal was deemed necessary to facilitate the firefighting goals of life and property protection. To control the advance of the fire front, firefighters constructed numerous, narrow fuel breaks to remove fuel sources. The firefighters ignited several back fires once fuel breaks had been established if site conditions were favorable. Helicopters with underslung drop buckets flew close to the tree top level at LANL and neighboring areas and dropped water on the fire. Airplanes also dropped fire-retardant slurry on the forest in advance of the fire front. Fire retardants in the form of foams were applied by handheld applicators and by truck-mounted applicators to buildings and structures, especially within the LANL technical areas (TAs) located along Pajarito Road and adjacent roads.

Post-fire actions included actions taken to allow safe reoccupancy of LANL facilities; monitoring and assessment; establishment of staging areas; removal and stabilization of contaminants and other hazardous wastes and materials; erosion control; and storm water control. Most of these actions occurred over large areas at LANL. The larger storm water control projects and contaminant removal projects are discussed by watershed.

Additionally, for all post-fire actions that required soil-disturbing activities, the individual sites were subsequently recontoured and reseeded with appropriate site-specific seed mixes. Temporary soil erosion control measures, such as silt fences, were installed to protect the sites from storm water runon and runoff until seedlings have become established according to a Storm Water Pollution Prevention Plan that was developed for LANL actions and implemented. Activities employed a variety of standard practices such as spraying water, including use of water spray trucks, to suppress fugitive dust where necessary; restricting vehicles to established roads; restricting vehicle fueling practices to appropriately established sites away from arroyos or any drainage; removing the smallest amount of vegetation possible; limiting activities within wetlands to the extent possible; and prohibiting activities within flagged perimeters of archeological sites.

Many structures, such as transportainers, trailers, sheds, storage buildings, cooling towers, pump houses, and military shelters, were damaged or destroyed by the fire as it moved over LANL. A total of 40 structures were damaged beyond reasonable repair or destroyed outright. Structures were removed using conventional heavy equipment, such

as front-end loaders, which resulted in some soil disturbance. Debris was sampled for substances regulated under the *Resource Conservation and Recovery Act* and the *Toxic Substances Control Act*, radioactive material, and New Mexico Environment Department special waste constituents before their removal and disposal at permitted disposal sites. Recyclable nonradioactive and nonhazardous materials were segregated from waste materials as much as practicable.

Hazard trees[2] along LANL roads and those next to buildings, structures, parking areas, and walkways were cut and removed from the site. Tree cutting activities resulted in minor surface soil disturbance, primarily at the site of each tree during the tree removal process.

Air, surface water, groundwater, soil, and produce monitoring continued as part of the post-fire actions. Approximately 30 damaged air and surface water monitoring stations were repaired or replaced. Concrete bumpers and other protective barriers have been installed around groundwater monitoring wells and other monitoring devices, as necessary, to provide protection to these structures from potential floods and damage by floating debris. New rain and stream flow gauges were installed or relocated (less than 10) as needed to monitor for flood conditions. In addition, many canyons (Los Alamos, Pueblo, Pajarito, Water, Cañada del Buey, Sandia, Potrillo, and Mortandad) were investigated to determine the movement or transport of contaminants through alluvial groundwater, surface water, ash flow, and sediments.

Burned area vegetative rehabilitation for erosion control across LANL included contour raking, seeding by hand and by air, mulching, and hydromulching. Moderately and severely burned areas were contour raked to break up the soil surface and to redirect and reduce water flow. The ground disturbance from raking was limited to the first few inches of the soil's surface. After raking, the areas were seeded by hand, by mechanical spreaders, or by small, low-flying aircraft. After seeding, straw mulch was spread by hand or by mechanical straw blowers.

The installation or replacement of similar storm water control measures, known as best management practices (BMPs), was required to protect 91 potential contaminant release sites (PRSs) that had been burned. Seventy-seven PRSs outside the burned area were also evaluated for potential accelerated actions. Culvert and drainage area clean-out activities were performed at all of the low-lying areas at LANL where storm water runoff was expected and where any inadvertent ponding of storm water might be expected from debris damming. Various flood damage control measures were installed to provide protection to electric power pole structures and other utility structures (such as electric substations, gas lines, water lines, wells and chlorination stations, sewage lift stations, and telephone and communication structures).

USACE undertook seven post-fire construction actions (summarized in Table S.1) according to stringent DOE and USACE design and construction requirements. Various

[2] Hazard trees are those that have been damaged and are a physical hazard to personnel or property.

material, work practices, and regulatory compliance standards were applied to the construction actions as well.

TABLE S.1—*U.S. Army Corps of Engineers Fire Rehabilitation Actions*

Title	Task Description	Area Impacted (ac/ha)
Weir and Sediment Trap in Los Alamos Canyon	Construct a rock gabion low-head weir structure in Los Alamos Canyon above the State Road (SR) 4 intersection with SR 502. The weir will be 10 feet (ft) (3 meters [m]) above grade and located on the downstream side of an excavated short-term detention basin to prevent sediments from migrating off LANL property. Excavated soil will be piled and sloped on the western side of the detention basin.	1.1/0.45 0.62/0.25 0.72/0.29
Reinforce Los Alamos Reservoir	Reinforce the existing embankment at the Los Alamos Reservoir by installing an articulated concrete mattress (ACM) over the upstream face top and the downstream embankment of the dam. Build a 300-ft (90-m) long access road downstream of the reservoir.	1.0/0.40 0.07/0.03
Pajarito Canyon Flood Retention Structure	Design and construct a concrete structure in Pajarito Canyon, approximately 2.0 miles (mi) (3.2 kilometers [km]) upstream of TA-18, to retain water and prevent potential downstream flooding at TA-18 and in White Rock. The flood retention structure design specifies the structure to be approximately 70 ft (21 m) above grade and 390 ft (117 m) across the width of Pajarito Canyon. The bottom of the structure will have a 42-inch (in.) (105-centimeter [cm]), non-gated drainage conduit. Normal rainfall amounts will flow through. Accumulations of water shall be retained for no longer than 96 hours and will drain naturally into existing streambeds.	9.2/3.7 2.1/.84 1.38/.55
Reinforce SR 501 Crossing at Pajarito Canyon	Grade and shape the downstream slope of SR 501 and place 6-in. (15-cm) thick shotcrete mattress for a distance of approximately 200 ft (60 m).	<0.5/<0.2
Reinforce SR 501 Crossing at Two Mile Canyon	Grade and shape the downstream slope of SR 501 and place 6-in. (15-cm) thick shotcrete mattress for a distance of approximately 200 ft (60 m). Place reinforcement matting for a distance of approximately 260 ft (78 m) adjacent to the shotcrete mattress.	<0.5/<0.2
Reinforce Anchor Ranch Road Crossing at Two Mile Canyon	Reinforce both the upstream and downstream slopes of Two Mile Canyon at the Anchor Ranch Road land bridge. Construct an emergency spillway to the south of the embankment. Modify the downstream slope to approximately a two-to-one slope.	<1.0/<0.4
Reinforce SR 501 at Water Canyon	Temporarily place six ACMs on filter fabric in severely washed out areas downstream of the embankment slope. Grade and shape the upstream and downstream slopes of SR 501, relocate previously placed ACM from the downstream slope to the upstream slope, and place shotcrete on the downstream slope for a distance of approximately 256 ft (76.8 m).	<1.0/<0.4

The 1999 LANL Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999) described the existing environment of the Los Alamos area; however, the Cerro Grande Fire altered many of the existing conditions both at LANL and in the surrounding area. These effects are only partially known at this time. The SEA summarizes the environmental baseline at LANL and in the surrounding geographic areas of concern, or the region of influence (ROI) as discussed in the 1999 LANL SWEIS, changes that are expected under the Expanded Operations Alternative selected in the SWEIS ROD, and changes as a result of the fire to the extent that they are now known or estimated. The

boundaries of the ROI depend on the resource under consideration. For hydrology, for example, the ROI includes all the watersheds affected by the fire and the Rio Grande to the point where it enters Cochiti Reservoir. The ROI for environmental restoration, in contrast, consists of LANL and the area immediately downstream.

Environmental impacts are described and discussed across the various resource areas that were directly, indirectly, or cumulatively affected by DOE emergency response actions. A sliding-scale approach was employed so that environmental resources are discussed at a level of detail commensurate with the level of impacts. The primary beneficial effects of DOE's suppression activities were that the fire was extinguished, no lives were lost, and property and environmental damage was minimized. The primary beneficial effects of the post-fire activities were to restore LANL to an operating condition quickly, to rehabilitate the burned areas at LANL, and to reduce the risk of damage and protect downstream environment, operations, property, and lives and well-being of workers and residents.

The methodologies used to determine impacts in this SEA differ from typical NEPA documents because of the emergency nature of the actions actually undertaken by or on behalf of DOE. For the most part, impacts are based on events or activities that have already occurred rather than on planned or proposed actions. For example, the acreage affected by constructing the flood retention structure in Pajarito Canyon (10 ac [4 ha]) is not an estimate but the actual area disturbed. Therefore, impacts to certain resources such as the Pajarito Canyon floodplain, have already occurred and are simply reported as fact in their appropriate sections. However, the potential impact of this disturbance on other media, such as biological resources, is estimated based upon many variables in addition to habitat disturbance.

In this SEA, impacts are addressed as occurring from activities either during the fire suppression or the post-fire time period. Short-term impacts are defined as those occurring within the next five years; long-term impacts are those occurring beyond this five-year period. Furthermore, impacts are addressed as either occurring across the entire facility or within defined watersheds at LANL. The major contributors to impacts during the fire suppression were fire road or firebreak construction and tree cutting. The major contributor to impacts during the post-fire period was the construction or modification of various flood control structures, contaminated sediment removal, and demolition actions taken in certain canyon areas at or near LANL. In general, DOE actions had localized or limited individual adverse impacts and were designed to protect life and property from the effects of the fire and subsequent soil erosion and surface water runoff caused by seasonally heavy rainfalls. In this respect, the actions had a significant beneficial cumulative impact at LANL and within the ROIs for most resources.

The actions covered in this SEA encompass a wide range of activities. The individual projects had some adverse effects, such as loss of habitat for wildlife, primarily resulting from soil and vegetation removal. The beneficial impacts however, include protection of cultural resources, substantial areas of floodplains and wetlands, and government, tribal, and private property. Table S.2 summarizes the effects of the fire suppression and post-fire activities.

TABLE S.2—*Summary of Impacts*

Resources	Fire Suppression	Post-Fire
Land Use	No long-term changes in land use as a result of this effort. Short-term reduction in trees within LANL buffer areas. Temporary expansion of TA-49 Cache Facility for firefighters and support crews.	No long-term changes as a result of this effort. Additional removal of trees by LANL. Certain recreation trails within LANL remain closed until cleanup and flood mitigation areas are complete and vegetation is reestablished.
Geology/Soils	None of the fire suppression activities included actions that could significantly affect the local geology. Activities included construction, firebreaks, access roads, and staging areas, backfires and slurry drops that exposed mineral soil and increased the likelihood of soil erosion.	None of the post-fire activities included actions that could significantly affect the local geology of these activities, only the soil stabilization treatments are intensive or extensive enough to significantly cause soil erosion. However, the expected result of the watershed treatments is to stabilize soils and reduce surface runoff.
Water Resources	No major effects on water or surface water quality is anticipated as a result of fire suppression activities. The fire-retardant slurry used was an ammonium polyphosphate solution. Ammonium and sodium ferrocyanide can be toxic to aquatic organisms if applied to surface waters. Perennial surface water areas of Los Alamos did not burn and are not known to have received slurry drops.	No significant adverse effects to the quality or quantity of surface water or perched groundwater or springs are anticipated from post-fire actions. These actions are designed to control water flow and hold back sediment and debris. Flood retention structures that temporarily retain and then slowly release water could lead to increased short-term groundwater recharge in some locations.
Floodplains and Wetlands	Fire suppression activities had a small adverse effect on floodplains where ground-disturbing activity occurred. No fire roads or firebreaks were in wetlands, so no wetlands were affected by fire suppression activities.	The construction of seven major and numerous minor storm water control projects resulted in approximately 20 ac (8 ha) of floodplains being directly disturbed or permanently altered. These controls will protect downstream floodplains and wetlands from erosion.
Biological Resources	The fire suppression activities resulted in transient and long-term effects to biological resources. The clearing of about 130 ac (52 ha) temporarily displaced local wildlife. Use of the affected area by some bird species may be expected to decline on a local basis while other species would remain unchanged.	Post-fire activities produced an array of biological effects. In general, protection of potential threatened and endangered (T&E) species habitat from flood damage will be beneficial for T&E species and other species. However, destruction of Mexican spotted owl core nesting and roosting habitats will have a minimal long-term adverse effect.
Climatology, Meteorology, and Air Quality	The use of equipment for fire suppression activities produced criteria air pollution emissions. Because of the closure of LANL and the townsite, these emissions were roughly 20 percent to 80 percent of typical LANL vehicle traffic for a two-week period—which is a negligible adverse effect.	The adverse effects on air quality from construction activities and contaminant disturbance and removal were of short duration. Doses to the nearest offsite receptor from airborne radioactive emissions associated with work in the PRSs were estimated not to exceed 0.1 millirem.
Visual Resources	The principal effect on visual resources from fire suppression activities was the cutting of firebreaks and fire roads. This is a temporary adverse effect to visual resources at LANL.	The various construction activities had minor adverse effects on visual resources. There was short-term increased suspended particulate matter, new structures in previous minimally disturbed areas, and deposition of black sediment where runoff accumulates behind storm water control structures.

TABLE S.2—*Continued*

Resources	Fire Suppression	Post-Fire
Cultural Resources	The leveling of a staging area in TA-49 destroyed one and damaged two other cultural resource sites. Although this is considered an adverse effect, these three sites constitute less than one percent of the total LANL archaeological sites.	Post-fire activities resulted in adverse impacts to two significant historic structures at TA-02. Although UC cultural resource specialists documented the buildings before they were dismantled, the removal of the buildings is considered an adverse impact. Post-fire activities also created a beneficial impact by reducing the likelihood that other cultural properties would be adversely affected by erosion.
Utilities and Infrastructure	The fire suppression activities had a temporary beneficial effect on water, gas, and electric utilities at LANL by minimizing damage from the fire. About 30 mi (48.3 km) of new or upgraded access roads were bladed, although most of the these were of temporary nature so effects were also temporary.	Beneficial impacts occurred from the installation of flood control and flood retention structures. Major benefits include improved access, maintenance, and protection from damage to both utilities and infrastructure at LANL.
Socioeconomics	No substantial changes to either the local or regional populations or economics are expected as a result of fire suppression activities.	No substantial changes to either the local or regional populations or economics are expected as a result of post-fire mitigation activities.
Noise	Actions authorized by DOE during the fire suppression period had a minimal effect on the types of noise and the typical noise levels found at or in the vicinity of LANL. These activities were temporary and during the period when LANL and the townsite were evacuated.	The types of noise from post-fire response actions were typical of on-going construction activities and maintenance operations routinely performed at LANL. Noise levels increased in and around LANL during this period.
Environmental Justice	The fire suppression activities had no disproportionately high and adverse human health on environmental effects on minority and low-income populations.	Post-fire activities will have a positive effect on environmental justice issues as the risk of soil erosion and flood damages are significantly reduced to downstream communities.
Human Health	Fire suppression activities had a minimal to moderate adverse effect on emergency response workers health due to exposure to smoke and fire, firefighting hazards, and exposure to chemicals used. A potentially significant benefit to public health was the prevention of further spread of the fire to additional residential areas.	Effects on worker health that resulted from post-fire activities were less than or similar to those that occurred during the fire suppression period. Workers were not exposed to fire and smoke, but continued to be exposed to other hazards, such as the removal of vegetation, construction activities, helicopter, and vehicle traffic. There was one reported worker injury from a fall associated with managing inventories for aerial seeding operations. The worker is expected to fully recover.
Environmental Restoration and Waste Management	There were no effects (due to no activity) on environmental restoration and risk management from fire suppression activities.	BMPs for 91 PRSs affected by the fire were completed. As of July 21, 2000, 47 accelerated actions were either in progress or had been completed. DOE actions taken during this period resulted in the generation of additional low-level radioactive waste sent to TA-54 and nonhazardous solid waste sent to approved landfill sites.

TABLE S.2—*Continued*

Resources	Fire Suppression	Post-Fire
Transportation	Effects on both the regional and internal LANL transportation system as a result of fire suppression were minimal. Some limited-period road closures were necessary during this period to prevent access to LANL and to adjacent communities for safety and security purposes.	Effects on both the regional and internal LANL transportation system were minimal. Some limited-period road closures were necessary during this period to support repair work and replacement of culverts, delivery of construction material, and to allow for movement of hazardous material.

DOE and UC maintain regulatory compliance with environmental laws and regulations as an integrated element of conducting work at LANL. The processes used during the response to the Cerro Grande Fire have continued to ensure compliance and improve the relationships with the regulatory and consulting agencies. Because emergency actions needed to be implemented immediately, DOE and UC initiated emergency permit processes and consultations under appropriate regulations. DOE, UC, and USACE entered into a memorandum of understanding to ensure that all parties maintained environmental compliance during the emergency. Routine compliance processes will continue for non-emergency actions and will be the only compliance processes conducted after actions taken under emergency permits and consultations are completed before or by November 30, 2000.

This Page Intentionally Left Blank

TABLE OF CONTENTS

Tables

Figures

Photos

ACRONYMS AND ABBREVIATIONS

ac	acres
ACHP	Advisory Council on Historic Preservation
AEI	area of environmental interest
ACM	articulated concrete mattress
AOCs	areas of concern
BAER	Burned Area Emergency Rehabilitation
BMP	best management practice
CEQ	Council on Environmental Quality
Ci	curies
cm	centimeters
DARHT	Dual-Axis Radiographic Hydrodynamic Test
DOE	(U.S.) Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ERT	(LANL) Emergency Rehabilitation Team
ft	feet
ft^2	square feet
ft^3	cubic feet
ft^3/s	cubic feet per second
FY	fiscal year
gal.	gallons
ha	hectares
HSWA	Hazardous and Solid Waste Amendments
in.	inches
km	kilometers
l	liters
LAAO	Los Alamos Area Office
LANL	Los Alamos National Laboratory
m	meters
m^2	square meters
m^3	cubic meters
m^3/h	cubic meters per hour
m^3/s	cubic meters per second
MDA	material disposal area
mi	miles
$\mu g/m^3$	micrograms per cubic meter
MOU	memorandum of understanding
mrem	millirem
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PCBs	polychlorinated biphenyls
the Plan	the LANL Emergency Rehabilitation Project Plan
PM-10	particulate matter smaller than 10 microns
PRSs	potential contaminant release sites
RCRA	Resource Conservation and Recovery Act
RLW	radioactive liquid waste
ROD	record of decision
ROI	region of influence
SEA	special environmental analysis
SHPO	State Historic Preservation Office
SR	State Road
SWEIS	site-wide environmental impact statement
SWPP	Storm Water Pollution Prevention (Plan)
t	metric tons
T&E	threatened and endangered (species)
TA	technical area

TCPs	traditional cultural properties	USACE	(U.S. Army) Corps of Engineers
TSSs	total suspended solids	USFWS	U.S. Fish and Wildlife Service
UC	University of California	USLE	universal soil loss equation
U.S.	United States	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)	0.90	meters (m)
miles (mi)	1.60	kilometers (km)
Area		
acres (ac)	0.40	hectares (ha)
square feet (ft^2)	0.09	square meters (m^2)
square yards (yd^2)	0.80	square meters (m^2)
square miles (mi^2)	2.60	square kilometers (km^2)
Volume		
gallons (gal.)	3.80	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)	0.90	metric ton (t)

1.0 PURPOSE AND NEED

1.1 Introduction

The U.S. Department of Energy (DOE), National Nuclear Security Administration, is issuing this special environmental analysis (SEA) to document its assessment of impacts associated with emergency activities conducted at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico (Figure 1.1), in response to major disaster conditions caused by the recent wildfire known as the Cerro Grande Fire. This wildfire burned about 7,650[1] acres (ac) (3,061 hectares [ha]) within the boundaries of LANL and about an additional 35,500 ac (14,200 ha) in neighboring areas (Figure 1.2). DOE's emergency response to the threat of this fire began with certain preventative actions undertaken immediately before the wildfire entered LANL boundaries in early May 2000. DOE's subsequent actions include those taken to suppress the fire while it burned within LANL boundaries, as well as post-fire activities taken to address the extreme potential for erosion and flood damage at LANL and properties downstream from the facility.

1.1.1 Need for Agency Action

A number of significant events occurred that resulted in DOE's need to take action in response to the Cerro Grande Fire (Appendix A). On the evening of May 4, 2000, employees of the Department of the Interior, National Park Service, Bandelier National Monument, ignited a prescribed burn in a forested area within the boundaries of Bandelier National Monument along a mountain slope of the Cerro Grande. This fire was quickly pushed by winds outside the boundaries of the prescription area and was declared by the National Park Service to be a "wildfire" on May 5, 2000. The fire spread rapidly in a generally northeastern/eastern direction across land administered by the Department of Agriculture, Forest Service, Santa Fe National Forest. Starting late on May 7, through May 8 and 9, while winds were somewhat moderate, shrubs and trees were cut and back fires were ignited in an effort to hold the fire line at New Mexico State Road (SR) 501, which is located at the northwestern side of LANL. A very narrow strip of land a few hundred feet wide within that back fire area is administered by DOE as a part of LANL. The wind speed increased dramatically on May 10, 2000, and spread embers over a mile in advance of the wildfire fronts and well beyond the established fire lines, igniting forested areas within the heart of LANL and residential areas within the Los Alamos townsite located nearby. From May 10 until about May 17, the fire burned within LANL and the townsite area (Photo 1.1) before it was stopped and considered contained. In the wake of this fire, about 43,000 ac (17,200 ha) of forest burned along the mountain flanks within, above, and to the north of LANL. Over 200 residential units occupied by over 400 families burned within the Los Alamos townsite (Photo 1.2).

[1] This number of acres is an estimate based on data derived from the Burned Area Emergency Rehabilitation (BAER) Team Report (BAER 2000). It does not include DOE administered lands in Rendija Canyon since these are not part of LANL. Any differences in acres affected among the BAER Report, other published sources, and this document are the result of data entry variations or rounding differences and are not intended to indicate significant differences.

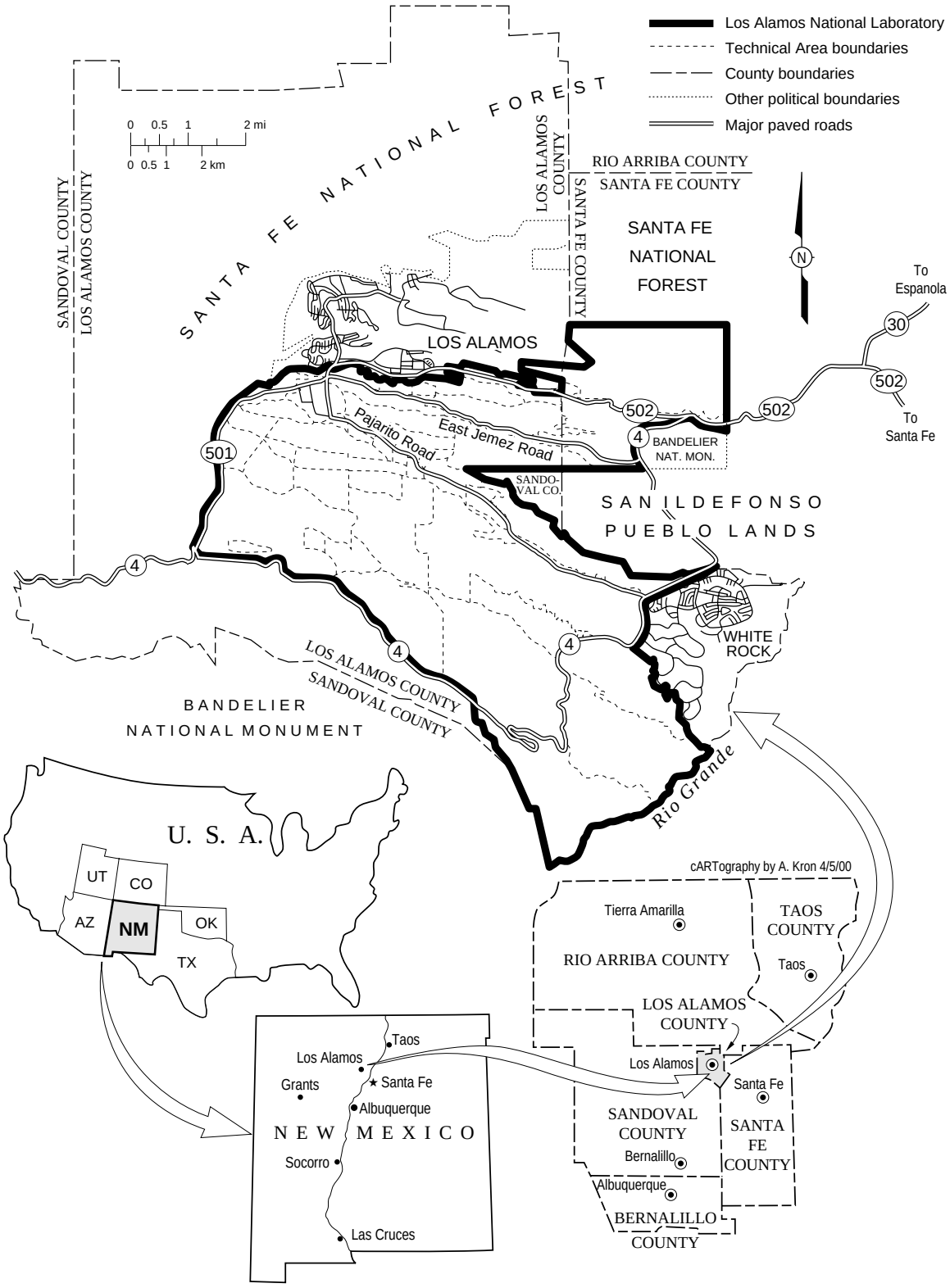

FIGURE 1.1—*Location of Los Alamos National Laboratory*

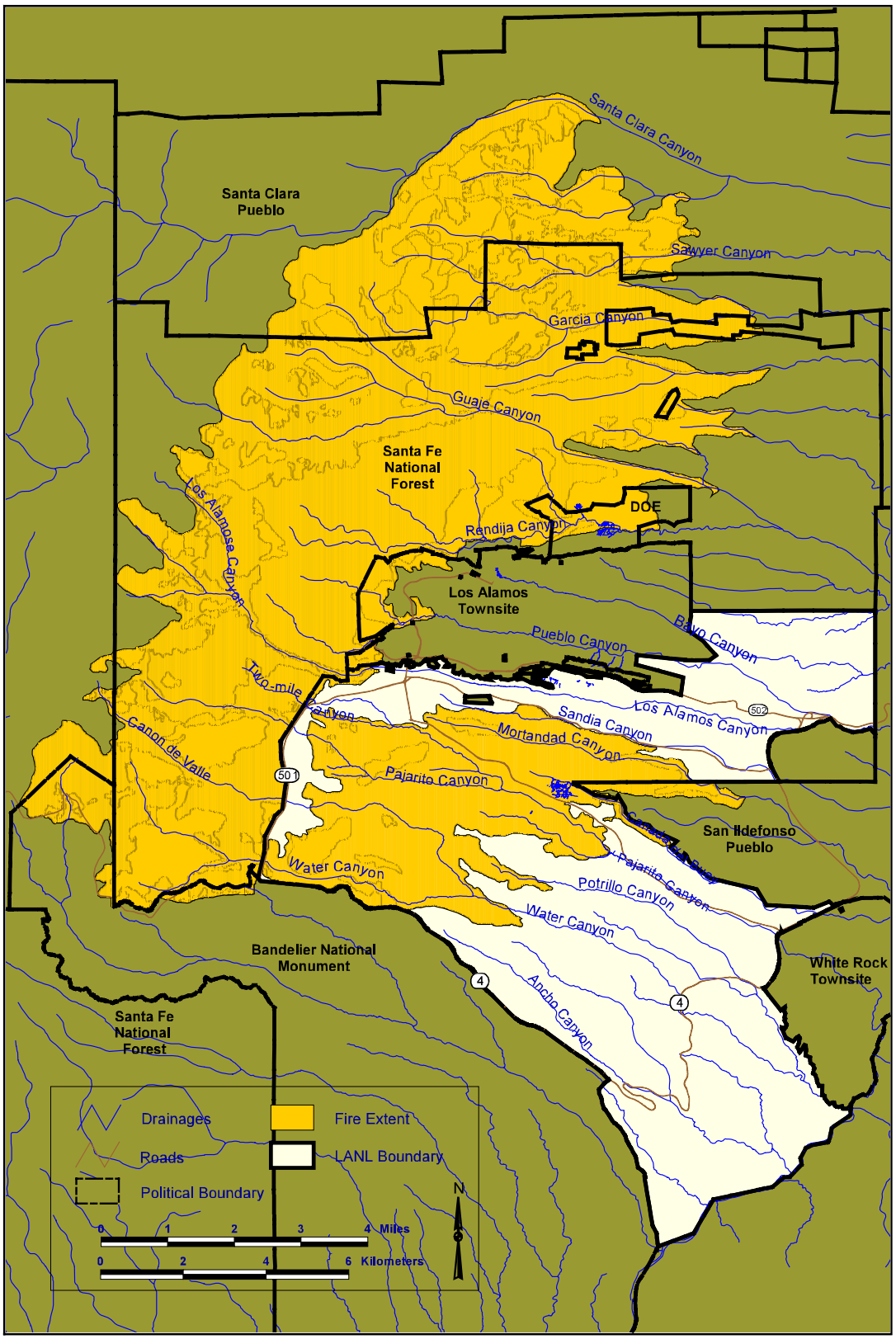

FIGURE 1.2—*Extent of the Cerro Grande Fire*

PHOTO 1.1—*Cerro Grande Fire at LANL May 11, 2000*

PHOTO 1.2—*Cerro Grande Fire Damage to Los Alamos Townsite May 12, 2000*

The Cerro Grande Fire resulted in more property loss than any other wildfire in New Mexico's recorded history. This fire also consumed enough forest acreage to make it the second largest wildfire in New Mexico's recorded history. As a result of this wildfire event, DOE identified the need to take actions on an emergency basis to protect human life and property. DOE considered that its actions should not just be protective of the lives of its employees, contractors, and subcontractors, but also the lives of all people living and working in the LANL region. DOE also considered that its actions should not just protect property belonging to the U.S. Government, but also the properties of neighboring and downstream landowners and residents. These end goals were approached through direct fire suppression and fire control actions; through the subsequent restoration of LANL facilities and structures to accommodate the resumption of human occupancy; and through a wide variety of actions undertaken to reduce the potential for significant storm water flood damage, including revegetation efforts and the development of constructed storm water control features. This SEA discusses all of these actions in detail in later sections.

1.1.2 Regulatory Framework

DOE would normally prepare an environmental impact statement (EIS) in compliance with the *National Environmental Policy Act of 1969* (NEPA), as amended, to analyze potentially significant beneficial or adverse impacts that could occur if a proposed action(s) was implemented. A draft EIS would be issued for stakeholder and public review and comment pursuant to the Council on Environmental Quality's (CEQ's) NEPA Implementing Regulations (40 CFR Parts 1500–1508) and DOE's NEPA implementing regulations (10 CFR Part 1021). After DOE received and incorporated comments, DOE would issue a final EIS, followed no sooner than 30 days later by a record of decision (ROD). This EIS process takes DOE an average of about 30 months to complete.

However, because of the urgent nature of the actions required of DOE 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, DOE had to act immediately. DOE was, therefore, unable to comply with NEPA in the usual manner. DOE thereby invoked the CEQ's emergencies provision of its NEPA Implementing Regulations (40 CFR Part 1506.11) and the emergency circumstances provision of DOE's own NEPA implementing regulations (10 CFR Part 1021.343(a)). Pursuant to those provisions, DOE consulted with the CEQ in May and early June about alternative arrangements with regard to NEPA compliance for its emergency actions. Consistent with agreements reached during those consultations (see Appendix A), DOE has prepared this SEA of known and potential impacts from wildfire suppression, post-fire recovery, and flood control actions as part of the alternative arrangement contemplated by the CEQ regulation. Additionally, on June 21, 2000, DOE published a Federal Register notice (see Appendix A) in which DOE disclosed the actions it had taken and foresaw taking, together with its intention to prepare this SEA and its estimate of potential impacts (as they were understood at the time). DOE also used that Federal Register notice to issue a public notice and statement of findings regarding DOE's intention to take action involving construction and other activities within floodplains and wetlands pursuant to

DOE's regulations for Compliance with Floodplains/Wetlands Environmental Review Requirements (10 CFR Part 1022). DOE did not receive any comments on the notice.

1.1.3 Public Involvement

Public involvement for the alternative arrangements included public and stakeholder meetings, informational announcements and fact sheets, newspaper articles, and web site postings. Three public and stakeholder meetings were held by the Forest Service at which technical specialists discussed fire related issues of concern with the public that included regulatory compliance issues. These meetings were held on June 1, 2, and 7, 2000, at Los Alamos, Santa Clara Pueblo, and San Ildefonso Pueblo. At those times, DOE announced its discussions with the CEQ and its proposal to issue an SEA as part of its alternatives arrangements for NEPA compliance with regards to its fire suppression actions taken and other anticipated connected actions. Public meetings were held by DOE in Los Alamos for the purpose of discussing with and updating the public and stakeholders on actions taken and actions planned at LANL on a weekly basis beginning on June 30 and continuing through August 11, 2000. The first three meetings were broadcast live over a local AM radio station (KRSN) that serves the Los Alamos County area. Similar monthly meetings will be held beginning on September 15, 2000, and continuing through the end of the year or beyond as needed. A Public Advisory Group was also established that focuses specifically on communications issues as they relate to potential runoff and flood mitigation activities. DOE has also provided information about its NEPA compliance process in meetings with the local Pueblo tribal leaders, and in notification letters regarding the SEA preparation sent to the State, pueblos and tribes, and other various identified interested parties. A link to the Federal Register notice is also posted on the DOE NEPA internet website and on the LANL website under "Cerro Grande Fire Info" (the UR is http://www.lanl.gov/labview/).

Upon issuance of the SEA, DOE will distribute the document to stakeholders and members of the public, make the document available at local public DOE reading rooms, and will place the document on the internet websites noted above. An announcement of its availability will be made in local newspapers and will be broadcast by KRSN. Meetings with the governors of the four Accord Pueblos[2] are planned to discuss the SEA and further mitigation measures in late September and early October 2000. The monthly DOE hosted public meetings in September and October will provide the public with information of the SEA's availability and provide an opportunity to comment on mitigation measures proposed and to suggest other additional measures for DOE's consideration.

The SEA encompasses the time from the initiation of fire control measures in the first week of May 2000 until the end of November 2000. The reason for the extended activity time frame is that rain typically falls in Los Alamos County from about June through

[2] Accord refers to the written agreements signed by DOE and the Jemez, Cochiti, Santa Clara, and San Ildefonso Pueblos on December 8, 1992, stating the basic understanding and commitments of the parties and describing the general framework for working together. Subsequently, cooperative agreements between each Pueblo and DOE, and between each Pueblo and the UC have been signed, which specify further details related to the accord agreements.

October, with over half of the annual rainfall amounts usually occurring during the months of July and August. Depending upon actual weather conditions, the completion of some of the activities planned for wetland and floodplain locations might be delayed until the rainy season has abated and site conditions allow the work to proceed to completion. Additionally, after review of actual rain conditions, some additional work may be required to prepare the LANL facility for subsequent seasonal precipitation.

1.2 Cerro Grande Fire Effects and Risks

LANL is a federal facility employing about 12,000 persons in northern New Mexico and comprising about 27,690 ac (11,076 ha) that is administered by DOE. It is located in north-central New Mexico on the Pajarito Plateau in a region characterized by forested areas with mountains, canyons, and valleys, as well as diverse cultures and ecosystems. The Pajarito Plateau is a volcanic shelf on the eastern slope of the Jemez Mountains at an approximate elevation of 7,000 feet (ft) (2,100 meters [m]). This plateau is dissected by 13 steeply sloped and deeply eroded canyons that have formed isolated finger-like mesas oriented in a west to east direction. Land management practices employed by the various land stewards in the vicinity of LANL during the last 50 years have been characterized by severe reductions in cattle grazing and timber cutting in the area, as well as by artificial (institutionalized) fire suppression efforts. The most obvious effects of these practices have been an intense increase in overall tree stand densities, tree continuity, and overall fuel loading within the forested areas, with a corresponding decrease in understory ground cover. The heavily forested areas within and surrounding LANL before the Cerro Grande Fire were generally overgrown with dense stands of unhealthy trees with excessive amounts of standing and fallen dead tree material. Over the past decade, local community leaders and government land stewards have recognized that forest conditions presented an extreme wildfire hazard to LANL, to Los Alamos County residents (nearly 18,000 people), and to other nearby land owners, residents, and communities. Adequate funding and other resources, however, were not available to agencies and individuals to immediately alleviate this hazard.

The Cerro Grande Fire created large areas of burned vegetation, including areas of bare ash along the steep slopes and canyon sides above and within LANL (Photo 1.3). Areas within the fire's perimeter burned with high, moderate, and low severities (Figure 1.3). Burn severity is a relative measure of the degree of change in a watershed that relates to the severity of the effects of the fire on watershed conditions. About 34 percent of the total area burned by the Cerro Grande Fire burned at a high-burn severity (Photo 1.4), and about 8 percent burned at a moderate-burn severity (Photo 1.5). Additionally, about 58 percent burned at a low-burn severity (Photo 1.6) or was skipped over by the flames leaving "islands" of green vegetation within the overall perimeter of the burned area. Most LANL acreage burned with a low-burn severity, with only small areas of high-burn severity and moderate-burn severity. Specifically, about 88 percent of the LANL area that burned did so with low-severity consequences, 11 percent with moderate severity, and less than 1 percent with high-severity results. The vegetation mortality

PHOTO 1.3—*Upper Los Alamos Canyon and Los Alamos Reservoir after the Cerro Grande Fire*

PHOTO 1.4—*Example of High-Severity Burn (Inset: High-Intensity Crown Fire)*

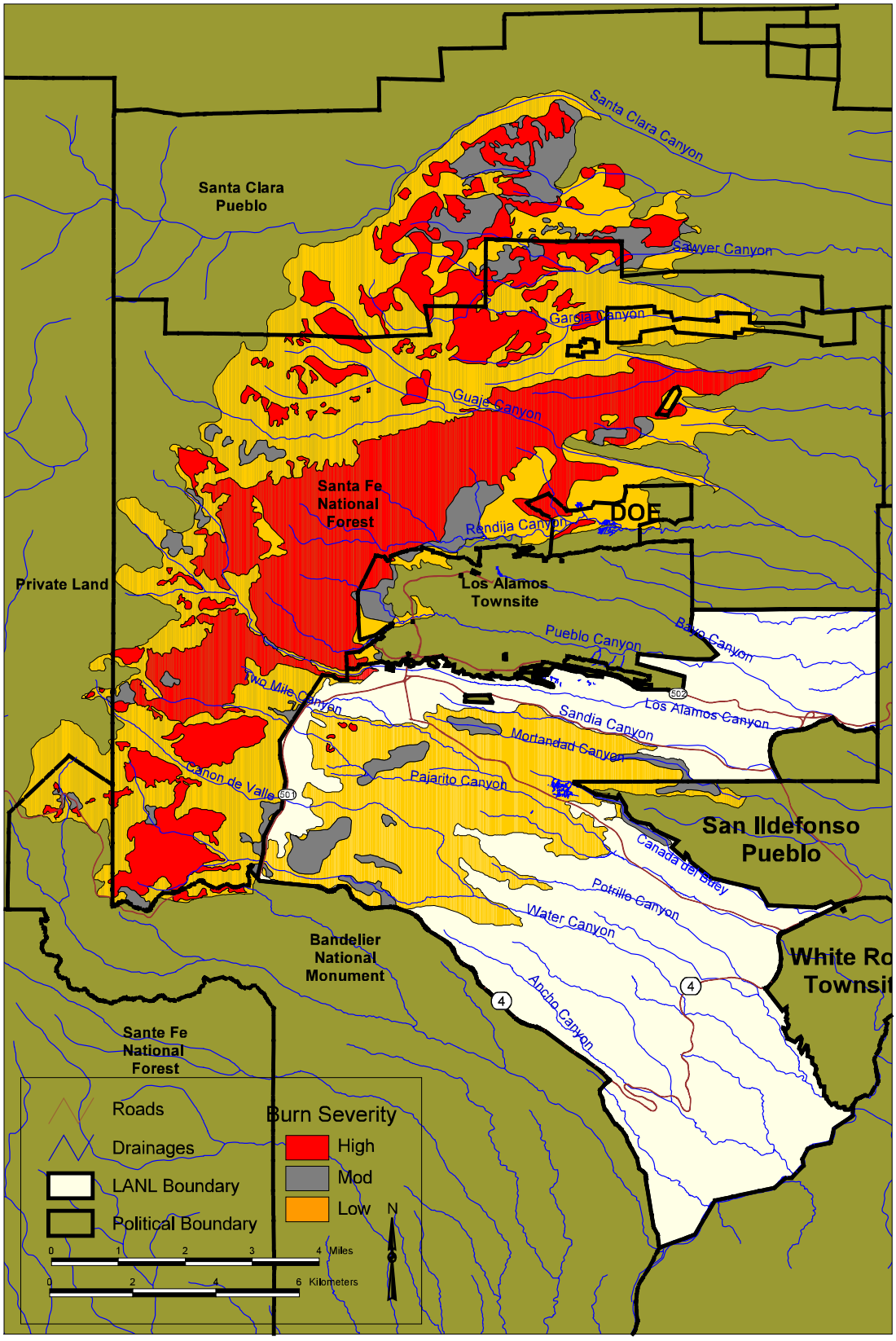

FIGURE 1.3—*Burn Severity Categories within the Region of Influence (ROI)*

PHOTO 1.5—*Example of Moderate-Severity Burn*

PHOTO 1.6—*Example of Low-Severity Burn (Inset: Low-Intensity Fire)*

classifications[3] generally correspond with the levels of burn-severity ratings. Overall, the surface soil properties on sites with high-burn severity were altered. The soil structure broke down and a hydrophobic layer that resists water penetration was established. These characteristics allow for rain-impact surface soil erosion, reduced water infiltration into the soil, and a severe increase in soil erosion and runoff during storm events. Similarly, areas with a moderate-burn severity have potential for additional soil erosion above their pre-burn soil erosion rates. Seed resources are adversely affected by high- and moderate-burn severity fires, which may impede the ability of vegetation to be naturally restored after a fire.

Post-fire conditions present along the hills and ridges at elevations above LANL, as well as within LANL, pose a very high risk for erosion and flood damages at the LANL facility and to nearby residential communities downstream all the way to the Rio Grande. This high risk for flooding also exists for Los Alamos townsite located north of LANL, as well as for Pueblo lands and residences located downstream of the townsite. Seventy-seven potential contaminant release sites (PRSs) and two nuclear facilities at LANL that contain hazardous and radioactively contaminated soils and materials are located within floodplain areas. Without DOE action, these PRSs and nuclear facilities have the potential to release contaminants and materials downstream. Numerous cultural resources sites and traditional cultural properties (TCPs) are located in canyon areas or along drainages. These sites are now at increased risk of flood damage. Each canyon also provides potential habitat for federally-listed threatened and endangered (T&E) species, which could be affected as well. Canyon storm water discharge flow measurements for a six-hour storm event with a once-in-100-year return rate at LANL typically are in the range of about 35 to 590 cubic feet per second (ft^3/s) (1.05 to 17.7 cubic meters per second [m^3/s]); post-fire modeling estimates the canyon discharge flows (before rehabilitation work) to be in the range of 90 to 3,276 ft^3/s (2.7 to 98.3 m^3/s) for the same duration storm events. Some canyons are expected to have even greater flow amounts over some areas because of location-specific site conditions after the fire. While the rehabilitation actions (e.g., raking, seeding, and mulching) undertaken by the Forest Service on the forests above LANL may reduce the severity of floods onto LANL, the actions are only expected to maximally reduce the storm water discharge onto LANL by about 30 percent during the first year after the fire (BAER 2000). The potential for flooding onto and across LANL will exist for the next several years to decades in some locations until enough vegetation is established to cover the hillsides and canyons to act as a sufficient deterrent to the soil erosion and flooding threat.

1.3 Purpose of This Document and Related NEPA Analyses and Other Documents

This SEA provides the reader with an assessment of the impacts that have resulted because of actions undertaken by DOE (or undertaken on the behalf of DOE by other parties at DOE's direction or with DOE funding) to address a major disaster emergency situation. The SEA describes the actions, identifies impacts resulting from the actions,

[3] Vegetation mortality classifications (BAER 2000:371) were developed to quantify impacts to vegetation: Class 1: 0 – 10 percent vegetation mortality, Class 2: 10 – 40 percent vegetation mortality, Class 3: 40 – 70 percent vegetation mortality, Class 4: 70 – 100 percent vegetation mortality.

describes mitigation measures taken that render impacts of these actions not significant or that lessen the adverse effect of the actions, and analyzes cumulative impacts.

Decisions to undertake actions were made by DOE through a working team known as the LANL Emergency Rehabilitation Team (ERT). The ERT consists of DOE and teams from both the University of California (UC) (as the management and operations contractor for LANL) and the U.S. Army Corps of Engineers (USACE), working jointly in support of DOE. USACE worked under an Interagency Agreement (DEAI04-00AL79799) with DOE to construct engineer-designed storm water structures in the field. The ERT evaluated and estimated the impacts from the Cerro Grande Fire; identified and designed appropriate mitigation measures for increased erosion, storm water runoff, and potential flood conditions; and implemented these measures to prevent further damage to people, property, and the environment. The ERT selected a subset of the actions discussed in the June 21, 2000, Federal Register notice (see Appendix A) for implementation. A written plan, the LANL Emergency Rehabilitation Project Plan (the Plan) was first issued on July 7, 2000, (LANL 2000a) and subsequently updated on August 11, 2000.

A range of data points and prediction models were used to assist the ERT in reaching decisions regarding actions to be implemented at LANL. At first, decisions were made largely based on recommendations from the Forest Service's BAER Team (BAER 2000). The BAER Team is a multidisciplinary team experienced in fire recovery planning and in implementation of erosion and flood control measures. As data and information became available or were developed, the ERT used predictive modeling specific to the LANL site in the ERT decision process. Decisions were reached regarding the larger engineered structures after weighing the advantages and disadvantages of several technical and locational alternatives as well as the alternative of not taking any action within specific canyon reaches. These decisions took into account a variety of different factors, including cultural resource locations; T&E species potential habitat conditions; PRSs; information on contaminants within canyon reaches; potential storm water flow rates; canyon contours and land form conditions; potential silt and debris flow accumulations; implementation time and difficulties; engineering uncertainties; water quality estimates downstream from LANL; and other factors, including costs. Actions undertaken through the ERT have been coordinated with the four Accord Pueblos and federal, state, and local stakeholders, including the U.S. Department of the Interior (National Park Service and Bureau of Land Management); U.S. Department of Agriculture (Forest Service); the Environmental Protection Agency (EPA); the Federal Emergency Management Agency; the State of New Mexico (Department of Health, Engineer's Office, and Environment Department [NMED]); and the Incorporated County of Los Alamos, Santa Fe County, and other surrounding counties. In some cases, DOE modified possible actions based upon information or concerns expressed by one or more of these parties. Actions included in the Plan have for the most part already been completed or are underway and will be completed soon.

Unlike an EIS produced in the course of routine NEPA compliance, this SEA does not include an impact assessment of alternative actions that DOE could have taken to meet its purpose and need for action. Nor does it include an assessment of the No-Action

Alternative. Furthermore, DOE will not issue a formal ROD based on this SEA analysis. Actions not included in this SEA will be the subject of other NEPA reviews and analyses. Specifically, certain actions (such as replacement of experimental equipment and construction of a new emergency operations center building) are expected to be proposed soon that may in some way relate to the Cerro Grande Fire event, but which are not necessary for the immediate protection of human life or property. DOE has adequate time in which to undertake the routine NEPA compliance process for these proposals.

This SEA does not include an analysis of the impacts that resulted from the Cerro Grande Fire itself. Fire impacts at LANL are to be documented in other reports. A special edition of the LANL Site-Wide Environmental Impact Statement (SWEIS) Yearbook entitled *Wildfire 2000* (LANL 2000b), was issued recently by UC (LA-UR-00-3471; http//lib-www.lanl.gov/la-pubs/00393627.pdf). This document compares the postulated accident analysis provided in the 1999 LANL SWEIS (DOE 1999) 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. Pursuant to DOE's NEPA implementing regulations (10 CFR Part 1021.330 (d)), DOE will evaluate the 1999 LANL SWEIS in or before 2004, by means of a supplement analysis to determine if the existing EIS remains adequate or whether to prepare a new SWEIS or supplement the existing EIS, as appropriate. The effects of the Cerro Grande Fire will be considered in this five-year evaluation process for the SWEIS. Also, the BAER Team published a rehabilitation plan in June 2000, the *Cerro Grande Fire Burned Area Emergency Rehabilitation Plan* (BAER 2000), which included information on the effects of the fire, the risks of future flooding downstream along the canyons trending across the Cerro Grande Fire burned area, and recommended storm water control measures. The initial fire rehabilitation efforts for all the involved government agencies with lands affected by the Cerro Grande Fire were coordinated by the BAER Team. This rehabilitation plan presents only limited and preliminary information about the fire's specific effects on LANL and about the fire suppression actions taken there. The BAER Team plan also presents limited information on the potential erosion and flooding risks at LANL and the storm water control measures to be implemented. The BAER Team did not focus its efforts on LANL because of its lack of experience with facilities that involve the use or storage of radioactive materials and with facilities that have radioactively contaminated PRSs in the environment. Another report that will include information and analysis of the impacts of the Cerro Grande Fire is the LANL *Environmental Surveillance and Compliance at Los Alamos During 2000.* This annual report will include information about the fire and subsequent environmental changes that result to the various media included by the surveillance and compliance program.

Resource management plans produced by DOE and UC over the next five years will include information about the Cerro Grande Fire. Management plans recently implemented or under development at the time of the Cerro Grande Fire are being revised to include the effects of the Cerro Grande Fire on their respective resources. These include plans required by the DOE's Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility EIS and the SWEIS Mitigation Action Plans (such as the Threatened

and Endangered Species Habitat Management Plan and the Cultural Resources Management Plan).

Other related NEPA compliance documents will discuss aspects of the existing post-fire environment. DOE recently issued a final environmental assessment (EA) and finding of no significant impact on its proposed Wildfire Hazard Reduction and Forest Health Improvement Program for LANL on August 10, 2000. In late 1999, DOE notified LANL stakeholders, including local pueblos and tribes and various identified interested parties, of its intent to prepare an EA for a proposed wildfire hazard reduction program at LANL. This draft EA was scheduled for release to stakeholders and the public for review during the week of May 8, 2000; however, with the advent of the Cerro Grande Fire, this draft document was not released as scheduled. After the Cerro Grande Fire was contained within LANL, DOE revised the draft EA to include the effects of the fire and finally issued the draft EA in July 2000. This long-term management program will allow DOE to thin forest vegetation to an appropriate level and then maintain it at that level to accomplish both the reduction of wildfire hazards and to improve the overall health of the forest resources at LANL. This EA did not include the analyses of any of the environmental impacts resulting from DOE's emergency actions that are the subject of this SEA.

Similarly, DOE is preparing an EIS for the proposed relocation of the mission and operations currently conducted at LANL's Technical Area (TA) 18 (Figure 1.4). This EIS also will not include the analyses of any of the environmental impacts resulting from DOE's emergency actions that are the subject of this SEA. TA-18 is one of the two nuclear facilities noted previously that is located within a LANL floodplain. DOE issued a Notice of Intent to prepare this EIS in the Federal Register on May 2, 2000, and scoping meetings were held at various locations later in May 2000. The draft EIS is scheduled to be issued for stakeholder and public review and comment in late 2000; and the final EIS is also scheduled for 2000. DOE expects to issue a ROD in 2001. This SEA will only consider the impacts of moving materials around TA-18 to position them in safer locations within the TA to protect them from the possible effects of site flooding. The EIS will focus on the analyses of impacts associated with upgrading existing facilities at TA-18 and moving the TA-18 mission operations elsewhere at LANL or to another of DOE's nuclear complex facilities.

This SEA also does not address the potential impacts that could result from erosion and floods at LANL should these occur beyond the design function of the engineered structures installed at LANL and analyzed herein. In the event of such a flood(s), DOE will undertake action and compliance with NEPA and other applicable environmental laws as appropriate. Documentation necessary will be prepared as needed at the time of that event.

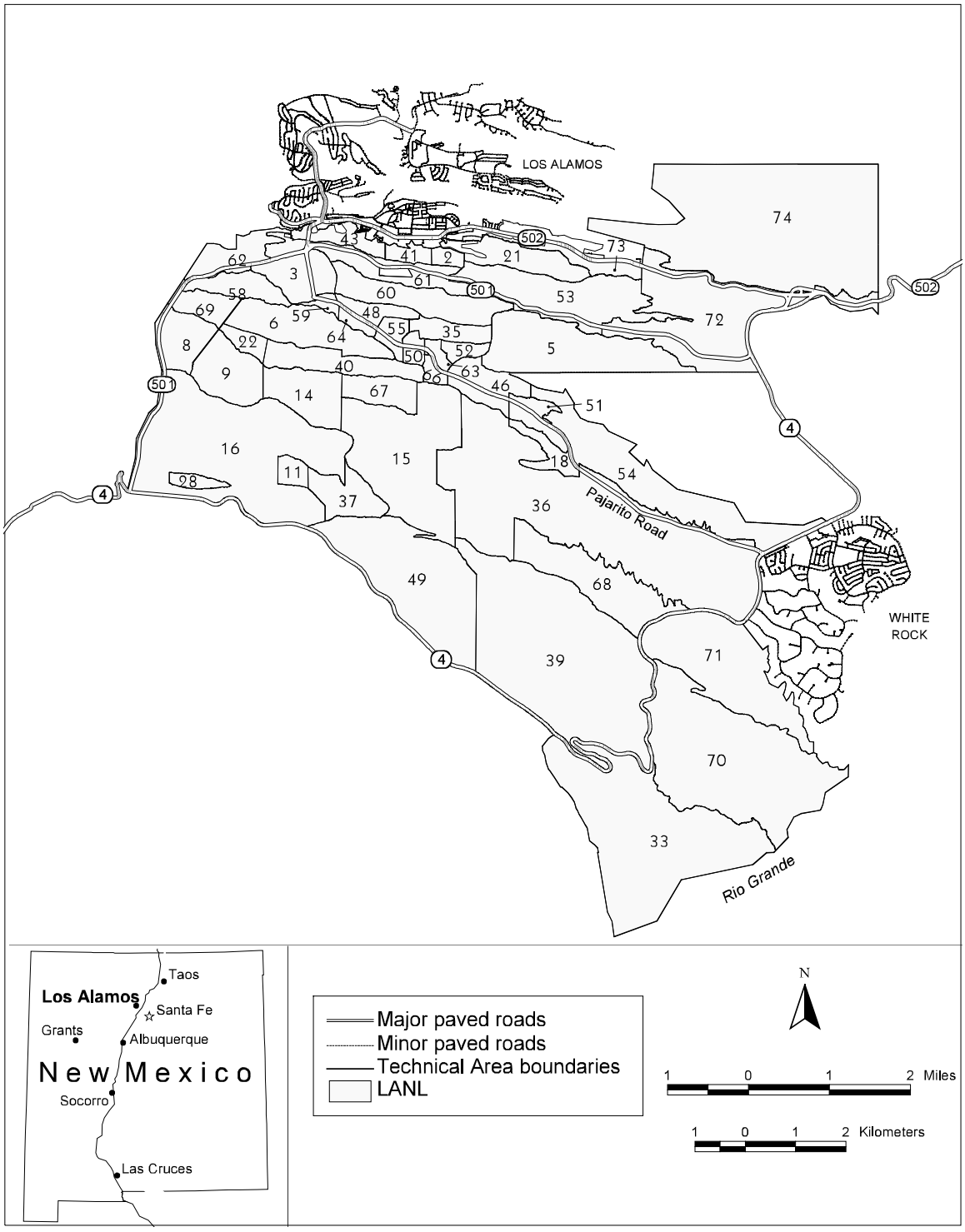

FIGURE 1.4—*LANL Technical Areas*

This Page Intentionally Left Blank

2.0 EMERGENCY ACTIONS UNDERTAKEN

2.1 Introduction

DOE's emergency response to the threat of the Cerro Grande Fire began with certain preventive actions undertaken immediately before the wildfire entered LANL boundaries in early May 2000. These actions, as well as subsequent actions, were taken by DOE, by UC and its subcontractors, or by other government agencies and their contractors and subcontractors at DOE's request or as a result of funding from DOE. These actions included fire suppression and control activities (such as creating firebreaks and dropping water and fire-retardant slurry), both over large areas of the LANL facility and within specific watersheds, to protect human lives and government property. Immediately after the fire, DOE initiated other actions to address the extreme potential for storm water flooding and other storm water damages at LANL and properties downstream from LANL. These actions were taken to address threats to human lives and to properties and to support the safe reoccupancy of LANL facilities by UC and its subcontractor workers.

The prescribed burn was ignited on May 4, 2000, and was declared to be a wildfire less than 24 hours later on May 5. Firefighter crews then began to conduct various fire line operations, including the setting of backfires and the clearing of narrow firebreaks using handheld tools as well as heavy machinery wherever possible. Aircraft dropped fire-retardant slurry and water loads in an effort to bring the wildfire under control over the next couple of days. Some of these actions occurred on land along SR 501 that is administered by the DOE as part of the LANL facility. Through a cooperative arrangement between the Forest Service and DOE, the Forest Service has permission to freely access property under their administration via various forest access roads that originate at SR 501 and cross the narrow belt of DOE-administered land. Firefighters would have used some of these roads to reach areas of the Santa Fe National Forest that were on fire. Additionally, it would have been difficult for firefighters to distinguish the boundary fences in some areas along this strip of land; under the emergency circumstances they likely made the assumption that all land west of SR 501 was Forest Service-administered property and conducted firefighting measures on this land accordingly. On May 7, the fire jumped east of the main fire line and was driven by high winds across the upper portions of Water and Pajarito Canyons, Cañon de Valle, and as far north as the edge of Los Alamos Canyon. Back fires were set along sections of SR 501, including within the LANL boundary.

DOE's subsequent actions include those taken to suppress the fire while it burned within LANL's TAs. By the next day (May 8), fires were spotting within the edges of several TAs, particularly within TA-16, which is located on the east side of SR 501. Firefighters quickly extinguished the spot fires before they could consume very much vegetation or result in major facility damage. Slurry drops (Photo 2.1) in advance of the front line were increased, and bulldozers were used to blade firebreaks within LANL boundaries. On May 9, the fire continued to spot within the edges of LANL's TAs and these spot fires were quickly controlled. Firefighters applied fire-retardant foam products to protect LANL facilities in addition to continuing the other fire suppression actions already on-going. However, winds the next day (May 10) carried fire far in front of the main fire

front deep into both LANL and the Los Alamos townsite. Hopes of immediately containing the fire were gone, and the fire rampaged for several days but then abated.

PHOTO 2.1—*Slurry Being Dropped*

The Cerro Grande Fire was considered to be contained within LANL by May 22 and in total control by June 7. Spot fires would continue to flare up "within the black" (that is, within the area encompassed by the fire's perimeter) for yet another six weeks before finally becoming extinguished.

The remainder of this section, and subsequent analyses presented later in this report, discuss DOE activities specific to fire suppression actions and to post-fire actions. Actions are further grouped according to their general LANL-wide applications (which includes general fire suppression actions in Rendija Canyon although this land is not part of the LANL reserve) or by canyon-specific locations within general watersheds where that identification is important to understanding the impacts of the activities. In this report, the watersheds are defined by the canyons that join together to empty into the Rio Grande at a single point (Table 2.1), rather than by the more detailed fashion described and employed in the 1999 LANL SWEIS analyses (DOE 1999). To this end, five watersheds are identified (Figure 2.1) where actions were conducted. Actions discussed later may also be grouped in terms of LANL facility reoccupation activities or soil erosion and storm water control and damage reduction activities.

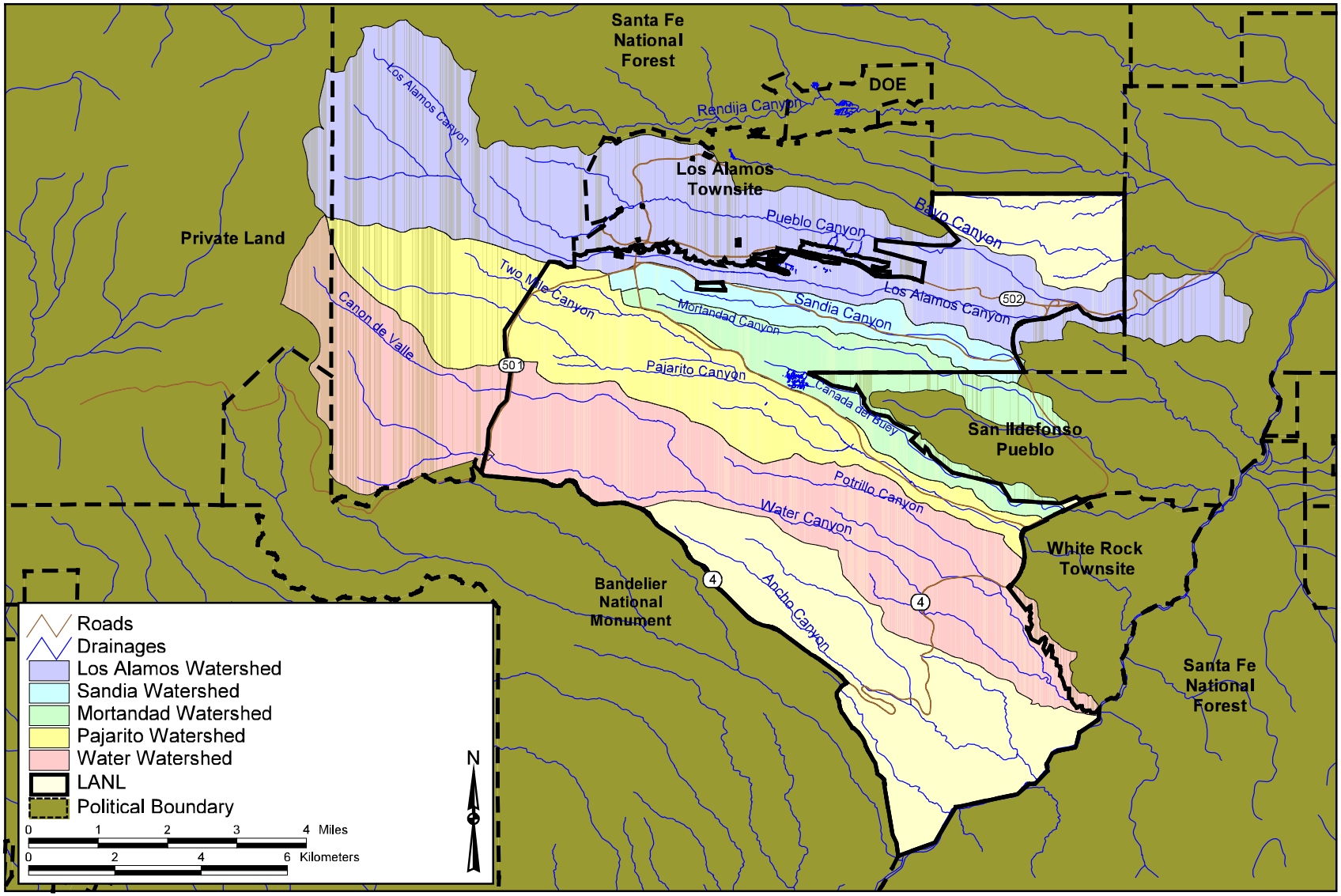

FIGURE 2.1—*Watersheds in the ROI*

TABLE 2.1—*Watersheds Where Actions were Conducted*

Watershed Designation	Canyons Included in Watershed Designation
Los Alamos Canyon	Los Alamos Canyon, DP Canyon, Pueblo Canyon, Acid Canyon, Bayo Canyon, Rendija Canyon, Guaje Canyon
Pajarito Canyon	Pajarito Canyon, Two Mile Canyon, Three Mile Canyon
Mortandad Canyon	Mortandad Canyon, Cañada del Buey, Ten-Site Canyon
Water Canyon	Water Canyon, Potrillo Canyon, Fence Canyon, Cañon de Valle
Sandia Canyon	Sandia Canyon

2.2 Fire Suppression Actions

Fire suppression and control actions included actions taken within LANL boundaries and within a DOE-administered tract located in Rendija Canyon. Actions were undertaken by firefighters specializing in both structural and wildland fires. These firefighters were from various local and regional areas and represented a wide variety of city, county, state, federal, and pueblo government organizations as well as small communities and other neighborhood organizations. Most of these actions occurred over large areas at LANL. Soil-disturbing activities are discussed later by watershed.

2.2.1 LANL-wide Fire Suppression Activities

Activities undertaken during the fire suppression period involved numerous LANL-wide locations. At the peak of the firefighting efforts, a total of about 1,600 firefighters and 100 pieces of firefighting equipment were present in the LANL vicinity performing fire suppression activities. The firefighters used nine sites around LANL for activity and equipment staging purposes. Each of these sites was less than 1.0 ac (0.4 ha) in size. With one exception, they were in previously disturbed or developed areas. Additionally, firefighters used the existing Fire Equipment Cache Facility (Cache Facility) site located at LANL's TA-49. The Cache Facility was also used as a rest and recovery site for the firefighters. About 550 firefighters ate, rested, and slept at this 58 ac (23 ha) site during the peak fire suppression period.

Trees were cut using chain saws and hand axes at many locations at LANL (Photo 2.2). Firefighters felled trees to remove the fire's fuel sources near buildings, structures (including aboveground utility lines, such as electric lines, pole structures, and gas mains), access roadways, and other locations where fuel removal was deemed necessary to facilitate the firefighting goals of life and property protection. The trees were later collected by LANL staff or subcontractor staff and removed by truck from the sites where they were felled. The trees were stockpiled at various locations and will eventually undergo routine LANL processing for disposal. The disposal process generally entails chipping the trees into mulch for reuse on site; entering the excess property disposal system to designate trees for release to the public; or, if the trees are contaminated with radioactive material, disposal at LANL's low-level radioactive waste site at TA-54.

To control the advance of the fire front, firefighters constructed numerous, narrow fuel breaks to remove fuel sources (Figure 2.2). Trees, bushes, and grasses were removed with rakes, axes, chain saws, and other similar hand tools. Typically, the fuel breaks created by hand tools were less than 10 ft (3 m) in width and involved only minor soil disturbance.

PHOTO 2.2—*Firefighter Felling Burned Tree*

Once fuel breaks had been established, the firefighters ignited several back fires if conditions were favorable. The back fires burned from the fuel break back towards the fire front creating a larger area without fuel to help control the fire's spread. Back fires were ignited with matches or with handheld torches that use small canisters filled with a flammable material.

Helicopters with underslung drop buckets flew close to the tree top level at LANL and neighboring areas and dropped water on the fire (Photo 2.3). The drop buckets were filled from various water sources including a permanent 5,000-gallon (gal.) (18,950-liter [l]) fill tank located at LANL's TA-49 expressly for such use, the Los Alamos Reservoir, and the Rio Grande. Temporary portable 3,000-gal. (11,370-l) "pumpkin tanks" were brought to LANL and set up at TA-8 and TA-52 to supply helicopters with water to fight fires within the LANL boundary. The helicopters used the helipad at TA-49, the Los Alamos Airport, and the Santa Fe Airport for various staging and refueling purposes.

Airplanes also dropped fire-retardant slurry on the forest in advance of the fire front (see Photo 2.1, page 2-2). The slurry was composed of an ammonium polyphosphate solution (with trace amounts of sodium ferrocyanide), which acts both to reduce the flammability of the trees and other fuel sources that it settles upon and as a post-fire fertilizer to help the forest recover after it has burned. These airplanes flew just above tree level over LANL and adjacent forest areas and mostly used the Albuquerque International Airport for staging and refueling purposes, although some of the smaller planes were able to use the Los Alamos and Santa Fe Airports as well.

Fire retardants in the form of foams were applied by handheld applicators and by truck-mounted applicators to buildings and structures, especially within the LANL TAs located along Pajarito Road and adjacent roads (see Figure 1.4, page 1-15). The foam was

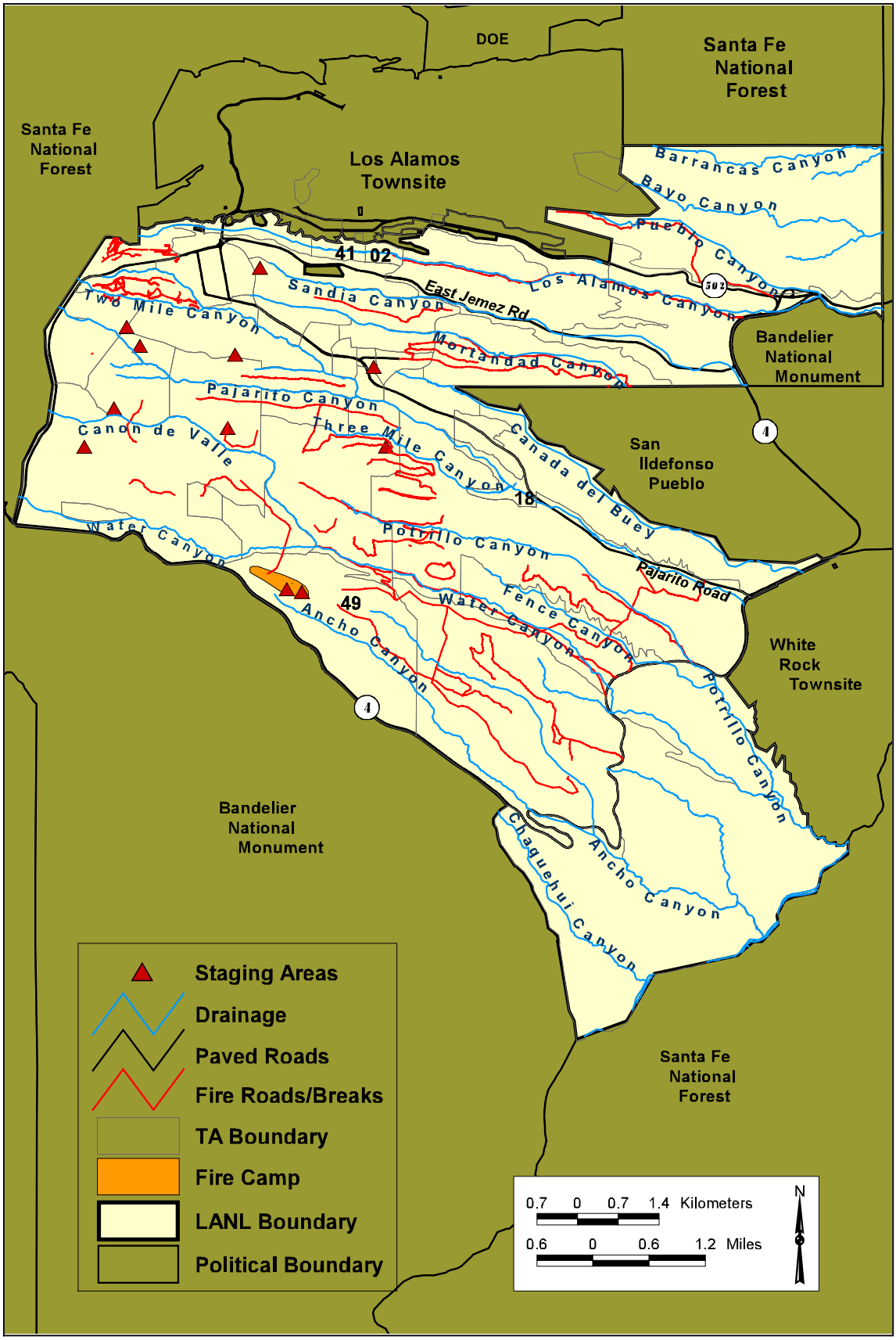

FIGURE 2.2—*Fire Suppression Features within LANL*

PHOTO 2.3—*Helicopter Dropping Muddy Water on Fire*

composed of a phosphate-based material, which acts to reduce the flammability properties of fuel sources.

UC staff and various regulatory agencies continued air monitoring and sampling actions throughout the fire suppression period. These activities used existing LANL air monitors and portable monitors brought to the site.

2.2.2 Watershed-specific Fire Suppression Activities

Some activities undertaken during the fire suppression period were specific to various watershed locations within LANL boundaries (see Figure 2.1, page 2-3). These ground-disturbing activities included using heavy machinery, such as bulldozers, to establish firebreaks by blading areas free of vegetation, to create new fire access roads and to improve existing roads so that the roads could be used by heavy transport equipment and fire trucks. These activities are described by their watershed location in Table 2.2. Professional archeologists and other environmental professionals participated in the planning and performance of the tasks to avoid disturbance of cultural and natural resources to the greatest practicable extent.

A smoldering subsurface fire at Material Disposal Area (MDA) R, a high explosive treatment area dating from the 1940s, was also suppressed. MDA-R is located within TA-16 along the south side of the upper rim of Cañon de Valle. Limited characterization of the area had been performed in the past and it was known that residues of explosives materials (including TNT) and heavy metals (including barium, cobalt, lead, silver, and zinc) were present in the waste material, as were railroad ties and other flammable woods

and wood products. The landfill started smoldering on about May 10. The work performed to extinguish this subsurface fire involved several days of slow saturation of the site with water and site monitoring, including air sampling. When suppression was unsuccessful through saturation of the disposal area, a remote robotic excavator was placed into the smoldering debris to excavate the debris, move it to a clear area, and douse it with water. Almost the entire MDA was excavated by the time the fire was completely extinguished. The work to remove the remainder of the waste at MDA-R will be undertaken later as part of an accelerated *Resource Conservation and Recovery Act* (RCRA) Corrective Action Process, which is subject to separate NEPA review.

TABLE 2.2—*Area (ac/ha) of Ground Disturbed at LANL during the Fire Suppression Period*

Activities	Total Area Disturbed* ac/ha	Area Disturbed within Watersheds				
		Water ac/ha	Pajarito ac/ha	Mortandad ac/ha	Los Alamos ac/ha	Sandia ac/ha
Firebreaks - bulldozer	97/39	30/12	11/4.4	21/8	0/0	0/0
Access Roads - new	51/20	6/2.4	42/17	0/0	3/1.2	0/0
Access Roads - improved	325/130	117/46	80/32	31/12	50/20	5/2

* Acreage total may include areas outside of the watersheds.

2.3 Post-fire Actions

Post-fire actions included actions taken to allow safe reoccupancy of LANL facilities; monitoring and assessment; establishment of staging areas; removal and stabilization of contaminants and other hazardous wastes and materials; erosion control; and storm water control. Most of these actions occurred over large areas at LANL. The larger storm water control projects and contaminant removal projects are discussed by watershed.

2.3.1 LANL-wide Post-fire Activities

Many of the post-fire activities were spread out over LANL, both within the areas that had been burned and over areas that had not burned. The activities described as being LANL-wide activities were taken and repeated at multiple locations and were mostly small in relative scale, and the direct and indirect impacts are limited to the areas in the immediate vicinity of the action itself.

Various material, work practices, and regulatory compliance standards were applied to implementing these activities. All post-fire actions at LANL that had the potential to affect historic properties or other cultural resources, or that had the potential to affect sensitive habitat of federally-listed T&E species, were planned and executed with the participation of professional archeologists and biologists employed by UC.

Additionally, for all post-fire actions that required soil-disturbing activities, the individual sites were subsequently recontoured and reseeded with appropriate site-specific seed mixes. Temporary soil erosion control measures, such as silt fences, were installed to protect the sites from storm water runon and runoff until seedlings have become

established according to a Storm Water Pollution Prevention (SWPP) Plan that was developed for LANL actions and implemented. Activities employed a variety of standard practices such as spraying water to suppress fugitive dust, restricting vehicles to established roads, restricting vehicle fueling practices to appropriately established sites away from arroyos and drainages, removing the smallest amount of vegetation possible, limiting activities within wetlands to the extent possible, and prohibiting activities within flagged perimeters of archeological sites.

Facility Reoccupancy

Public access was discontinued within all canyon areas at LANL except for the use of Pajarito Road and East Jemez Road. Signs were erected to warn the public to keep out of low-lying land within LANL boundaries and to prohibit hiking within burned areas undergoing rehabilitation.

Many structures, such as transportainers, trailers, sheds, storage buildings, cooling towers, pump houses, and military shelters, were damaged or destroyed by the fire as it moved over LANL (Photos 2.4 and 2.5). A total of 40 structures were damaged beyond reasonable repair or destroyed outright (Table 2.3). Structures were removed using conventional heavy equipment, such as front-end loaders, which resulted in some soil disturbance. Debris was sampled for radioactive material, for substances regulated under RCRA and the *Toxic Substances Control Act*, and for NMED special waste constituents before their removal and disposal at permitted disposal sites. Recyclable nonradioactive and nonhazardous materials were segregated from waste materials as much as practicable. If recyclable materials could not be segregated, all waste was disposed of according to standard LANL waste management practices. At the site of each structure, a ground area of approximately 100 ft wide by 100 ft long by 2 ft deep (30 m by 30 m by 0.6 m) was disturbed during removal of the trailers and other similar structures.

TABLE 2.3—*LANL Structures Damaged or Destroyed by the Cerro Grande Fire*

TA	Structures
15	50, 239, 314, 329, 339, 371, 372, 374, 375
16	515, 516, 518, 519, 520, 524, 559, 578
40	40, 72, 73
56	86, 87, 121, 181, 241, 242, 325, 397
52	111
64	7, 9, 11, 12, 13, 15, 18, 19, 21, 23, 24

Many buildings across the LANL site required replacement of various filters, monitors, alarms, cables, and other facility health and safety features. Equipment and furnishings, such as computers and carpets, were damaged by smoke and fire and required replacement. Building electrical and communications lines, smoke detectors and fire protection systems, and other infrastructure components also required repair or replacement. About 200 structures, including office buildings, warehouses, transportables, process laboratories, and sheds, suffered varying degrees of damage. Of those, about 78 structures only required filter replacements and general custodial cleaning (walls, floors, and other internal and external cleanup). Water storage tanks and pipes, as well as treatment lines, were drained and flushed around LANL as needed.

PHOTO 2.4—*LANL Trailer Burned by the Cerro Grande Fire*

PHOTO 2.5—*Burned Transportable at LANL*

Hazard trees[1] along LANL roads and those next to buildings, structures, parking areas, and walkways were cut and removed from the site. Tree cutting activities resulted in minor surface soil disturbance, primarily at the site of each tree during the tree removal process.

Monitoring and Assessments

Air, surface water, groundwater, soil, and produce monitoring has continued as part of the post-fire actions. Approximately 30 damaged air and surface water monitoring stations have been repaired or replaced. Concrete bumpers and other protective barriers have been installed around groundwater monitoring wells and other monitoring devices, as necessary, to provide protection to these structures from potential floods and damage by floating debris. New rain and stream flow gauges were installed or relocated (less than 10) as needed to monitor for flood conditions. In addition, many canyons (Los Alamos, Pueblo, Pajarito, Water, Cañada del Buey, Sandia, Potrillo, and Mortandad) were investigated to determine the movement or transport of contaminants through alluvial groundwater, surface water, ash flow, and sediments. Contaminant monitoring has been expanded, and additional air and groundwater monitoring stations have been installed within and outside of LANL boundaries. Baseline characterization activities have been, and continue to be, conducted in response to the Cerro Grande Fire. These activities are located outside of LANL in the Jemez Mountains, in Pueblo, Pajarito, Los Alamos, Mortandad, Water, and Sandia Canyons, Cañon de Valle, and Cañada del Buey, and on San Ildefonso Pueblo lands in Mortandad and Los Alamos Canyons. Characterization activities are also being conducted in the Rio Grande and Cochiti Reservoir. An in-stream water quality monitoring sampling station was installed in June 2000 at the Water Canyon confluence with the Rio Grande (one side of the sampling station's support lines is anchored within the boundaries of LANL's TA-70).

Cultural resource sites in drainage areas and floodplains are being assessed, and protection or stabilization activities have been initiated. Sites vulnerable to flooding such as the historic cabin at TA-18 (Photo 2.6) are the first priority in receiving the placement of storm water control measures. This action started in June 2000 and will continue until completed. Similarly, areas of potential habitat for federally-listed T&E species are undergoing evaluation. Evaluation efforts will extend beyond this summer's breeding season. No protection or stabilization activities are anticipated for these areas during the time frame encompassed by this SEA. Any actions required later will be the subject of separate NEPA compliance reviews.

Establishment of Staging Areas

Equipment and supply staging areas were sited and used across a number of locations near the work areas. These staging areas included those within developed areas and existing paved areas, as well as unpaved and undeveloped areas. Some soil disturbance resulted from the siting of some of the staging areas. Heavy equipment was placed at many of the staging areas. Equipment, such as a sandbagging machine, was brought in,

[1] Hazard trees are those that have been damaged and are a physical hazard to personnel or property.

installed, and operated on-site to facilitate the recovery activities. Supplies were brought in and staged until needed. Supplies included straw bales and wattles (long nylon mesh tubes filled with straw); rocks; wire mesh; wood, fiber, and straw mulches; jute matting material; stakes; and similar materials. Tools were also staged at some of these areas, such as rakes, hoes, and shovels. Staging areas for cut logs were also established at various locations, including TA-5 and TA-63.

PHOTO 2.6—*Concrete Barriers to Prevent Storm Water Damage at Historic Cabin*

Erosion Control

Burned area vegetative rehabilitation for soil erosion control across LANL included contour raking, seeding by hand and by air, mulching, and hydromulching (Figure 2.3). Technical descriptions of these treatments can be found in the Cerro Grande Fire BAER Report Specifications (BAER 2000). Moderately and severely burned areas were contour raked to break up the soil surface and to redirect and reduce water flow (Photo 2.7). The ground disturbance from raking was limited to the first few inches of the soil's surface. After raking, the areas were seeded by hand, by mechanical spreaders, or by small, low-flying aircraft. After seeding, straw mulch was spread by hand or by mechanical straw blowers (Photo 2.8). About 15,000 straw bales were used in the mulching. About 1,000 ac (400 ha) were raked, seeded, and mulched—about 350 ac (140 ha) seeded by hand and 650 ac (260 ha) by air. Hand work was begun in early June and completed in August 2000 by professional recovery teams, assisted by LANL worker volunteers. About 23 tons (21 metric tons [t]) of seed were used. The types of seed used included native and other species; the BAER Team-recommended seed mix was used extensively in aerial and hand seeding efforts. This seed mix was composed of 30 percent annual ryegrass (*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot), 10 percent cereal barley (*Hordeum vulgare* L.), 30 percent mountain brome (*Bromus marginatus* Nees ex Steud.), and 30 percent slender wheatgrass (*Elymus trachycaulus* [Link] Gould ex Shinners). The brome

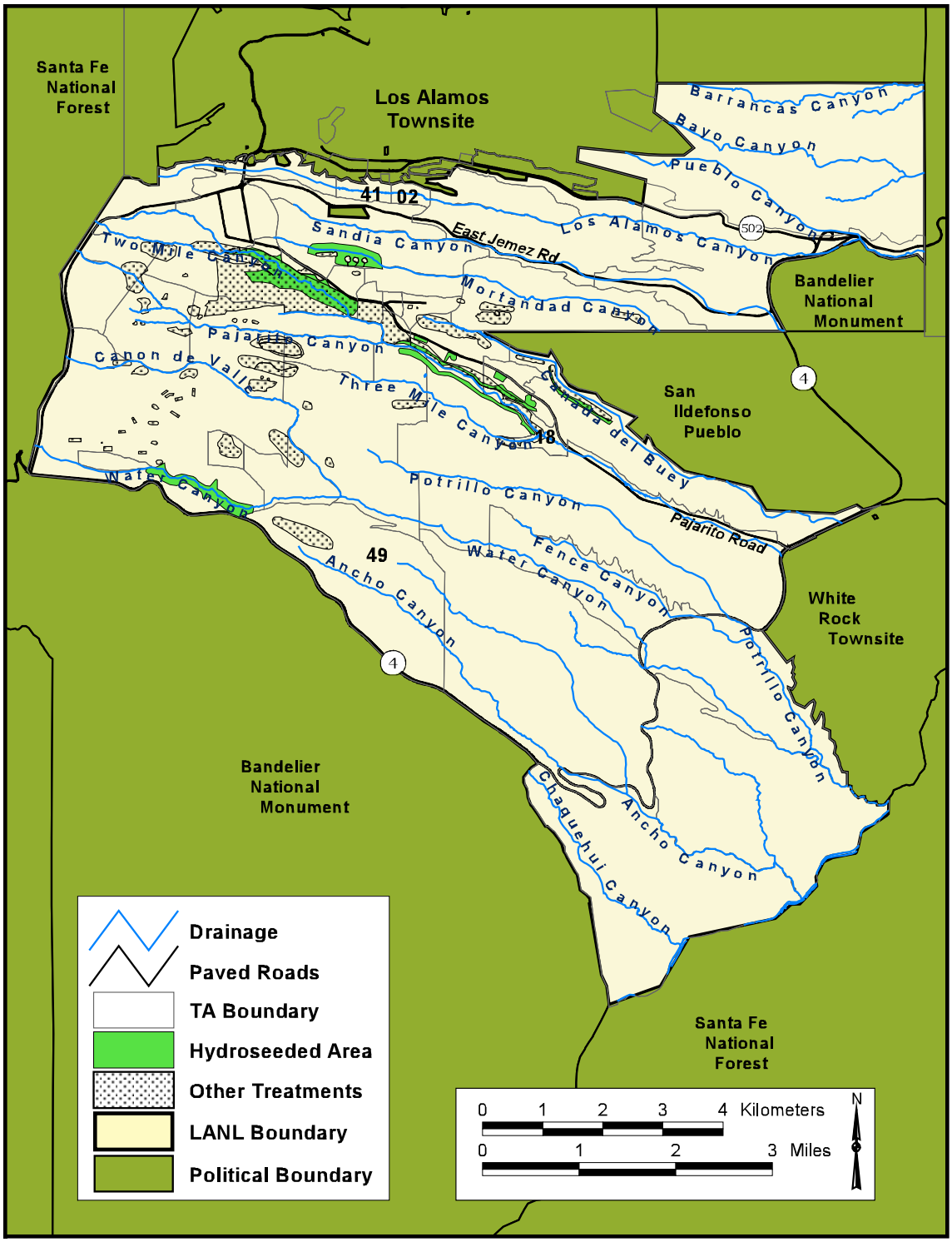

FIGURE 2.3—*Erosion Control Treatments within LANL*

PHOTO 2.7—*Contour Raking*

PHOTO 2.8—*Burned Area with Straw Mulch*

and wheatgrass are species native to Los Alamos County. Aerial seeding was performed to achieve a rate of 50 live seeds per square foot of space. Airplanes performing aerial seeding procedure used the Los Alamos and Santa Fe Airports for staging and refueling.

From late June to mid-August 2000, hydromulching was applied to steep, severely burned slopes. Hydromulching consists of spraying a mix composed of straw or wood fiber, organic tackifier (such as a simple cellulose solution), and seed from small low-flying aircraft or truck-mounted equipment (Photo 2.9). Mulch is used to help keep soil in place and to increase the chances that seeds will germinate. It is typically applied at about 2,000 pounds per ac. The aircraft performing hydromulching used Los Alamos Airport for staging, refueling, and loading hydromulch. The aircraft averaged 200 drops per day and covered about 150 ac (60 ha); the truck-mounted hydromulching was primarily used around PRSs. About 175 tons (157.5 t) of hydromulch was applied.

PHOTO 2.9—*Spraying Hydromulch*

Temporary erosion control measures were installed at many scattered locations within LANL (see Figure 2.3, page 2-13). Measures included contour tree felling (Photo 2.10) over about 750 ac (300 ha), installation of on-grade rock and log check dams (Photo 2.11), placement of erosion control jute matting, and placement of straw bales (about 3,200 bales) and wattles (about 125,000 linear feet [37,500 m]) (Photo 2.12). Equipment used to install these control measures included chain saws, shovels, rakes, all-terrain vehicles, bulldozers, and water trucks. About 1,000 ac (400 ha) of land within the boundaries of LANL were treated with these various erosion control measures. Ground disturbance was limited to areas directly around the erosion control measures' installation sites.

PHOTO 2.10—*Contour Felling*

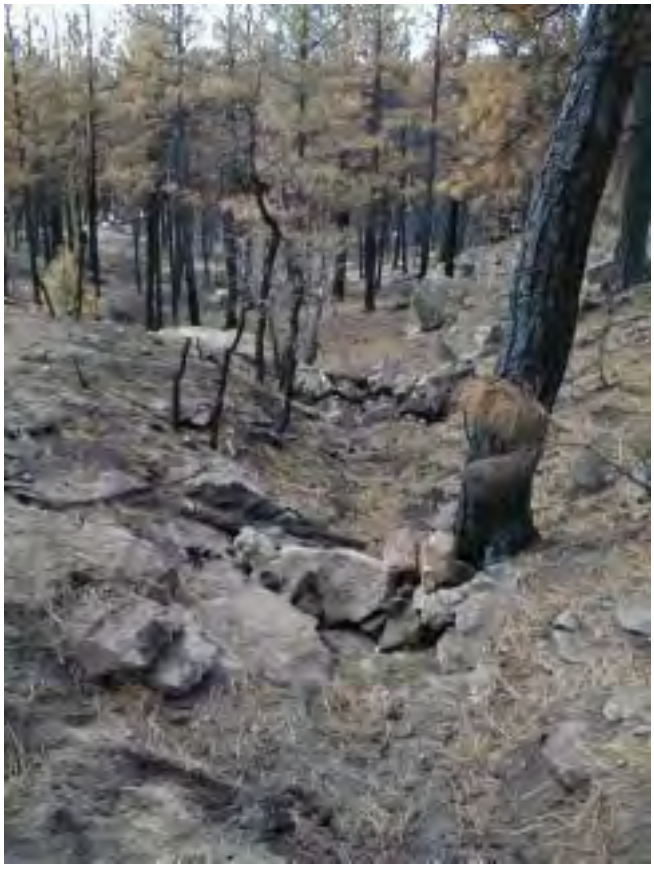

PHOTO 2.11—*Rock Check Dam on Burned Slope*

PHOTO 2.12—Straw Wattles in Severely Burned Area

The installation or replacement of similar storm water control measures, known as best management practices (BMPs), were required to protect 91 PRSs that had been burned (Figure 2.4, Table 2.4) from soil erosion and storm water runoff in many areas (Table 2.4). In addition to the 91 PRSs requiring BMPs, 77 PRSs located within floodplain or drainage areas (Table 2.5) were evaluated for accelerated cleanup actions. About 47 of these 77 PRSs required accelerated cleanup or other actions, such as sampling or stabilization. As part of this effort, two areas were provided at TA-6 and TA-63 to stage equipment and supplies such as straw bales and wattles, jute fabric, silt fencing materials, and staking materials. Soil disturbance was limited to the immediate vicinity of the BMP installation sites. Damaged, dying, or dead trees near drainages and live and dead trees at construction sites were cut and removed. This resulted in some localized soil disturbance.

Clean-out Activities

Culvert and drainage area clean-out activities were performed at all of the low-lying areas at LANL where storm water runoff was expected and where debris damming might cause storm water to pond. Ponding could result in soil saturation, which could in turn result in roadbed failure. Generally, hand tools or small back-hoe machines were used to remove any obstructions, including tree limbs, brush, leaves, and silt deposits from existing culverts and drainages. Wash out areas around culverts and in drainages were also repaired by addition of rock gabions (a box formed from chain-link mesh, filled with stones, placed in drainage channels, and used for flood and erosion control), soil, or concrete material. This repair work was done as necessary to protect these areas from storm water damage. Some temporary soil-disturbing activities included blading access roads to enable machinery and workers to reach some of the culverts and drainage areas.

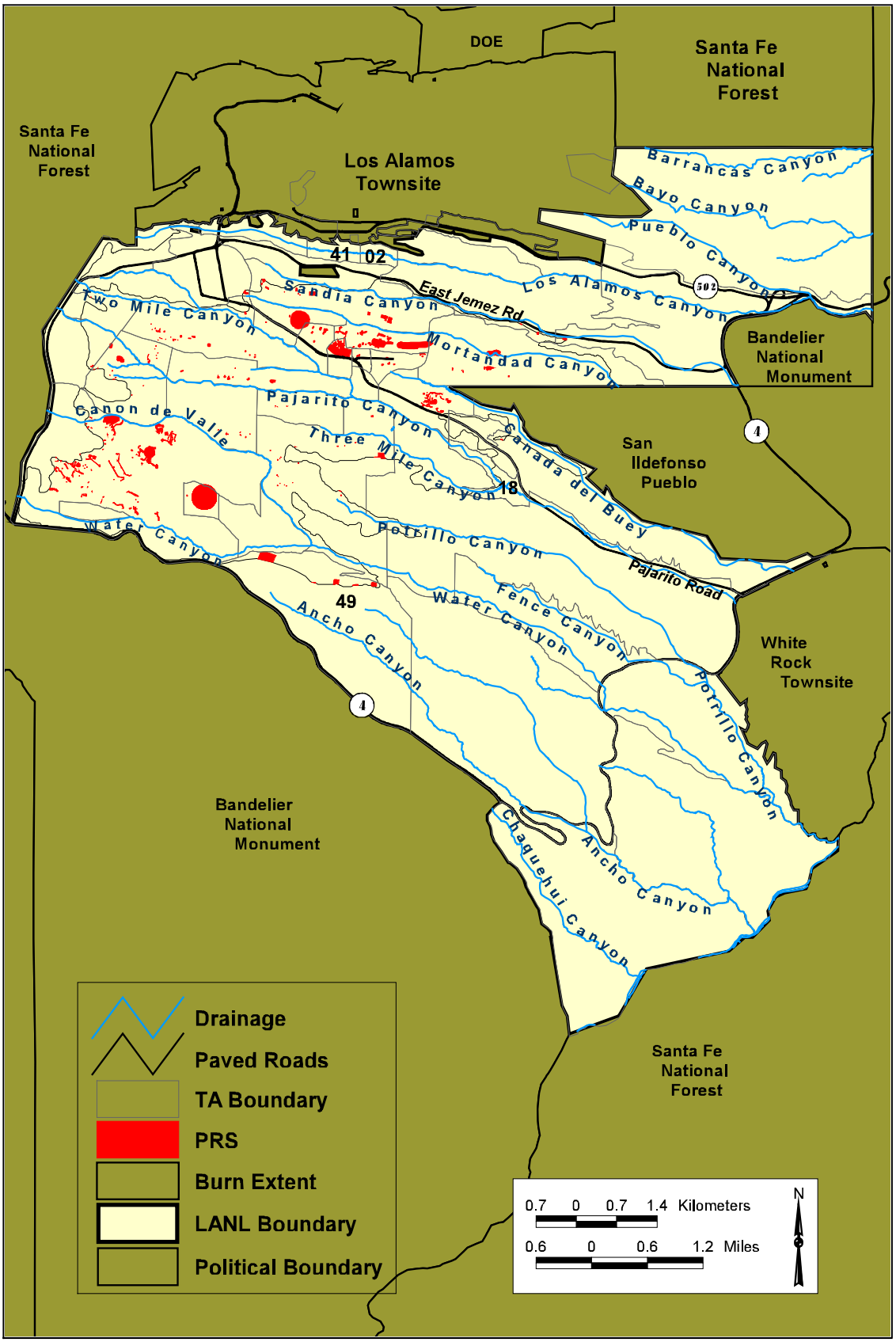

FIGURE 2.4—*Potential Release Sites within the Burned Area at LANL*

TABLE 2.4—*91 PRSs Affected by Fire*

TA	PRS #s	Watershed	HSWA*	BMPs**	Acres/Hectares
49	49-001(g)	Water Canyon	X	A,K	2/.80
48	48-007(f)	Mortandad Canyon	X	A,B	0.5/0.2
	48-007(b,c)		X	A,B,D,E	0.5/0.2
	48-003		X	A,B,D	0.5/0.2
46	46-004 (f-h,m,q-z)	Cañada del Buey	X	A,B,E,J,G	17/6.8
	46-004 (a-c2)		X		
42	42-004	Cañon de Valle	-	A,B	1/0.4
40	40-009,010	Pajarito Canyon	X	B,C,L	4/1.6
	40-006 (b,c)		X	A,B	2/.80
36	C-36-003	Three Mile Canyon	X	B,K	3/1.2
22	22-015(c)	Pajarito Canyon	X	A,B	2/.80
16	16-030(h)	Water Canyon	X	A,B	0.5/0.2
	16-029(g)		X		0.5/0.2
	16-028(a,b)		X		1/0.4
	16-026(h2)		X		0.5/0.2
	16-021(c)	Cañon de Valle	X	F,B	1/0.4
	16-020		X	A,B	0.5/0.2
	16-019		X	A,B,D,I	2/.80
	16-018		X	L	1/0.4
	16-016(c)		X		
	16-004(f)	Water Canyon	X	A,B	0.5/0.2
	16-003(n,o)	Cañon de Valle	X	A,B	0.5/0.2
	16-003 (a,f)	Water Canyon	X	A,B	1/0.4
15	15-011(a,b,c,)	Cañon de Valle	X	B,C	0.5/0.2
	15-014 (i,j,k)		X		
	C-15-007, 010		-		
	15-007(b)		X	A,B	0.5/0.2
	15-006(c)	Three Mile Canyon	X	A,B,C,F,K	25/10
	15-008(b)		X		
14	14-009	Cañon de Valle	X	A,B,D,F	2/.80
	14-006		X	A,B	1/0.4
	14-002(c,d,e)		X	A,B	1/0.4
	14-002(a),		X	A,B,F	6/2.4
	14-010		X		
11	11-006(a,b,c,d)	Water Canyon	X	H,G	10/4
	11-004(a-f)		X		
9	09-013	Cañon de Valle	X	A,C,E,K	5/2
	09-009		X	A,B	2/.80
	09-004(a,n,o)		X		2/.80
6	06-007(g)	Two Mile Canyon	X	A,B	0.5/0.2
5	05-006(b,c,e,h)	Mortandad Canyon	X	A,B,C	15/6
	05-005(a,b)		X	A,B,C	15/6
	05-003, 004		X	A,B	4.5/1.8
	05-001(a,b)		X	A,B,C	15/6
4	04-003(b)		X	A,B	2.5/1
	04-001, 002		X		
TOTAL	91				Approximately 142 ac/57 ha

- = No Action, *HSWA = (RCRA) Hazardous and Solid Waste Amendments apply

**BMPs = A-raking, seeding, mulching; B-straw wattles; C-low flow silt dikes; D-riprap; E-earthen berms; F-rock check dam; G-hydromulch; H-log check dam; I-concrete barriers; J-tree felling; K-low flow silt fence; L-earthen/rock diversion structure

TABLE 2.5—*Floodplain PRSs: Status of Accelerated Actions as of August 24, 2000*

Watershed	#PRSs	Accelerated actions in process*	Recommended for corrective action	Corrective action complete	No immediate action required
Los Alamos Canyon Watershed					
TA-2	34	23	4	4	3
TA-41	6	6			
Los Alamos Canyon	1			1	
Pueblo Canyon	1				1
Pajarito Canyon Watershed					
TA-18	29	6			23
TA-27	1				1
Pajarito Canyon	1	1			
Other Watersheds					
Mortandad Canyon	2			1**	1
Water Canyon	2				2
Total	77	36	4	6	31

* Accelerated actions include additional site characterization or protective measures.
** Mortandad Canyon sediment traps.

Damage Reduction

Various flood damage control measures were installed to provide protection to electric power pole structures and other utility structures (such as electric substations, gas lines, water lines, wells and chlorination stations, sewage lift stations, and telephone and communication structures) (Photo 2.13). These measures included sandbags, concrete barriers, rock gabions (Photo 2.14), straw bales and wattles, and silt fences. Some electrical conduits and potable water and sewage waste distribution lines were moved, re-routed, or reinforced to ensure their continued integrity.

Radioactive and hazardous materials and waste were removed from TA-2, TA-41, and TA-18 to eliminate the possibility of their being transported downstream in storm water runoff. For the most part, containers were relocated to higher ground within the same TA where they were located. Other LANL sites were used to store these materials and waste as appropriate.

PHOTO 2.13—*Storm Water Protection around Utility Pole*

PHOTO 2.14—*Multiple Rock Gabions being Assembled at Los Alamos Canyon Weir*

2.3.2 Watershed-specific Post-fire Activities

Some post-fire activities that are described in the previous section (2.3.1) resulted in ground disturbance within certain watersheds. In addition, USACE projects to control storm water runoff and reduce flood hazards were constructed within these watersheds in both burned and unburned areas. Removal of contaminated soils and other sediments was also conducted within these watersheds. The activities described in this section were both small and large in relative scale. The direct and indirect impacts of the activities are not necessarily limited to the areas immediately in the vicinity of the action itself. The activities were almost all ground disturbing; however, some activities occurred in areas that had been previously disturbed and developed, while others were conducted at areas that had not been overtly disturbed or developed. Constructed erosion and water control devices and structures using rock and concrete materials are expected to remain in place for three to perhaps as many as ten years. Organic materials used for erosion control and storm water control purposes are expected to gradually decay in place over the next few years.

USACE undertook seven post-fire construction actions according to stringent DOE and USACE design and construction requirements (LANL 2000a). Various material, work practices, and regulatory compliance standards were applied to the construction actions as well. Engineering assessments of various kinds were performed at each construction site. Core drilling was conducted to investigate soil properties for designing flood control structures. The USACE projects implemented are summarized in Table 2.6, and their locations are shown in Figure 2.5. Please note that Figure 1.4 (see page 1-15) identifies technical areas at LANL referenced later in the text. The following sections describe

TABLE 2.6—*U.S. Army Corps of Engineers Fire Rehabilitation Actions*

Title	Task Description	Areas Impacted and dimensions	Area Impacted (ac/ha)
Weir and Sediment Trap in Los Alamos Canyon	Construct a rock gabion low-head weir structure in Los Alamos Canyon above the SR 4 intersection with SR 502. The weir will be 10 ft (3 m) above grade and located on the downstream side of an excavated short-term detention basin to prevent sediments from migrating off LANL property. Excavated soil will be piled and sloped on the western side of the detention basin.	Detention Basin: 10 ft (3 m) high by 500 ft (152 m) long by 100 ft (30.5 m) wide Excavated backfill: 30 ft (9.1 m) high by 27,000 square feet (ft^2) (2,508 square meters [m^2]) 30 ft (9.1 m) high by 31,500 ft^2 (2,926 m^2)	1.1/0.45 0.62/0.25 0.72/0.29
Reinforce Los Alamos Reservoir	Reinforce the existing embankment at the LA reservoir by installing an articulated concrete mattress (ACM) over the upstream face top and the downstream embankment of the dam. Build a 300-ft (90-m) long access road downstream of the reservoir.	ACM area: 200 ft (60 m) by 200 ft (60 m) Road: 300 ft (91 m) by 10 ft (3 m)	1.0/0.40 0.07/0.03
Pajarito Canyon Flood Retention Structure	Design and construct a concrete structure in Pajarito Canyon, approximately 2.0 miles (mi) (3.2 kilometers [km]) upstream of TA-18, to retain water and prevent potential downstream flooding at TA-18 and in White Rock. The flood retention structure design specifies the structure to be approximately 70 ft (21 m) above grade and 390 ft (117 m) across the width of Pajarito Canyon. The bottom of the structure will have a 42-inch (in.) (105-centimeter [cm]), non-gated drainage conduit. Normal rainfall amounts will flow through. Accumulations of water shall be retained for no longer than 96 hours and will drain naturally into existing streambeds.	Construction zone: 800 ft (244 m) by 500 ft (152 m) Staging areas: with batch plant 300 ft (90 m) by 300 ft (90 m) and 200 ft (60 m) by 300 ft (90 m)	9.2/3.7 2.1/.84 1.38/.55
Reinforce SR 501 Crossing at Pajarito Canyon	Grade and shape the downstream slope of SR 501 and place 6-in. (15-cm) thick shotcrete mattress for a distance of approximately 200 ft (60 m).	ACM area: 50 ft (15 m) by 200 ft (60 m)	<0.5/<0.2
Reinforce SR 501 Crossing at Two Mile Canyon	Grade and shape the downstream slope of SR 501 and place 6-in. (15-cm) thick shotcrete mattress for a distance of approximately 200 ft (60 m). Place reinforcement matting for a distance of approximately 260 ft (78 m) adjacent to the shotcrete mattress.	ACM area: 50 ft (15 m) by 200 ft (60 m) Shotcrete: 50 ft (15 m) by 260 ft (78 m)	<0.5/<0.2
Reinforce Anchor Ranch Road Crossing at Two Mile Canyon	Reinforce both the upstream and downstream slopes of Two Mile Canyon at the Anchor Ranch Road land bridge. Construct an emergency spillway to the south of the embankment. Modify the downstream slope to approximately a two-to-one slope.	ACM area: 100 ft (30 m) by 340 ft (115 m)	<1.0/<0.4
Reinforce SR 501 at Water Canyon	Temporarily place six ACMs on filter fabric in severely washed out areas downstream of the embankment slope. Grade and shape the upstream and downstream slopes of SR 501, relocates previously placed ACM from the downstream slope to the upstream slope, and place shotcrete on the downstream slope for a distance of approximately 256 ft (76.8 m).	ACM and shotcrete area: 100 ft (30 m) by 200 ft (60 m)	<1.0/<0.4

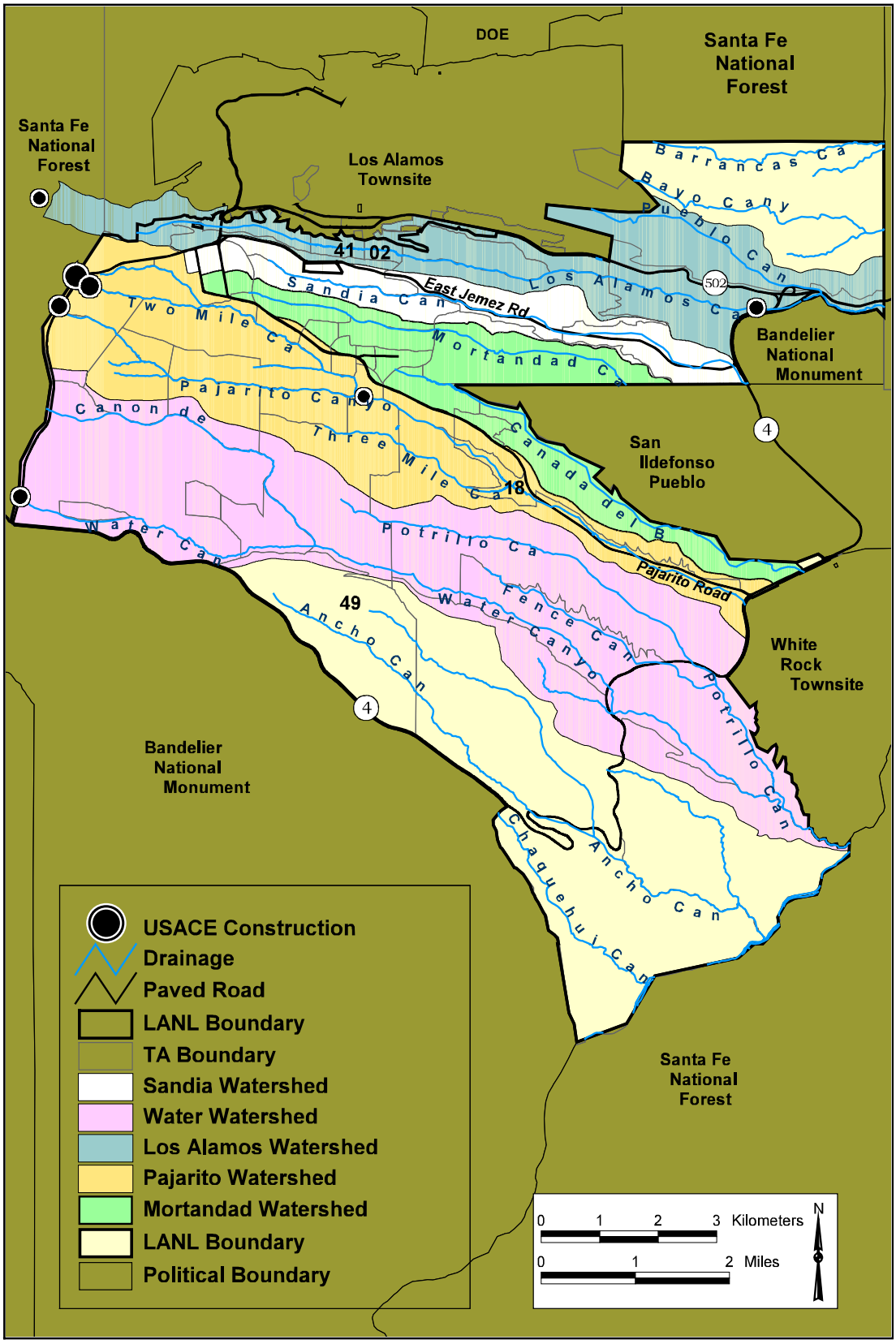

FIGURE 2.5—*Major Flood Control Projects at LANL*

activities in the Los Alamos Canyon watershed, the Pajarito Canyon watershed, and the other watersheds at LANL as described in Table 2.1 (see page 2-4).

2.3.2.1 Los Alamos Canyon Watershed

The activities described below occurred in Los Alamos Canyon. Other canyons within this watershed may have been subject to non-DOE rehabilitation activities, such as the installation of stream wattles and rock check dams, conducted by the Forest Service or the County of Los Alamos.

Removal of Structures from Floodplain

Some structures were removed from their canyon bottom locations to eliminate the possibility either that storm water runoff would transport radioactive or hazardous contaminants downstream or that these structures might become part of the debris load moving downstream in the event of a flood. The Los Alamos Canyon structures removed for this latter reason were abandoned structures at TA-2 already slated for demolition. To take action to protect them from the potential effects of a major flood event was considered not to be fiscally prudent. At TA-2, several structures were removed including the cooling tower (TA-2-49) and attached structure (TA-2-57), an underground pump station (TA-2-53)and three underground storage tanks (TA-2-54, 55, and 56) (1,200 gal. [4,548 l] each), a small masonry building used for storing radioactive materials and samples (the rod storage facility TA-2-4), a surge tank (TA-2-46), a storage building (TA-2-88), and a guard station (TA-2-69). Another storage structure (TA-2-50) was decontaminated but not demolished. Heavy machinery was used to demolish the structures and remove the resulting waste. Waste generated during the demolition, including contaminated soils, was transported to LANL's TA-54 for disposal.

Storm Water Controls

Sandbags, shielding blocks, and concrete barriers were placed at various locations at TA-2 and TA-41 to prevent damage to remaining structures in Los Alamos Canyon. Rock gabions were also installed to reduce storm water runoff acceleration at various strategic locations.

Diversion structures and BMPs were also installed to prevent erosion of material around the radioactive liquid waste (RLW) cross-facility pipeline located in Los Alamos Canyon at TA-2.

The existing unpaved road that traverses the lower portion of Los Alamos Canyon was regraded to accommodate heavy machinery transport. Rock gabions were installed as needed for erosion control along this roadway. A new road was bladed between the east fence at TA-41 and the TA-41-56 sewage lift station, around which BMPs were installed. Some of the security fencing at TA-41 and TA-2 was removed near the construction area but has been replaced.

Storm Water and Sediment Retention

At the upper end of Los Alamos Canyon, the Los Alamos Reservoir was drained to serve as a catchment for storm water and sediment and to facilitate strengthening the dam. Before strengthening the dam, cores were drilled at the top of the dam, and a new 300-ft (90-m) temporary road was constructed from the downstream slope of the dam to an existing camping area to facilitate equipment access. The pedestrian walkway over the reservoir dam was removed. The reservoir dam faces were strengthened to lessen the danger of dam failure so that the dam can trap water and debris from the heavily burned area of the watershed upstream from the reservoir. An ACM was installed as reinforcement over the upstream face, top, and downstream embankment of the dam (Photo 2.15). Shotcrete (blown concrete) was then placed over all faces of the dam. Downstream, a debris catcher was constructed in Los Alamos Canyon above the Los Alamos Ice Skating Rink. This debris catcher (also known as a "trash rack") (Photo 2.16) was constructed of metal bars and braces. It was designed to catch trees and other floating debris in the event of a flood. Another debris catcher was constructed about 500 ft (150 m) west of TA-41.

PHOTO 2.15—*Reinforcing Los Alamos Reservoir*

PHOTO 2.16—*Debris Catcher or "Trash Rack"*

A low-head weir and sediment trap was constructed in Los Alamos Canyon near the intersection of SR 4 and SR 501 within TA-72 to provide sediment control and retention and deceleration of storm water flow. The weir includes a large, relatively shallow basin that will serve as a sedimentation basin and sediment retention structure. The detention basin is 500 ft (150 m) long by 100 ft (30 m) wide by 10 ft (3 m) deep.

The weir is located on the downstream side of the detention basin and is about 10 ft (3 m) above grade. It is constructed of rock gabions (Photo 2.17). The total area affected, including the weir, detention basin, and excavated backfill area, is less than 3 ac (1.2 ha). Approximately 11,900 cubic yards (yd^3) (9,044 cubic meters [m^3]) of soil and rock were excavated and banked along the sides of the canyon.

Contaminant Removal

Approximately 915 yd^3 (700 m^3) of contaminated surface silt and soil were removed from a 2.5-ac (1.0-ha) site in Los Alamos Canyon east of the confluence of Los Alamos Canyon and DP Canyon, during June 2000. The soil was removed to minimize the overall potential for migration of contaminants in the event of a severe flood. The removed sediment contained low levels of radioactive contaminants from LANL operations in the 1940s and 1950s at a concentration of about 20 times greater than natural sediment deposits within Los Alamos Canyon. Heavy excavation and hauling equipment, such as a backhoe, excavator, and dump truck, was used to remove the soil. The contaminated soil was transported by truck and disposed of at TA-54, Area G.

PHOTO 2.17—*Los Alamos Canyon Weir Near SR 4 Under Construction*

Other Measures

Fences were erected in Los Alamos Canyon near the Diamond Drive bridge (also known as the Omega Bridge) to keep the public out of the TA-41 and TA-2 construction areas. These fences were designed with gates that would be opened in the event of a flood event.

2.3.2.2 Pajarito Canyon Watershed

Except for reinforcements of SR 501 and Anchor Ranch Road at canyon crossings, activities in the Pajarito Canyon watershed were conducted at TA-18 or just upstream from TA-18 near the junction of Pajarito and Two Mile Canyons.

Road Reinforcements

At Anchor Ranch Road, a test pit (about 6 ft long by 2 ft wide by 8 ft deep [1.8 m by 0.6 m by 2.4 m]) 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 crossing and the embankments where SR 501 crosses Two Mile Canyon and Pajarito Canyon were reinforced with concrete to protect the road beds from becoming saturated and failing. Existing ACMs 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 (additional fill soil was added as needed). Trenches, as necessary, were excavated at all embankments. Embankments were reinforced with soil nails (shafts drilled into the embankment and pressure grouted) ACMs, and/or shotcrete (a concrete mix blown onto surfaces) (Photo 2.18). A spillway coated with shotcrete was incorporated into the design and

construction of the Anchor Ranch Road land bridge site at Pajarito Canyon. Outlet structures were also incorporated into the design and construction of all three canyon crossing road locations so that water would not pond behind the roadbeds for more than four days (96 hours) after a storm event.

PHOTO 2.18—*ACMs Used to Reinforce Road*

Flood Retention Structure

In early June 2000, a temporary earthen berm was constructed immediately upstream from the TA-18 facilities in Pajarito Canyon to serve as a storm water and debris retention structure. This structure was removed after construction of the large concrete flood and retention structure further upstream was started.

A new roller-compacted concrete flood and sediment retention structure in Pajarito Canyon above TA-18 (Photo 2.19) was installed to control storm water flooding and runoff down the canyon into TA-18 and into the White Rock residential area. Trees were removed from the construction area in the canyon bottom, and the area was graded in preparation for core drilling and construction. The existing road along the south side of Pajarito Road was graded and widened to accommodate construction trucks and vehicles. A new road was constructed to accommodate the heavy concrete equipment needed for construction of the structure itself. This road is about 25 ft (7.5 m) wide and less than 0.25 mi (0.4 km) in length. An existing road up Pajarito Canyon from TA-18 was regraded and improved for construction use on this project as well. Core drilling was performed and the resulting data were used, along with other information, to determine the size of the finished structure. The area cleared for the flood retention structure and

PHOTO 2.19—*Base of Flood Retention Structure in Pajarito Canyon Under Construction*

equipment staging and operations was about 800 ft (240 m) long by 500 ft (150 m) wide, totaling about 10 ac (4 ha). The structure extends 390 ft (117 m) across the canyon and is about 70 ft (21 m) high. The bottom of the retention structure is equipped with one 42-in.- (105-cm-) diameter drainage conduit, which will allow accumulated storm water to exit. Accumulated water will be retained no longer than 96 hours; water will drain naturally into the existing streambed. Soil was backpiled on the upstream side of the retention structure to provide additional structural strength. Soil was later regraded and placed against the sides of the canyon. Construction of the flood retention structure was conducted over about a six-week time period from July to late August 2000.

Two staging areas were used for construction equipment and lay-down sites: one was located directly off Pajarito Road, southeast of TA-66-1, and the other was located on the first bench of the canyon. The sizes of staging areas were about 300 ft by 300 ft (90 m by 90 m) and 200 ft by 300 ft (60 m by 90 m), respectively. These staging areas required site clearing. A concrete pad was constructed at the first bench site to accommodate the concrete batch plant construction. A 38- to 46-in.-diameter (95- to 115-cm) plastic pipe was extended off the mesa top from the batch plant; the pipe was intended to move aggregate down to the lower staging area, where the aggregate was to be mixed with water. The mixture would then have flowed down the pipe to the retention structure construction site. However, this system did not function properly and it was necessary to move the concrete by truck down the canyon to the retention structure construction site. Four concrete trucks were used, and about 400 trips per day for three weeks were required to complete the job. Two generators and light towers were used at the site. Construction was conducted 24 hours a day for the duration of the 60-day construction period.

Steel Diversion Wall

A 760-ft-long (228-m) steel diversion wall was constructed upstream of TA-18 in Pajarito Canyon (Photo 2.20). The wall will divert storm water and debris to the south of critical assembly building 1 (Kiva 1) at TA-18. Approximately 1,000 ft (300 m) of steel panels attached to large metal beams (Photo 2.21) were installed. The beams were driven vertically into the ground with a vibratory hammer. The sheets extended approximately 5 ft to 6 ft (1.5 m to 1.8 m) aboveground. Sheet piling was initiated in early July and completed in about three weeks. The structure was backfilled with earth to provide additional strength on the downstream side.

PHOTO 2.20—*Steel Diversion Wall at TA-18 Under Construction*

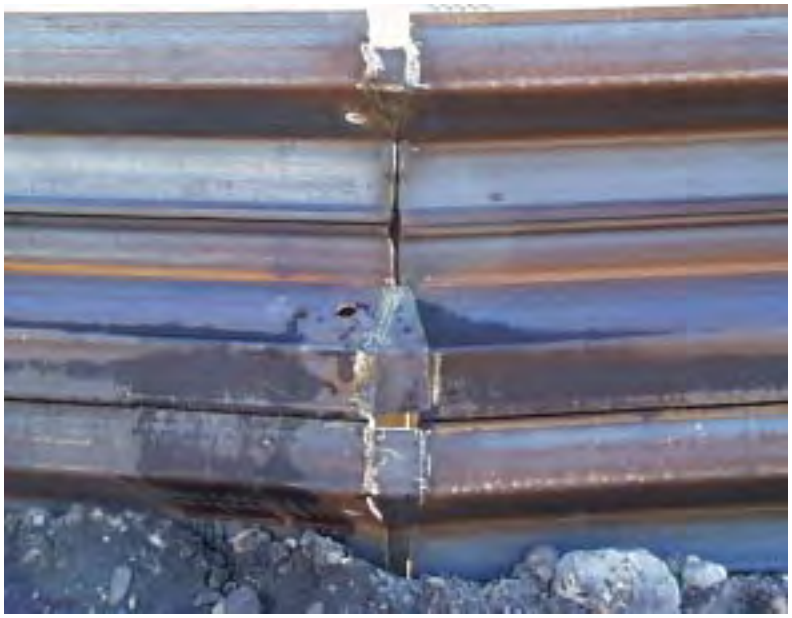

PHOTO 2.21—*Detail of Joined Steel Panel*

Other Activities at TA-18

The existing streambed located south of Kiva 1 in Pajarito Canyon was straightened, deepened, and widened approximately 10 to 15 ft (3 to 4.5 m) to create a larger drainage channel. About 1,600 ft (480 m) of channel was graded and scraped. The foot bridge that spanned the original drainage area was removed.

A "natural trash rack," or debris catcher, was also created above TA-18 in Pajarito Canyon for about one mile (1.6 km) by cutting burned and dead or dying trees within about 3 ft to 4 ft (0.9 m to 1.2 m) abovegrade. The tree tops and limbs were removed from the site using trucks. This action was conducted in June 2000 over about a two-week period. A debris catcher constructed of metal braces and bars was also installed at the upstream edge of the TA-18 facility (Photo 2.22). Both of these trash racks are designed to catch and hold back debris, such as logs and heavy rocks, that might be moved by floodwaters. The trash racks would therefore provide a protective measure to the TA-18 facilities against debris bombardment in the event of a flood.

PHOTO 2.22—*Trash Rack above TA-18 with Steel Diversion Wall in Background*

Additional activities were conducted at TA-18 that did not involve soil disturbance. These activities included moving on-site radioactive materials around the TA-18 facilities to maximize protection from storm water flooding conditions and moving nonessential employees to other LANL locations.

Culvert Replacement at SR 4

In June 2000, DOE allowed the New Mexico State Highway Department to use an area of TA-36 next to the intersection of Pajarito Road and SR 4 for an equipment and supply staging area. The Highway Department removed existing culverts along SR 4 within the road easement corridor and replaced the culverts with larger ones. As a part of that action the Highway Department removed vegetation surrounding the culvert site within the road easement and at the staging site nearby in Pajarito Canyon.

2.3.2.3 Other Watersheds

Sandia Canyon Watershed

The TA-60 access road into Sandia Canyon was repaired by grading part of the road. Diversion structures and BMPs, primarily rock gabions, were installed around the RLW cross-facility pipeline to prevent soil erosion around that structure within Sandia Canyon at TA-60.

Mortandad Canyon Watershed

The activities described below were located within Mortandad Canyon and Cañada del Buey. No watershed-specific activities were undertaken in Ten-Site Canyon. The access road into Mortandad Canyon was repaired by regrading it. Using this road, about 350 yd^3 (266 m^3) of sediment were removed from the three existing sediment traps in Mortandad Canyon during July 2000. The purpose of this maintenance action was to increase the capacity of the existing traps in case of flooding during an extreme rain event and to prevent the sediments from migrating off site. The traps were constructed in 1986 and consist of large excavated basins surrounded by U-shaped berms that were built from the excavated alluvium; the traps have not been cleaned since 1992. The traps are approximately 900 ft (270 m) long and a maximum of 200 ft (60 m) wide and are located along the Mortandad Canyon stream channel downstream from the confluence of Mortandad Canyon and Ten-Site Canyon. The total capacity of the sediment traps is about 1.2 million gal. (4.5 million l). The sediments were excavated using heavy equipment and silt was placed onto flatbed trucks and removed from the site to LANL's low-level waste disposal site at TA-54.

The existing roadway within Cañada del Buey was bermed to provide outfall drainage control. The storm water drainage outfall location for TA-54 was also recontoured within this canyon. A bulldozer was used to perform both of these soil-disturbing activities.

Water Canyon Watershed

The activities described below occurred in Water Canyon. No watershed-specific post-fire activities were undertaken in Cañon de Valle, Potrillo Canyon, or Fence Canyon.

Erosion and flood control structures were constructed along SR 501 at the Water Canyon crossing area. At this location, the road embankment was reinforced with shotcrete, which will serve to keep the road bank from becoming saturated and failing. The road

embankments and culverts will act as a flow control structure, slowing storm water runoff into the canyon. Existing ACMs and reinforcement matting were removed, along with trees on or near highway embankment slopes. The embankments were then cleared, tree roots and rocks were removed, and the area was regraded. Trenches were excavated at all embankments. The embankments were reinforced with ACMs, soil nails, and shotcrete as needed.

BMPs were installed at the MDA-R site, which was partially excavated to suppress a subterranean fire at that disposal site. These BMPs will protect the remaining waste from runon and runoff, as well as the pit formed when a portion of MDA-R was excavated.

2.4 Mitigation Measures

Mitigation measures were and will be implemented for actions described throughout Section 2.1. These mitigation measures are designed to

- minimize the potential for long-term significant impacts associated with specific response actions,
- minimize the cumulative effects of regional response actions,
- optimize the maintenance and function of response structures and actions, and
- contribute to the long-term fire recovery process.

These mitigation measures are part of the actions DOE will take to maintain response action structures and other initiatives. Some of these mitigation measures collectively provide the basis for site-wide mitigation as part of the Cerro Grande Fire SWPP Plan and are included in the *Clean Water Act* Section 404 Permit. The specific location and type of mitigation actions vary throughout the watersheds of the ROI but may be generally categorized under the headings of resource management mitigations.

The following describes the scope of mitigation measures:

- Monitoring, recontouring, and reseeding with site-specific seed mixtures at construction areas (that were previously seeded at the end of the construction activity) will be performed as needed until the construction sites have been completely revegetated.

- Restored burned areas that have been reseeded, as well as other erosion hazard reduction actions, will be monitored annually for the next five years (through 2005). Repair, replacement, or repetition of these actions will be undertaken as needed until at least 90 percent revegetation is achieved or until post-fire storm event flows approximate pre-fire flow rates according to modeling and monitoring results.

- Removal of the constructed flood control and erosion damage reduction features and the flood retention structure 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 the structures are removed, recontouring

and reseeding of these areas with appropriate site-specific seed mixtures would be conducted until these construction sites have been completely revegetated.

- Assessments and reevaluations of management plans for various natural and cultural resources within LANL will be undertaken and implemented as appropriate. These plans include the recently implemented LANL Threatened and Endangered Species Habitat Management Plan.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

The 1999 LANL SWEIS (DOE 1999) described the existing environment of the Los Alamos area; however, the Cerro Grande Fire altered many of the existing conditions both at LANL and in the surrounding area. These effects are only partially known at this time. Ongoing evaluations conducted over the next several years will increasingly refine DOE's understanding of the short- and long-term effects of the fire on various resources. Primarily, the fire destroyed vegetation and altered soil characteristics in the upper portions of several watersheds above LANL. As a consequence, the amount of storm water runoff for a given rain event has increased substantially. The rate, duration, and location of the rain event will determine the energy of the runoff and whether soils and sediments will be deposited or eroded. The higher energy expected for some runoff events will result in the flow entraining larger than normal amounts of fire-damaged vegetation debris, soil, sediments, and rock. Some sediments may contain low levels of radionuclides, heavy metals, and other contaminants. These effects are expected to continue at least for three to five years. Other long-term changes (five years or more) resulting from the fire include changes in habitat for T&E species and other biotic resources, in cultural resources, and in the visual environment. Floodplains and wetlands, air quality, waste management, environmental restoration, socioeconomics, transportation, and human health were all affected to some extent in the short term (less than five years).

Watersheds are natural boundaries that provide a commonality for describing multiple resource effects, including ecological resources, analysis, and management. The complex canyon and mesa topography and pronounced elevational gradients of the LANL region are particularly well suited for discussion about ecological impacts within regional watersheds. Watersheds provide the following descriptive benefits:

- relatively discrete landscape units with a hierarchical structure;
- relatively closed systems in terms of many ecological components and processes such as hydrologic regime, nutrient cycling, contaminant transport, erosion, and sedimentation;
- provide an ecologically consistent template for organizing information on ecosystem components, such as landscape-wide vegetation zones as well as resident and migratory wildlife populations (including T&E species and wetlands).

The following sections summarize the environmental baseline at LANL and in the surrounding geographic areas of concern, or the ROI as discussed in the 1999 LANL SWEIS, changes that are expected under the Expanded Operations Alternative selected in the SWEIS ROD, and changes as a result of the fire to the extent that they are now known or estimated. The boundaries of the ROI depend on the resource under consideration. For hydrology, for example, the ROI includes all the watersheds affected by the fire and the Rio Grande to the point where it enters Cochiti Reservoir. The ROI for environmental restoration, in contrast, consists of LANL and the area immediately downstream.

3.2 Land Use

Section 4.1.1 of the 1999 LANL SWEIS provides a detailed description of land use in the region and at LANL before the Cerro Grande Fire. Land use in and around LANL under the Preferred Alternative selected in the SWEIS ROD is described in detail in Section 5.3.1.1 of the SWEIS. The ROI includes LANL, Los Alamos, White Rock, and surrounding Forest Service and National Park Service lands.

Land use in this region consists of the Los Alamos and White Rock townsites, which primarily include residential, commercial, light industrial, and recreational facilities. Land use within LANL is described within LANL's Comprehensive Site Plan 2000 (LANL 2000c) and includes the following types of land use: administration, experimental science, high explosive testing and research and development, nuclear materials research and development, physical/technical support, public/corporate interface, theoretical/computational science, waste management, and reserve areas that provide an environmental and security buffer.

Land uses in the region are temporarily affected by the Cerro Grande Fire. During the period from the beginning of the fire to some point probably about two to three years in the future in at least part of LANL and the surrounding forest lands, access and use of certain recreation areas and trails is restricted. Fires within LANL, particularly in the buffer zones, reduced the amount of vegetation that provided part of the human health and safety and security buffer function.

One of the primary land use zones within Los Alamos townsite is residential. About 230 housing units in that zone were totally destroyed (Photo 3.1). Within LANL, the structures that were totally destroyed, including trailers, transportables, and storage units, numbered about 40 (personal communication, H. Nunes).

PHOTO 3.1—*Burned Residential Unit in Los Alamos Townsite*

3.3 Geology and Soils

3.3.1 Geology

The 1999 LANL SWEIS (DOE 1999) discusses the history of regional volcanism and seismic activity, predictions of future volcanic activity, seismic hazard analysis, and studies on fault rates and terminations. The SWEIS also discusses slope stability as a function of canyon wall steepness, canyon depth, and geologic stratigraphy. The ROI for geological resources consists of the entire burned area and LANL areas where various fire suppression and post-fire activities occurred. Although the Cerro Grande Fire had no effects on volcanism and seismic activity, there have been impacts on slope stability. Increased soil erosion caused by loss of canopy and ground cover during the fire has destabilized rocks close to the edges of mesas, mesa sideslopes, and canyon bottoms. One example of this phenomenon occurred on LANL immediately west of SR 501 on June 28, 2000, where geologic parent materials, originally lying beneath alluvium and soils, were uncovered and transported downstream.

3.3.2 Soils

The 1999 LANL SWEIS (DOE 1999) described the soil series on the mesa tops and their geochemistry, soil monitoring of radionuclides and heavy metals, and soil erosion as the mechanism for moving contaminants. The Cerro Grande Fire destroyed much of the forest canopy cover (see discussion in Section 3.4 and Table 3.1) and ground cover above these soils, thus increasing their susceptibility to erosion. In addition, the fire also altered soil characteristics that further increased the erosion potential.

The BAER Team used the Universal Soil Loss Equation (USLE) to assess potential soil erosion from field locations varying in burn severity, aspect, vegetation type, and a microclimate vegetation modifier (Figures 3.1 and 1.3 [see page 1-9]). These estimates of soil erosion for the soils in the entire burn area were derived from the Santa Fe National Forest soil survey, which contained estimates of USLE erosion rates (based on a limited set of factors) for potential conditions with no canopy and ground cover, such as those that occurred as a result of the fire. Before the fire, UC staff studied a portion of the burn area outside LANL using the full set of USLE factors. Soil erosion was estimated to be greater than the Santa Fe National Forest survey predicted (LANL 2000d).

By creating hydrophobic soils, the Cerro Grande Fire also affected the hydrologic functions of these soils in a manner that further enhanced potential erosion. There is a close correlation between these hydrophobic soil properties and the amount of heat experienced by the soil and the residence time of the heat in contact with the soil. The development of hydrophobic soils is a factor in assigning a high-burn severity designation (Figures 3.2 and 1.3).

3.3.2.1 Post-fire Acreage of Hydrophobic Soils

The ROI for soil issues is defined as the entire area burned by the Cerro Grande Fire (see Figure 1.2, page 1-3) and the LANL areas where DOE activities took place. Hydrophobic soils are scattered throughout this area generally in the upper elevations of the Jemez

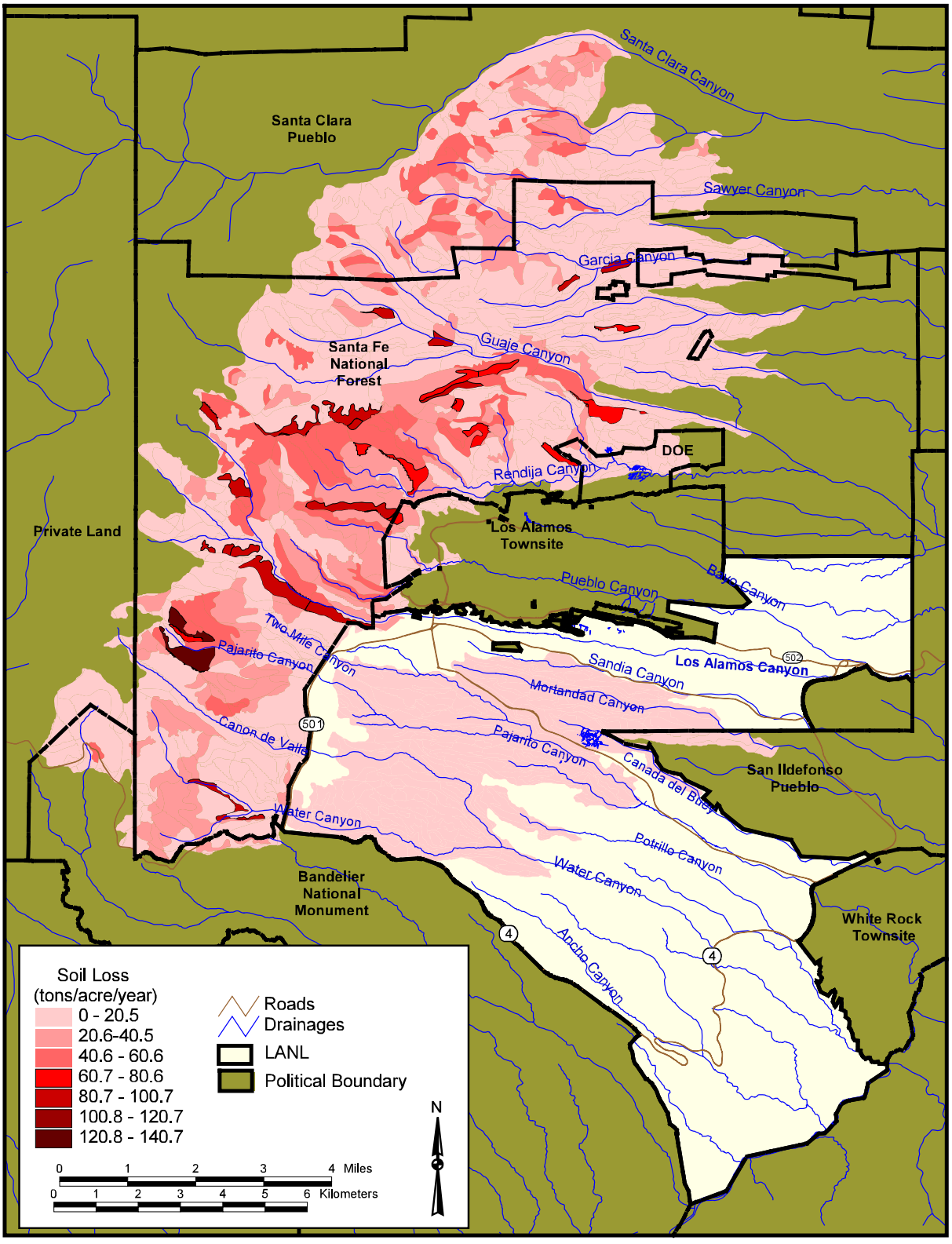

FIGURE 3.1—*Post-fire Soil Erosion Estimates in the ROI*

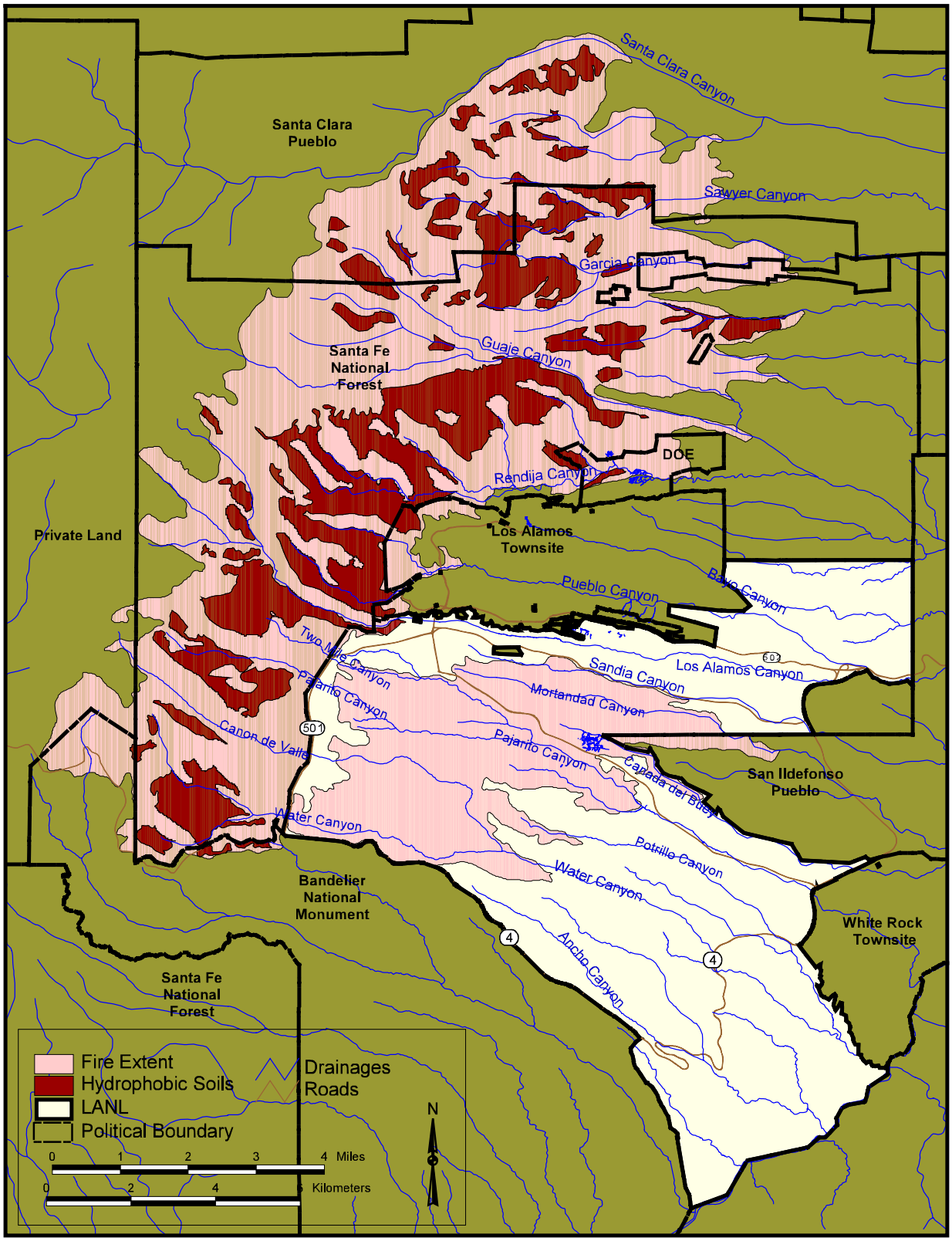

FIGURE 3.2—*Hydrophobic Soils in the ROI*

Mountains. They are usually limited to areas with a high-burn severity (Figure 3.2). Hydrophobic soils occurred on a total of about 9,310 ac (3,724 ha) of the 14,510 ac (5,804 ha) in the high-burn severity category. No large areas of hydrophobic soils were found within LANL (Figure 3.2).

3.3.2.2 Post-fire Acreage of Hydrophobic Soils by Watershed

The Cerro Grande Fire extended across 16 canyons (see Figure 1.2, page 1-3), burning from 103 ac (42 ha) in Frijoles Mesa Canyon to 6,553 ac (2,651 ha) in Guaje Canyon as shown in Table 3.1. Five of these canyons contained no detectable hydrophobic soils. Rendija Canyon contained the largest acreage of hydrophobic soils (1,917 ac [767 ha]), and Pueblo Canyon contained the largest percentage of hydrophobic soils (51.8 percent) relative to the acres burned in this watershed.

TABLE 3.1—*Burned Areas and Hydrophobic Soils in each Watershed Affected by the Cerro Grande Fire*

Watershed	Area Burned ac/ha	Hydrophobic Soils ac/ha	% Hydrophobic Soils
Los Alamos Canyon Watershed			
Los Alamos Canyon	2,922/1,169	661/264	22.6
Pueblo Canyon	1,602/641	829/332	51.8
Rendija Canyon	4,476/1,790	1,917/767	42.8
Guaje Canyon	6,553/2,621	1,314/526	20.1
Pajarito Canyon Watershed			
Pajarito Canyon	5,179/2,072	940/376	18.2
Mortandad Canyon Watershed			
Mortandad Canyon	1,343/537	0/0	0.0
Cañada del Buey	422/169	0/0	0.0
Water Canyon Watershed			
Water Canyon	4,918/1,967	737/295	15.0
Potrillo Canyon	234/94	0/0	0.0
Cañon de Valle	2,057/823	94/38	4.6
Sandia Canyon Watershed			
Sandia Canyon	407/163	0/0	0.0
Other Watersheds			
Chupaderos Canyon	2,005/802	508/203	25.4
Frijoles Mesa Canyon	103/41	0/0	0.0
Frijoles Canyon	1,145/458	52/21	4.6
Garcia Canyon	3,714/1,485	923/369	24.8
Santa Clara Canyon and Tributaries	5,886/2,354	1,335/534	22.7

3.4 Water Resources

The affected hydrological environment considered by this analysis includes baseline surface and subsurface water quality and quantity conditions as well as changes resulting from the Cerro Grande Fire.

3.4.1 Surface Water

The ROI for surface water issues extends from the crest of the Sierra de los Valles down to Cochiti Reservoir, which includes the five watersheds discussed in detail in this SEA (see Figure 2.1, page 2-3). Section 4.3.1 of the 1999 LANL SWEIS (DOE 1999) describes surface water conditions on LANL before the Cerro Grande Fire. 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. Runoff from thundershowers or snowmelt reaches the Rio Grande, the major river in north-central New Mexico, several times a year in some drainages. Effluents from sanitary sewage, industrial waste water treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

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 that cross LANL property. Table 3.2 shows estimated pre-fire and post-fire peak flows and total volume for storm water runoff in canyons on LANL (Rae 2000a and 2000b). Estimates are based on a six-hour storm with a 100-year return period, which is the event used by DOE at LANL for siting new construction and which has been used in various NEPA analyses including the 1999 LANL SWEIS. Estimated post-burn peak flows in Pueblo Canyon, one of the most severely burned, were almost 16 times greater than pre-burn. Soil erosion rates and sediment loads from these burned areas are also expected to be much greater than pre-fire levels for many years, depending on the success of soil erosion control structures and vegetation recovery (see Section 3.3, page 3-3). Fire also mineralizes organic nitrogen, which can produce a flush of nitrate into surface and shallow groundwater and a subsequent temporary reduction in water quality. Total suspended solids will also increase and temporarily reduce surface water quality.

TABLE 3.2—*Hydrological Model Output Estimates for Burned Watersheds*

Watershed	Pre-burn Peak Flow (ft^3/s^{-1} / m^3/h^{-1})	Post-burn Peak Flow (ft^3/s^{-1} / m^3/h^{-1})	Volume (acre-ft/ha-m)
Los Alamos			
LA Canyon:			
at Reservoir		2,216/225,800	476/58
at Omega Bridge	532/54,200	2,182/222,300	529/65
Pueblo Canyon:			
at Diamond Dr.	206/21,000	3,276/333,800	297/36
at LA Canyon		1,072/109,200	420/52
below Pueblo Canyon	589/60,000	1,299/132,400	1,006/124
Pajarito			
Pajarito Canyon:			
at SR 501	146/14,900	2,063/210,200	235/29
below Two Mile		2,806/285,900	60/7
TA-18		2,492/253,900	673/83
at SR 4		1,881/191,700	638/78
Mortandad			
Mortandad at LANL boundary	35/3,600	264/26,900	N/A
Cañada del Buey at SR 4	72/7,300	90/9,200	41/5

TABLE 3.2—*Continued*

Watershed	Pre-burn Peak Flow (ft^3/s^{-1} / m^3/h^{-1})	Post-burn Peak Flow (ft^3/s^{-1} / m^3/h^{-1})	Volume (acre-ft/ha-m)
Water Canyon			
Water Canyon at SR 501	264/26,900	1,849/188,400	289/36
Cañon de Valle at SR 501	147/15,000	714/72,800	147/18

Estimates based on EES-15/ESH-18 hydrologic estimates of a six-hour storm with a 100-year return period. Pajarito Canyon estimates were revised following the June 28 runoff event. Pre-burn estimates are not available for all locations. Cubic meters per hour is m^3/h^{-1}. Cubic feet per second is ft^3/s^{-1}.
Source: Conversions taken from the Soil Science Society of America Journal.

The BAER Report did not identify any large areas of hydrophobic soils on DOE property (see Figure 3.2, page 3-5). The primary source of runoff, therefore, is from the slopes of the Jemez Mountains west of LANL. On-site generation of runoff is not expected to make a major contribution to peak flows through the canyons on LANL.

3.4.2 Groundwater

Section 4.3.2 of the 1999 LANL SWEIS describes groundwater conditions on LANL before the Cerro Grande Fire. Intermediate perched groundwater bodies of limited extent occur beneath the alluvium in portions of Pueblo, Los Alamos, and Sandia Canyons; in volcanic rocks on the sides of the Jemez Mountains to the west of LANL; and on the western portion of the Pajarito Plateau. Undiscovered intermediate perched groundwater bodies may exist, as the drilling coverage for these groundwater bodies has been relatively limited. Springs in the LANL area flow from alluvial and intermediate perched groundwater bodies and the main aquifer. Springs can be found in Water, Guaje, Pueblo, Los Alamos, Pajarito, Frijoles, and White Rock watersheds.

The Cerro Grande Fire has removed vegetation over large areas of individual watersheds. This is likely to result in an increase in runoff and a substantial reduction in plant transpiration of water from upland soils. Over a period of three to five years, this could lead to an increase in perched groundwater and springs within the ROI. Over the long term, this situation is likely to revert to pre-fire conditions. Additionally, as noted, fire mineralizes organic nitrogen, which can produce a flush of nitrate into surface and shallow groundwater and a subsequent temporary reduction in water quality.

The main aquifer is separated from alluvial and intermediate perched zone groundwater bodies by 350 to 620 ft (107 to 189 m) of unsaturated volcanic tuff and sediments. Recharge of the main aquifer is not fully understood nor characterized. The effects of the Cerro Grande Fire on intermediate and deep groundwater are unknown.

3.5 Floodplains and Wetlands

The Cerro Grande Fire removed vegetation from many of the watersheds on the eastern side of the Pajarito Plateau (see Table 3.1, page 3-6). Many of these watersheds are on or above LANL and other areas are adjacent to LANL. This section considers the existing floodplains and wetlands within the LANL boundaries. The ROI for floodplains and wetlands includes floodplains and wetlands with LANL boundaries and those downstream from LANL.

The loss of vegetation on these watersheds will result in more runoff reaching the canyon bottoms. More runoff in the canyons will result in the transport of greater than normal amounts of debris, including fire-damaged vegetation and soil.

In normal years, large amounts of rain falling in or above Los Alamos would likely not reach the Rio Grande. However, following the fire many of these canyons will probably transport water and debris to the Rio Grande after very heavy rain events.

3.5.1 Floodplains

DOE had delineated all 100-year floodplains within LANL boundaries before the Cerro Grande Fire (Figures 3.3 through 3.7) in accordance with requirements presented in RCRA (40 CFR Part 270) and Executive Order 11988—Floodplain Management (1999 LANL SWEIS). Due to increased runoff as a result of the fire, all of the floodplain areas in and below burn areas indicated in Figures 3.3 through 3.7 have increased (under unmodified conditions). The amount of increase will depend on the amount of vegetation mortality, soil conditions, slope, and other factors. In rainstorms, more water will reach the canyon bottoms than normally would occur. Depending on the character of the runoff event, the floodplains could be affected by erosion or deposition.

Overall, most LANL development is on mesa tops, and development within canyons is light; however, there are a number of structures within the 100-year floodplain. Most may be characterized as small storage buildings, guard stations, wellheads, water treatment stations, and light laboratory buildings. There are no waste management facilities in the 100-year floodplain. Some facilities are characterized as moderate hazard due to the presence of sealed sources or x-ray equipment, but most are low-hazard radiological facilities or have been assigned no hazard designation. The Solution High-Energy Burst Assembly Building at TA-18 is within the Pajarito Canyon 100-year floodplain. The 500-year floodplain has been designated only for Los Alamos Canyon. The Omega-West reactor (inactive) is located within this 500-year floodplain and is classified as a low-hazard radiological facility. Depending on the character of the runoff event, structures and facilities located in floodplains could be affected by erosion or silt and debris deposition.

3.5.2 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. LANL has wetlands that were identified by the National Wetlands Inventory, conducted by the U.S. Fish and Wildlife Service (USFWS) in 1990, as well as other wetlands that have been identified subsequent to the 1990 Inventory.

Wetlands must have the following attributes: at least periodically, the land supports predominantly hydrophytes (plants adapted to abundant water such as cattails and willows); 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 (USACE 1987). Wetlands in the general LANL region provide habitat for reptiles, amphibians, and invertebrates (e.g., insects). Wetlands also

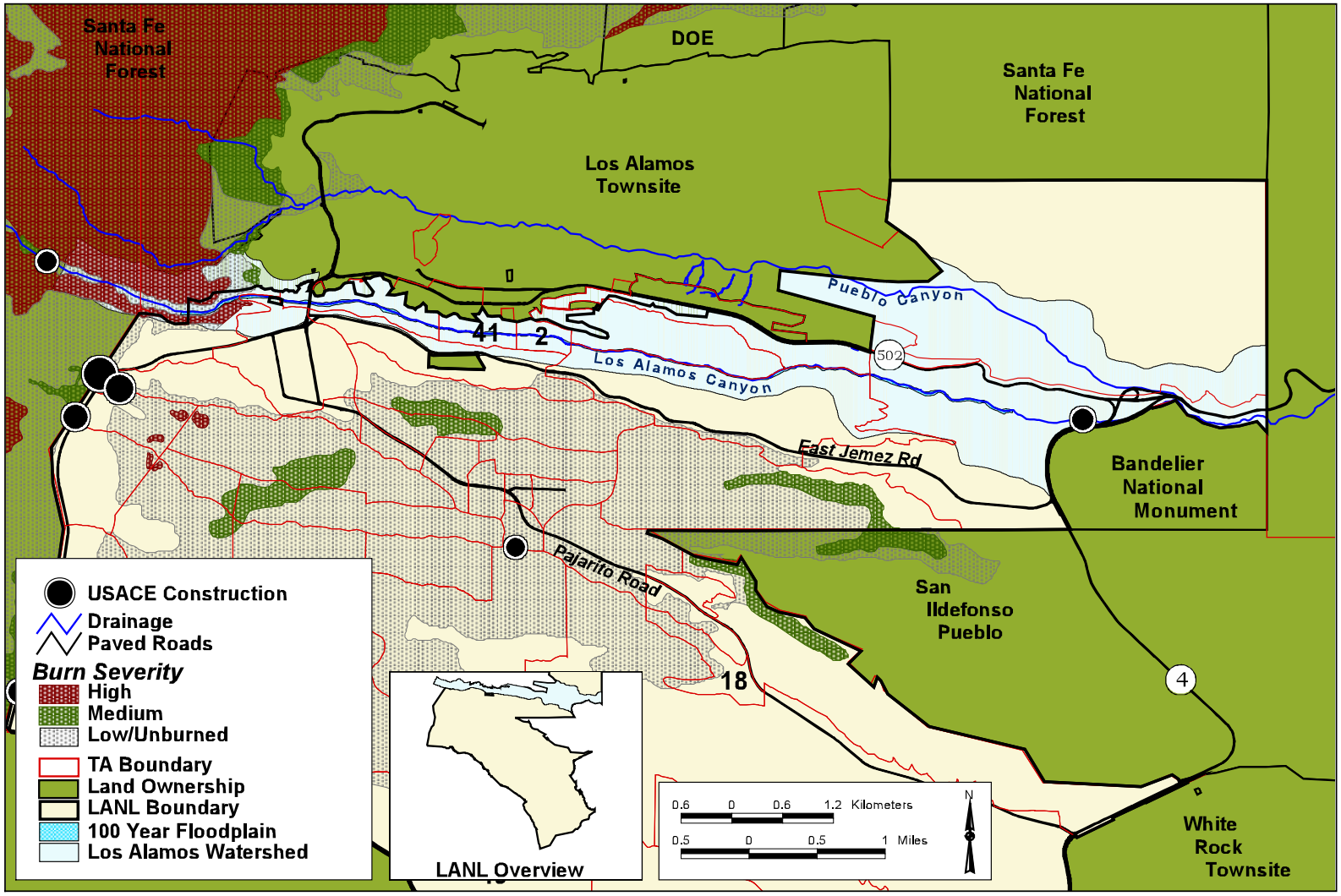

FIGURE 3.3—*Los Alamos Canyon Watershed with Burn Severity and 100-Year Pre-fire Floodplain*

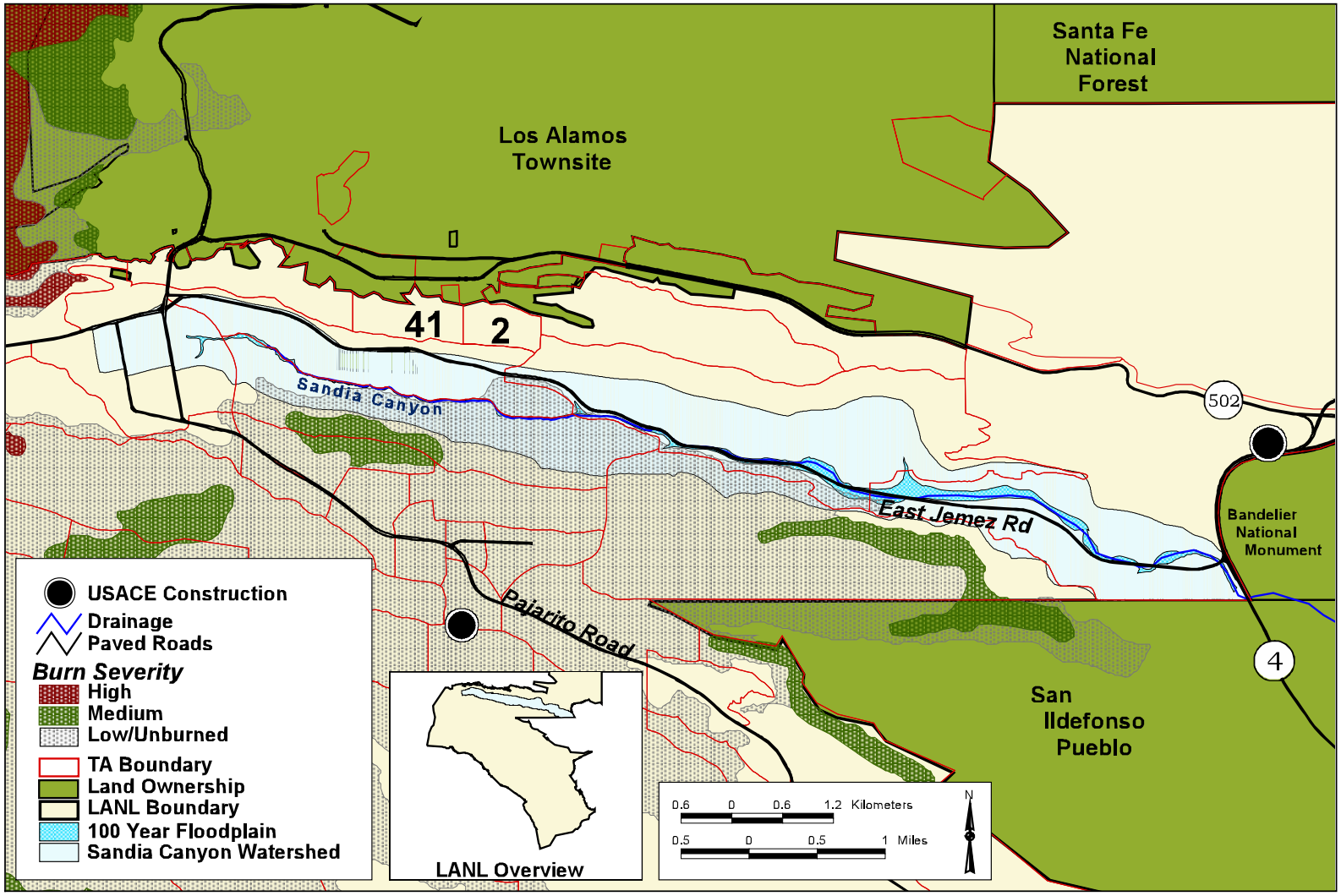

FIGURE 3.4—*Sandia Canyon Watershed with Burn Severity and 100-Year Pre-fire Floodplain*

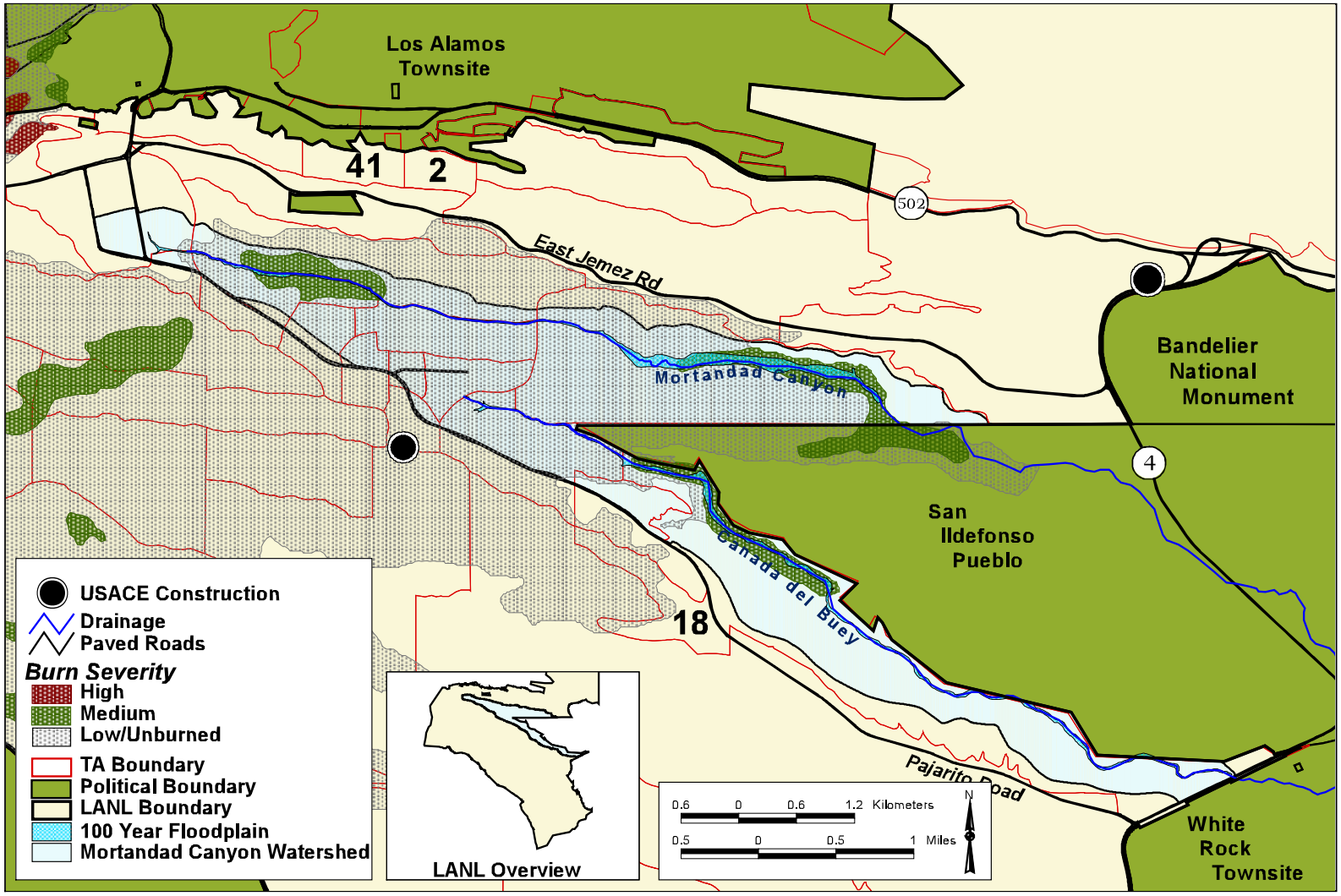

FIGURE 3.5—*Mortandad Canyon Watershed with Burn Severity and 100-Year Pre-fire Floodplain*

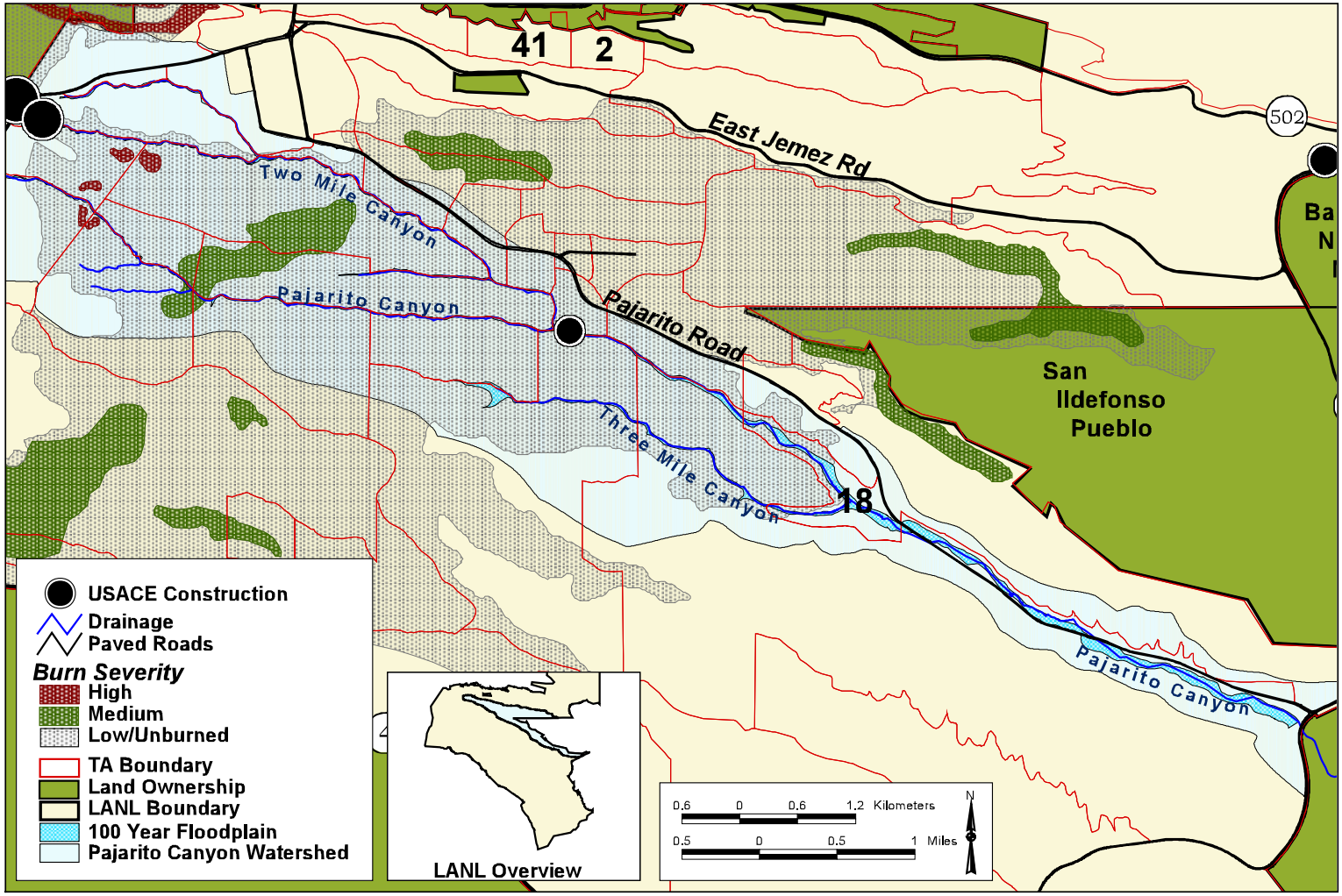

FIGURE 3.6—*Pajarito Canyon Watershed with Burn Severity and 100-Year Pre-fire Floodplain*

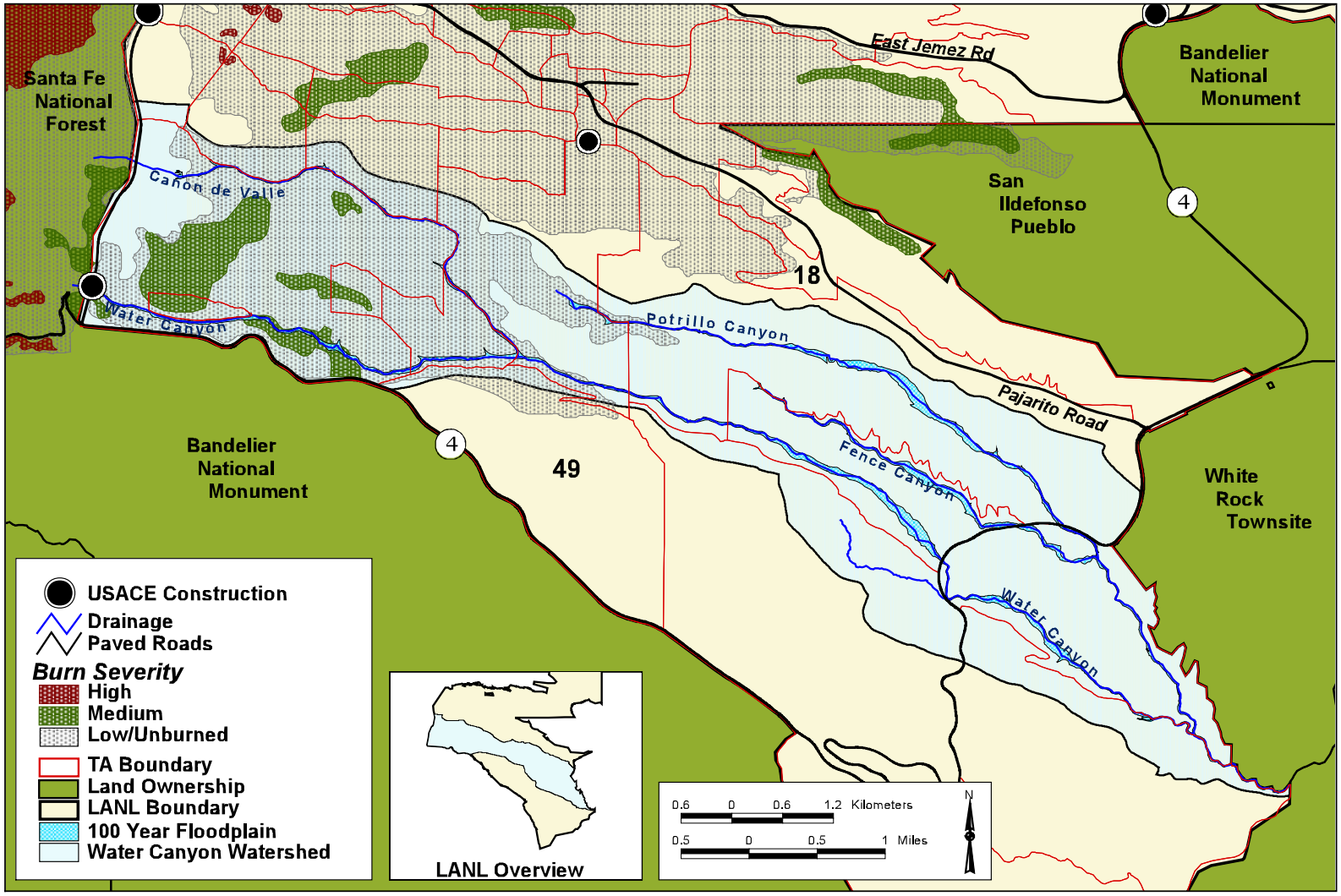

FIGURE 3.7—*Water Canyon Watershed with Burn Severity and 100-Year Pre-fire Floodplain*

potentially contribute to the overall habitat requirements of the Mexican spotted owl, southwestern willow flycatcher, and spotted bat, all of which are federal- or state-listed species, or both. 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 or seeps.

There are a total of 77 ac (31 ha) of wetlands at LANL. More than 95 percent of the identified wetlands are located in the Sandia, Mortandad, Pajarito, and Water Canyons watersheds (1999 LANL SWEIS). 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. No wetlands within LANL were severely burned. Additional riparian areas along the drainages burned during the fire; however, these are not wetlands and are not included in the total acres of wetland.

During a fire, the surface vegetation is destroyed. If the fire does not last too long or is not too intense, the vegetation will grow back within the same growing season. If the area of the wetland is severely burned, the vegetation may take several years to return. A flood event of sufficient energy could scour out or channelize the streambed and either damage or destroy the wetlands. Wetland areas could receive increased sediment from runoff as well. Small amounts of sediment from the burned area will enhance wetland growth due to nutrients in the ash. However, large amounts of deposited sediment can permanently alter the condition of existing wetlands and destroy them. The effects of the Cerro Grande Fire on LANL wetlands have not yet been fully assessed.

3.5.2.1 By Watersheds

Los Alamos Canyon Watershed

Most of the vegetation in Los Alamos Canyon upstream of LANL was destroyed during the fire. Most of the vegetation in Pueblo Canyon upstream of Diamond Drive in Los Alamos townsite was also destroyed. The Forest Service and the County of Los Alamos either administer or own lands in upper Pueblo Canyon. However, DOE administers some of the lower portions of Pueblo Canyon and had many activities in this canyon in the past. On DOE-administered land, the Los Alamos Canyon watershed had 1.24 ac (0.50 ha) of the floodplain burned at low-intensity while 7.42 ac (3 ha) were burned severely. Vegetation mortality is shown in Table 3.3 and Figure 3.3 (page 3-10).

TABLE 3.3—*Vegetation Mortality on Floodplains by Watershed*

Watershed	Vegetation Mortality			
	Low 10% to 40% (ac/ha)	Moderate 40% to 70% (ac/ha)	Severe 70% to 100% (ac/ha)	Total per Watershed (ac/ha)
Los Alamos	1.24/0.50	NA	7.42/3.00	64.01/25.90
Pajarito	72.76/29.45	2.32/0.94	0.24/0.10	176.65/71.49
Sandia	1.58/0.64	NA	NA	102.82/41.61
Mortandad	54.58/22.09	8.55/3.46	NA	124.17/50.25
Water	66.51/26.92	6.77/2.74	NA	345.54/139.84
Total Type	**196.67/79.60**	**17.64/7.14**	**7.66/3.10**	**813.19/329.09**

Because of the potential for increased runoff, the floodplain has been greatly increased in Los Alamos and Pueblo Canyons. Because of increased size of the floodplain, any rain event in the watershed will have greater than normal runoff and erosion. Additional debris and ash left from the fire will also be transported down the canyons during rainstorms.

No wetlands were directly burned in the Los Alamos Canyon watershed. However, riparian areas burned in the upper portions of the DOE portions of this watershed. Riparian areas are areas directly adjacent to the stream bottom that require water to be present only temporarily during the year. The riparian areas usually receive stream flow intermittently during the rainy season or in the spring after snow begins to melt. Wetlands in the watershed are likely to receive increased runoff.

Pajarito Canyon Watershed

There was significant mortality of vegetation in the upper portions of this watershed west of LANL. The upper watershed suffered mostly high damage to vegetation while the lower portion had low and moderate vegetation damage. In the LANL portion of the watershed, 72.76 ac (29.45 ha) burned at a low intensity, 2.32 ac (0.94 ha) were burned moderately, and 0.24 ac (0.10 ha) was severely burned. Because of the fire in the watershed, the size of the Pajarito, Two Mile, and Three Mile Canyons floodplain has increased (see Figure 3.6, page 3-13). Because of increased size of the floodplain, any rain event in the watershed will cause greater than normal runoff and erosion. Stormwater runoff will carry additional debris and ash left from the fire down the canyons.

Wetland vegetation totaling 1.24 ac (0.5 ha) burned in the Pajarito Canyon watershed, suffering a 10 percent to 40 percent vegetation mortality. The wetlands that burned were only small areas of hydrophytic vegetation immediately surrounding isolated springs. Riparian areas also burned in the upper portions of the LANL portion of this watershed. None of the large wetlands in the lower portions of the watershed burned. As in other canyons, the wetlands in the watershed are likely to receive increased runoff.

Other Watersheds

Sandia Canyon Watershed

In the Sandia Canyon watershed, about 1.58 ac (0.64 ha) of floodplain burned at a low intensity (see Figure 3.4, page 3-11). The areas of this watershed that burned were patchy and were not large contiguous areas. There should be little effect to the floodplain in Sandia Canyon.

No wetlands were directly burned in the Sandia Canyon watershed. However, wetlands in the watershed are likely to receive increased runoff.

Mortandad Canyon Watershed

There was significant mortality of vegetation in the Mortandad Canyon watershed. The upper watershed suffered mostly moderate damage to vegetation while the lower portion

had severe vegetation loss. In the watershed, there were 54.58 ac (22.09 ha) of floodplain vegetation with low-intensity burn and 8.55 ac (3.46 ha) were moderately burned (see Table 3.3, page 3-15). Because of the fire in the watershed, the size of the Mortandad Canyon and Cañada del Buey floodplain has increased (see Figure 3.5, page 3-12). Because of increased size of the floodplain, any rain event in the watershed will have greater than normal runoff and erosion. Additional debris and ash left from the fire will also be transported down the canyons during the rainstorms.

A total of 4.78 ac (1.93 ha) of wetlands vegetation in the Mortandad watershed were burned. Specifically, about 2.98 ac (1.2 ha) suffered a 10 percent to 40 percent vegetation mortality, while 1.8 ac (0.73 ha) suffered a 40 percent to 70 percent vegetation mortality. In addition, riparian areas burned in the upper portions of this watershed. The wetlands in the watershed are likely to receive increased runoff.

Water Canyon Watershed

There was significant loss of vegetation in the upper portions of this watershed west of LANL. However, the size of the upper watershed west of LANL is relatively small compared to Los Alamos and Pajarito Canyons watersheds. The upper watershed suffered mostly severe damage to vegetation while the lower portion had low and moderate vegetation mortality. On the LANL portion of the watershed, 66.51 ac (26.92 ha) of the floodplain burned at low-intensity while 6.77 ac (2.74 ha) were moderately burned (see Table 3.3, page 3-15). Because of the fire in the watershed, sizes of the Water and Potrillo Canyons floodplain have increased (see Figure 3.7, page 3-14). Because of increased size of the floodplain, any rain event in the watershed will cause greater than normal runoff and erosion. Stormwater runoff will carry additional debris and ash left from the fire down the canyons.

A total of about 9.83 ac (3.98 ha) of wetlands vegetation in the Water Canyon watershed were burned. Specifically, 7.67 ac (3.1 ha) of wetland vegetation suffered a 10 percent to 40 percent vegetation mortality and 2.16 ac (0.88 ha) suffered a 40 percent to 70 percent vegetation mortality. All of the wetlands areas were in upper Cañon de Valle. The burned wetlands were large areas of hydrophytic vegetation in the canyon bottom. In addition, riparian areas burned in the upper portions of the LANL portion of this watershed. The wetlands in the watershed are likely to receive increased runoff.

3.6 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 (Photo 3.2) and deer, bear, mountain lions, coyotes, rodents, bats, reptiles, amphibians, invertebrates, and a myriad of resident, seasonal, and migratory bird life. In addition, T&E species, 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 de facto refuge for wildlife.

PHOTO 3.2—*Elk Calf in the Los Alamos Area*

Section 4.5.1 of the 1999 LANL SWEIS provides a detailed summary of the ecological resources in and around LANL before the Cerro Grande Fire. The ROI is also described in this section. The impacts on the ecological resources in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.5. DOE and UC have developed a LANL Threatened and Endangered Species Habitat Management Plan in consultation with USFWS that delineates the habitat of T&E species. This management plan contains guidelines for managing LANL activities so as to limit potential effects on these species and their potential habitat within LANL.

3.6.1 ROI

3.6.1.1 Habitat Changes

Table 3.4 lists the total vegetation mortality within LANL.

TABLE 3.4–*Total Percentage of Vegetation Mortality on LANL within each Vegetation Zone*

Land Cover Type	Total Area (ac)	Vegetation Mortality (%)			
		0 to 10	10 to 40	40 to 70	70 to 100
Mixed Conifer	829.52	43.84	49.43	2.51	4.22
Aspen	40.90	21.44	49.10	28.95	0.51
Ponderosa Pine	8,174.09	45.59	47.33	5.74	1.34
Piñon/Juniper	12,930.17	89.08	9.71	1.19	0.02
Juniper Woodland	986.11	98.46	1.30	0.23	0.01
Grassland	1,815.46	47.83	45.63	6.53	0.01

The Cerro Grande Fire burned approximately 43,150 ac (17,261 ha). Preliminary results indicate that about 34 percent of those acres were burned with low severity (i.e., burn severity relates to the fire's impact on soil features), 8 percent with moderate severity, and about 58 percent with high severity. The fire created a habitat mosaic that is dynamic and will offer changing opportunities for plant and animal communities.

One of the BAER Team restoration activities of the burned area west of LANL includes reseeding efforts. The mixture of seeds being used for the reseeding effort contains two nonnative species (BAER 2000). These reseeding efforts in addition to other post-fire ecological conditions may alter the vegetative composition and abundance of the burned area from those of the pre-fire conditions.

3.6.1.2 Threatened and Endangered Species Conditions

The results of the Cerro Grande Fire will likely not cause a long-term change to the overall number of federally-listed T&E species inhabiting the region. However, the results of the fire will likely change the distribution and movement of various species, including the Mexican spotted owl. In the July 21, 2000, Federal Register, the USFWS proposed to designate 13.5 million ac (5.5 million ha) as critical habitat for the Mexican spotted owl within portions of the western U.S. (65 FR 141). Several canyons adjacent to LANL have been proposed as critical habitat. However, there are no areas on LANL that have been proposed as critical habitat. The areas off LANL that have been proposed as critical habitat suffered heavy damage during the Cerro Grande Fire. Specifically, two primary areas considered as critical habitat for the Mexican spotted owl located on Forest Service land near LANL suffered almost 100 percent vegetation mortality. The fire may also have long-term effects to the habitat of several state-listed species, including the Jemez Mountains salamander.

3.6.1.3 Other Wildlife

The Cerro Grande Fire dramatically altered the habitat of many species. While eliminating or fragmenting the habitats of many wildlife species (e.g., reptiles, amphibians, invertebrates, small mammals, birds), the effects of the fire will also increase and improve habitat for other species (e.g., large mammals) by creating more foraging areas. During the fire, individuals of many wildlife species died. Population recovery is expected within the next several breeding seasons. Elk and deer populations are expected to increase in the next years in response to the additional foraging areas resulting from post-fire vegetation regrowth around Los Alamos County.

3.6.2 LANL-Wide

3.6.2.1 Habitat Changes

The Cerro Grande Fire burned approximately 7,650 ac (3,061 ha) on LANL lands. Table 3.5 shows the percentage of vegetation mortality within each watershed. Depending on the fire intensity (fire intensity relates to the fire's impact to vegetation), existing vegetation will either be replaced by new species or will recover in a relatively short time period. In areas of moderate- to high-fire intensity where trees and understory species

were destroyed, a recolonization of different species may occur. In areas of low to moderate intensity, the existing species may recover quickly, depending on precipitation and other weather factors. However, these areas will probably look quite different because old dead material and detritus have burned and because burned materials released nutrients that will stimulate a productive growth spurt. As vegetation proceeds through the natural course of succession in the burned areas, there will also be a corresponding change in the diversity, composition, and numbers of wildlife species utilizing those areas. Much of this vegetation may be high in nutrients and very attractive to foraging species.

TABLE 3.5–*Total Percentage of Vegetation Mortality within Selected Watersheds at LANL*

Watershed percent vegetation mortality	Mixed Conifer (%)	Aspen (%)	Ponderosa Pine (%)	Piñon/ Juniper (%)	Juniper Woodland (%)	Grassland (%)
Los Alamos Canyon						
0 to 10	54.98	0	76.36	99.90	99.66	100.00
10 to 40	1.54	0	0.69	0	0	0
40 to 70	3.80	0	0	0	0	0
70 to 100	39.68	100.00	22.95	0.10	0.34	0
Pajarito Canyon						
0 to 10	20.12	10.90	25.24	56.92	73.98	28.92
10 to 40	75.03	81.95	67.12	41.55	24.36	67.49
40 to 70	4.14	7.15	5.13	1.37	1.31	3.52
70 to 100	0.71	0	2.51	0.16	0.35	0.07
Sandia Canyon						
0 to 10	81.09	100.00	78.34	95.75	99.79	73.05
10 to 40	18.91	0	21.66	4.25	0.21	26.95
40 to 70	0	0	0	0	0	0
70 to 100	0	0	0	0	0	0
Mortandad Canyon						
0 to 10	0	100.00	20.80	51.18	63.01	15.63
10 to 40	87.73	0	69.82	41.00	31.72	82.19
40 to 70	12.27	0	9.38	7.82	5.27	2.18
70 to 100	0	0	0	0	0	0
Water Canyon						
0 to 10	28.11	26.54	36.74	91.71	98.09	26.34
10 to 40	69.80	38.87	53.71	6.90	1.29	56.41
40 to 70	2.09	34.59	9.55	1.39	0.62	17.25
70 to 100	0	0	0	0	0	0

3.6.2.2 Federal and State Listed Threatened and Endangered Species Conditions

Table 3.6 lists four federally-listed species that may be located within LANL boundaries or nearby. The Cerro Grande Fire did not severely burn the T&E species areas of environmental interest (AEIs) on LANL, although many of the Mexican spotted owl AEIs received moderate- and low-severity burns (Table 3.7). Habitat within the Southwestern Willow Flycatcher AEI and Bald Eagle AEI did not burn.

TABLE 3.6–*Federal Threatened or Endangered Species Considered under the Fire Suppression Activities and Emergency Actions*

Common Name	Scientific Name	Status*	Habitat
Mexican spotted owl	*Strix occidentalis lucida*	FT	Ponderosa pine and mixed conifer forests. Uneven-aged, multistoried forests with closed canopies.
Bald eagle	*Haliaeetus leucocephalus*	FT	Roosts in riparian areas near streams and lakes.
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE	Nests in riparian areas with willows and cottonwoods.
Whooping crane	*Grus americana*	FE	Sandbars and wetlands. Uses White Rock Canyon during migration.

FE = Federally listed as Endangered, FT = Federally listed as Threatened

TABLE 3.7–*Total Percentage of Vegetation Mortality within the Core Area of each Mexican Spotted Owl AEI**

Location (%)	Mixed Conifer (%)	Aspen (%)	Ponderosa Pine (%)	Piñon/ Juniper (%)	Juniper Woodland (%)	Grassland (%)
Los Alamos Canyon						
0 to 10	48.49	79.01	60.51	99.79	100.00	98.42
10 to 40	1.54	0.71	0.64	0	0	0
40 to 70	12.62	2.24	0.65	0	0	0.31
70 to 100	37.35	18.04	38.20	0.21	0	1.27
Sandia Canyon/Mortandad Canyon						
0 to 10	52.93	0	38.78	51.26	81.36	26.14
10 to 40	47.07	100.00	61.22	48.74	18.64	73.86
40 to 70	0	0	0	0	0	0
70 to 100	0	0	0	0	0	0
Pajarito Canyon						
0 to 10	0	0	0.03	0	0	0
10 to 40	93.95	100.00	89.78	96.72	100.00	100.00
40 to 70	6.05	0	10.19	3.28	0	0
70 to 100	0	0	0	0	0	0
Cañon de Valle						
0 to 10	26.92	47.46	39.76	83.02	100.00	4.37
10 to 40	73.08	52.54	60.24	16.98	0	95.63
40 to 70	0	0	0	0	0	0
70 to 100	0	0	0	0	0	0
Three Mile Canyon						
0 to 10	0	0	0.02	3.02	0	0
10 to 40	100.00	100.00	99.98	96.98	100.00	100.00
40 to 70	0	0	0	0	0	0
70 to 100	0	0	0	0	0	0

* Pueblo Canyon AEI is not included in this table because there was no vegetation mortality.

Some federally-protected species have historically inhabited areas in the vicinity of LANL but are no longer present. The black-footed ferret (*Mustela nigripes*) has a historical range that includes 12 states (Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming) and the Canadian provinces of Alberta and Saskatchewan. Black-footed ferrets depend almost exclusively on prairie dogs for food and shelter. Ferret range is coincident with that of prairie dogs, with no documentation of black-footed ferrets breeding outside of

prairie dog colonies. Only prairie dog colonies with a combined area greater than 80 ac (32 ha) are large enough to support black-footed ferrets. There are no prairie dog colonies of the appropriate size in LANL and black-footed ferrets are therefore not discussed further in this document.

Potential habitat for American peregrine falcon (*Falco peregrinus anatum*) exists within LANL boundaries. Recently, the peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife. DOE is required to track potential effects to de-listed species for five years, thus DOE will continue to track the potential effect to peregrine falcon habitat until the end of 2004.

The State of New Mexico *Wildlife Conservation Act* (NMSA 1978a) states that "it is unlawful for any person to take (harass, hunt, capture, or kill any wildlife or attempt to do so), possess, transport, export, process, sell or offer for sale or ship any species of wildlife appearing on any of the following lists." This provision applies only to species identified as endangered. State T&E species are identified in Table 3.8. There are no known plants on LANL that are listed as endangered plant species in New Mexico (NMSA 1978b). State-endangered species listed in Table 3.8 are protected from certain activities.

TABLE 3.8–*New Mexico Threatened and Endangered Species Potentially Occurring in the Area of Fire Suppression and Emergency Actions*

Scientific Name	Common Name	New Mexico Status*	Habitat	Potential to Occur⊗
Pisidium lilljeborgi	Lilljeborg's pea-clam	NMT	Habitats include lakes, occurring at higher latitudes and altitudes. The New Mexico population of the species occurs in cold, alpine Nambe Lake, which is located in a glacial cirque.	Low
Stagnicola caperatus	Wrinkled marsh snail	NME	High-elevation emergent wetlands.	Low
Plethodon neomexicanus	Jemez Mountains salamander	NMT	Shady, wooded, spruce-fir dominated sites at elevations of 7,200 to 9,200 ft (2,190 to 2,800 m).	Moderate
Aegolius funereus	Boreal owl	NMT	Relatively inaccessible mature to old growth spruce-fir forests.	Low
Cynanthus latirostris magicus	Broad-billed hummingbird	NMT	Primarily in riparian woodlands at low to moderate elevations.	Low
Lagopus leucurus altipetens	White-tailed ptarmigan	NME	Inhabits alpine tundra and timberline habitats, which in New Mexico are mainly above 10,500 ft (3,201 m).	Low
Vireo vicinior	Gray vireo	NMT	Open piñon-juniper and oak woodlands.	Moderate
Ammodramus bairdii	Baird's sparrow	NMT	Found in New Mexico in a variety of habitats, ranging from desert grasslands in the south to mountain meadows in the San Juan and Sangre de Cristo mountains—up to an elevation of 11,800 ft (3,540 m).	Low
Falco peregrinus anatum	American peregrine falcon	NMT	Uses juniper savannah, piñon-juniper woodland, ponderosa pine forest, and mixed-conifer forests. Requires cliffs for nesting.	High

TABLE 3.8—*Continued*

Scientific Name	Common Name	New Mexico Status*	Habitat	Potential to Occur⊗
Haliaeetus leucocephalus	Bald eagle	NMT	Roosts in riparian areas near streams and lakes.	High
Grus americana	Whooping crane	NME	Uses sandbars and wetlands including White Rock Canyon during migration.	Low
Empidonax traillii extimus	Southwestern willow flycatcher	NME	Nests in riparian areas with willows and cottonwoods.	Moderate to High
Euderma maculatum	Spotted bat	NMT	Found in a wide variety of habitats, from riparian to ponderosa pine and spruce-fir forests.	High
Martes americana origenes	American marten	NMT	Found in late successional spruce-fir forests.	Low
Zapus hudsonius luteus	New Mexican jumping mouse	NMT	In both the Jemez Mountains and the Rio Grande Valley, preferred habitat contains permanent streams, moderate to high soil moisture, and dense and diverse streamside vegetation consisting of grasses, sedges, and forbs.	Moderate

*CODES FOR LEGAL STATUS
NME = New Mexico endangered
NMT = New Mexico threatened

⊗ POTENTIAL TO OCCUR
High = species is known to occur in the area
Moderate = the area has some species habitat components
Low = the area does not have species habitat components

3.6.2.3 Other Wildlife

The effects of the Cerro Grande Fire on wildlife at LANL are expected to be similar to those experienced in other portions of the ROI. Elk, deer, and human interface problems are expected to increase at LANL.

3.7 Climatology, Meteorology, and Air Quality

Los Alamos has a semiarid, temperate mountain climate. Meteorological conditions within the Los Alamos area are influenced by the elevation and the ruggedness of the Pajarito Plateau. The climate is characterized by seasonable, variable rainfall with precipitation ranging from 10 to 20 in. (25 to 51 cm) per year. The normal annual precipitation for Los Alamos for the period 1961 to 1990 was about 19 in. (48 cm). The Jemez Mountains receive over 25 in. (64 cm) annually. The heaviest precipitation occurs during the months of July, August, and September (1999 LANL SWEIS, Section 4.41). Although there have been no known instances of large-scale flooding as a result of rainfall, there have been infrequent episodes of localized flooding during heavy downpours (1999 LANL SWEIS, Section 4.4.1.2). The conditions discussed in the 1999 LANL SWEIS constitute the climatological and meteorological baseline for this analysis.

The 1999 LANL SWEIS describes the air quality of the Los Alamos area and analyzes the impact of LANL operations on the regional air quality. It also analyzed consequences from wildfire at LANL. In contrast to the SWEIS accident analysis, emissions reported from the Cerro Grande Fire represented the entire area burned, which included LANL, Santa Fe National Forest, Los Alamos County, Santa Clara Pueblo and San Ildefonso Pueblo lands, and various private landholdings. Several organizations (UC, DOE, EPA,

and NMED) analyzed samples of the smoke plume for both chemical and radioactive constituents. Monitoring data indicated that the emissions were consistent with those expected from burning natural vegetation and soils (LANL 2000b).

The Cerro Grande Fire's primary effect on air quality in the ROI was a temporary increase in smoke (Photo 3.3) and increased concentrations of radioactive constituents, particulate matter, and other chemicals (discussed in following paragraphs). The only longer-term effect is a probable increase in suspended particulate matter due to removal of vegetation; over the longer term (one to three years), the loss of vegetative cover would increase the likelihood that particulate matter would become airborne. Until vegetation is re-established, the amount of suspended particulates could increase, but air quality would still be within the parameters analyzed in the 1999 LANL SWEIS.

PHOTO 3.3—*Smoke from the Cerro Grande Fire Spreads Eastward toward LANL*

Radiological emissions were produced during the Cerro Grande Fire. Most wildfires, regardless of location, emit radioactive lead-210, bismuth-210, and polonium-210, which are naturally occurring decay products of radon. Radon is a gas, but these decay products are metals that settle to the ground and on plant surfaces. During a fire, these metal particles (from soil and vegetation) become airborne in greater than normal concentrations. Other radionuclides are also present naturally (potassium-40, carbon-14, beryllium-7, and uranium). In addition, human-made radioisotopes are expected in small

quantities from world wide fallout resulting from historical atmospheric testing and weapons use (Rea 2000). Radioactive emissions from the Cerro Grande Fire were similar to those from similar fires in other areas of the world. Details of radioactive emissions are presented in *Wildfire 2000* (LANL 2000b).

Nonradiological emissions resulted from the Cerro Grande Fire. Typically, smoke from forest fires contains large amounts of particulates, carbon dioxide, and water vapor. Particulate matter emissions factors range from 4 to 180 pounds per ton of fuel. The size of particulates produced by a wildfire range from an average of 0.3 microns to greater than 10 microns depending on the fire intensity and the length of the fire's leading edge (Rea 2000). In a large, hot fire like the Cerro Grande Fire, particulates tend to be larger (>10 microns). Monitoring stations recorded higher than normal concentrations of PM-10 (particulates smaller than 10 microns) during the fire. All sampling networks showed higher-than-normal air concentrations of particulate matter associated with smoke from the fire. LANL's sampling station at TA-54 detected PM-10 at slightly higher than normal concentrations until the fire was very close to TA-54. On those days, air concentrations as high as 1,000 micrograms per cubic meter ($\mu g/m^3$) were measured because of the monitoring station's proximity to the fire and the smoke plume.

In addition to particulate matter, carbon dioxide, and water vapor, fires produce varying amounts of carbon monoxide, hydrocarbons, and other complex organic compounds. Nitrogen oxide and hydrocarbons react together in the presence of ultraviolet light to produce ozone and organic oxidants. Carbon monoxide is produced in lesser quantities (70 pounds/ton of fuel) during open burning periods of a wildfire than in the smoldering periods, which can produce up to 800 pounds/ton of fuel (Rea 2000). As the fire was suppressed, emissions of carbon monoxide would have temporarily increased in areas of smoldering vegetation.

Metals and organic compounds were detected by air monitors at LANL, but at concentrations that did not pose a health risk. No pesticides were detected. Metals were present in small quantities; sampling showed very low concentrations and quantities measured were well below accepted workplace concentrations. These air-borne metals appeared to be attributable to burning vegetation. Of the 12 organic compounds detected, the highest observed concentration was less than 10 percent of the prescribed workplace standard (LANL 2000b). Monitoring in the vicinity of MDA-R indicated that the burning materials at MDA-R produced air-borne pollutants at levels that were below applicable occupational exposure limits (Eklund 2000). Asbestos was detected but the highest concentrations were about ten percent of the Occupational Safety and Health Administration asbestos limit (LANL 2000b).

3.8 Visual Resources

The 1999 LANL SWEIS defines the LANL viewshed as the region from which an observer can potentially view LANL. Discussion of the existing visual environment is based on this regional viewshed. Conditions described in the 1999 LANL SWEIS still generally apply to the ROI for visual resources issues.

The LANL viewshed is diverse, interesting, and panoramic (1999 LANL SWEIS). Long-distance views of LANL and the Jemez Mountains have not been affected by the Cerro Grande Fire. Although the fire destroyed some vegetation, LANL facilities are still generally screened from the view of passing motorists. Very tall structures and high-visibility facilities such as the water towers and waste domes at TA-54 are still prominent in the viewshed. Light from LANL facilities contributes less night-time light pollution than does the Los Alamos townsite or community of White Rock (1999 LANL SWEIS). The Cerro Grande Fire did not alter the respective contribution of LANL and the surrounding communities to night-time light pollution.

Views from various locations in Los Alamos County and its immediate surroundings have been altered by the Cerro Grande Fire. Although the visual environment is still diverse, interesting, and panoramic, portions of the visual landscape are dramatically stark (Photo 3.4). Rocky outcrops forming the mountains are now visible through the burned forest areas. The eastern slopes of the Jemez Mountains, instead of presenting a relatively uniform view of dense green forest, are now a mosaic of burned and unburned areas. Grasses and shrubs initially will replace forest stands and will contribute to the visual contrast between the burned and unburned areas for many years.

PHOTO 3.4—*Severely Burned Mountain Slopes above Los Alamos Townsite*

In addition to effects on panoramic views, the Cerro Grande Fire also had local effects. Destruction of vegetation, erosion, and deposition of charcoal-laden sediments along stream channels have severely affected the visual appeal of trails and recreation areas. New vegetation growth is expected to moderate these effects over a period of years.

3.9 Cultural Resources

The ROI for cultural resource issues is limited to the boundaries of LANL. Cultural resources downstream from LANL have not been inventoried. Any downstream cultural sites should not be affected by the flood and erosion retention projects discussed in this SEA, as off-site water flow is expected to remain within historic levels.

Over 2,000 archaeological sites and historic properties have been identified at LANL. Some of these sites consist of artifact scatters that reflect the ephemeral remains of ancient hunting campsites, while others include the Manhattan Project buildings where the Atomic Age began.

As of 1999, a total of approximately 19,000 ac (7,600 ha) at LANL had been 100 percent surveyed. This represents about 68 percent of the LANL facility. Sixteen hundred prehistoric archaeological sites have been recorded, for a site density of about one site per 10 ac (4 ha). There are also about 100 sites that date to the Homestead Era from the turn-of-the-century to the 1940s and 500 buildings that were constructed during the Manhattan Project or Cold War Eras (1943–1956). Twenty-three federally recognized tribes and two affected Hispanic communities claim traditional use of LANL lands. For example, one claim asserts that these lands are located within the ancestral domain of San Ildefonso Pueblo. As such, the Pueblo recognizes several of the large prehistoric villages at LANL as ancestral homes.

Approximately 1,500 prehistoric and historic sites, buildings, and structures have been considered eligible for inclusion in the National Register of Historic Places (NRHP) under the *National Historic Preservation Act* (NHPA). Under the NHPA, cultural resources undergo an evaluation process that determines if the resource is eligible for listing on the NRHP. Resources that are already listed, determined eligible for listing, or have an undetermined status are afforded a level of consideration under the NHPA Section 106 process. In order to be determined eligible for inclusion in the NRHP, a resource must meet one or more of the criteria found in 36 CFR Part 60 as follows:

- Criterion A: Associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B: Associated with the lives of people significant in our past.
- Criterion C: Embodies the distinctive characteristics of a type, period, or method of construction.
- Criterion D: Yielded or may be likely to yield information important in prehistory or history.

The resource also must retain most, if not all, of seven aspects of integrity of location, design, setting, materials, workmanship, feeling, and association.

The Cerro Grande Fire affected 304 prehistoric and 58 historic (including Manhattan Project) recorded sites (Table 3.9). The impacts to prehistoric sites from the fire are not fully known. Vegetation was burned off some of these sites. Burned out tree root systems have formed conduits for modern debris and water to mix with subsurface archaeological deposits. They also provide an entry point for burrowing animals. Snags

or dead or dying trees may fall and pull out deposits including wall stones that are enmeshed in the tree roots. Post-fire surveys of cultural resources within the burn area have been initiated.

TABLE 3.9—*Cultural Resources within Burned Areas and Pre-fire 100-Year Floodplain*

Watersheds	Burned Areas		Pre-fire 100-Year Floodplain	
	Prehistoric	Historic	Prehistoric	Historic
Los Alamos	0	0	0	0
Pajarito	76	37	1	3
Water	113	6	3	1
Mortandad	62	12	3	1
Sandia	14	1	0	0
Rendija	39	2	0	0
Total	304	58	0	0

Historic resources within the burned area were severely adversely impacted. Many wooden structures from the Homestead Era and from the Manhattan Project/Cold War period and various Manhattan Project artifacts were destroyed (Table 3.10).

TABLE 3.10—*Historic Resources Affected by Cerro Grande Fire or Post-fire Flooding*

Structure	Type	Condition
Montoya y Gomez Cabin Site (LA 21334)	Homestead Era	Buildings destroyed by fire
Gomez Homestead (LA 86643)	Homestead Era	Buildings destroyed by fire
Upper Pajarito Canyon Bridge (LA 89826)	Homestead Era	Buildings destroyed by fire
Grant Homestead (LA 16807)	Homestead Era	Buildings destroyed by fire
David Romero Homestead (LA 16806B)	Homestead Era	Light fire damage to ground surrounding the site
Anchor Ranch icehouse (LA 16808)	Homestead Era	Building destroyed by June 28, 2000 (post-fire) flood
TA-6	Manhattan Project Era –wooden structural remains	Two structures destroyed by fire
TA-16-515 TA-16-516 TA-16-518 TA-16-519 TA-16-520	Manhattan Project Era – part of "V-Site"	Buildings and artifacts destroyed by fire
TA-40-72 TA-40-73	Manhattan Project Era- wooden storage buildings	Buildings destroyed by fire
TA-7 (now part of TA-6)	Manhattan Project/Cold War period – firing sites	Wooden elements destroyed by fire
TA-16-372	Cold War period – wooden cooling tower	Building destroyed by fire
TA-15-50	Cold War period – staff shop, part of complex known as "The Hollow"	Building destroyed by fire

There has been a significant loss of Homestead Era historic sites in the Jemez Mountains/Pajarito Plateau area as a result of the Cerro Grande Fire and previous wildfires such as the Dome Fire in 1996. The structural remains associated with the homesteads are rapidly dwindling throughout the region. Before the fire, LANL's historic homesteads were among the best remaining evidence of this period. Virtually all wooden buildings associated with the Homestead Era were destroyed by the fire and the sites were largely reduced to rubble. On June 28, 2000, an intense rain also produced

flooding that destroyed an already deteriorating Homestead Era icehouse structure (Photos 3.5 and 3.6).

PHOTO 3.5—*Anchor Ranch Icehouse before June 28, 2000, Flooding*

PHOTO 3.6—*Anchor Ranch Icehouse after Flooding*

The fire also destroyed most of the V-Site structures that remained from the Manhattan Project Era. The Manhattan Project and the development of the atomic bomb became one of the most extraordinary scientific undertakings in the history of humankind. Many

of the world's best physicists, mathematicians, and engineers lived and worked on the top-secret plateau that would come to be known as Los Alamos. The V-Site was typical of the wooden laboratories built in Los Alamos for the Manhattan Project. A cluster of clapboard wooden buildings, the V-Site was among the last vestiges of the Manhattan Project at Los Alamos. In these buildings, scientists worked on the "Gadget" (Trinity device), the world's first successful nuclear detonation, which was the prototype for the bomb that was detonated over Nagasaki, Japan, on August 9, 1945.

The V-Site was abandoned in the early 1950s, and its buildings were slated for demolition. However, in May 1999, the White House Millennium Council awarded the V-Site a grant under the Save America's Treasures program to restore, preserve, and use these buildings as a museum and interpretive center for the Manhattan Project. The Cerro Grande Fire largely destroyed portions of this site and its remaining artifacts. Photos 3.7 and 3.8 illustrate the "before" and "after" effects of the fire.

PHOTO 3.7—*V-Site in 1999*

PHOTO 3.8—*Portion of V-Site Destroyed in the Cerro Grande Fire*

All but one building of the Manhattan Era V-Site was destroyed by the fire. Program planning was underway to restore the V-Site buildings, build a road into the site to allow public access, and create a world-class interpretive center and museum on the history of the Manhattan Project before the Cerro Grande Fire. The V-Site renovation was being collaboratively undertaken by DOE, LANL, the Bradbury Science Museum, and Recursos de Santa Fe. Historic artifacts associated with a former casting building at TA-16-27 were stored in TA-16-518, a long wooden shed at V-Site. Most of the artifacts were destroyed and the artifacts that remain have fire damage. The program planning is now being revised because of the cultural resources changes at LANL attributed to the fire.

As stated in the 1999 LANL SWEIS, on-site impacts to TCPs are possible throughout LANL and are likely in the wake of the Cerro Grande Fire. The locational information to fully analyze impacts to TCPs is insufficient at this time. DOE and UC have recently drafted *A Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites at Los Alamos National Laboratory, New Mexico* (DOE 2000). This plan outlines consultation requirements, regulatory considerations, confidentiality and protocol issues, and long-term management considerations. When finalized this plan will

be used in consultation efforts associated with effects from the Cerro Grande Fire and resulting flood damage.

3.10 Utilities and Infrastructure

Section 4.9.2 of the 1999 LANL SWEIS describes utility and infrastructure services at LANL before the Cerro Grande Fire. The utilities and infrastructure in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.5.9.2 of the SWEIS. The ROI includes both LANL and Los Alamos County.

Ownership and distribution of utility services is split between DOE and Los Alamos County. Utility systems at LANL include electrical service, natural gas, steam, water, sanitary wastewater, and refuse. Ongoing maintenance of power line corridors includes thinning and clearing low-lying vegetation and topping off tall trees. This type of maintenance provides easy access and protects the power line from potential fire and storm-related danger. Safeguards and security operations are conducted at LANL to provide protection of national security interests, proprietary information, government property, and the general public. Vegetation, such as trees, is used at LANL to enhance buffer areas for operational and security purposes. Facility fire protection programs at LANL ensure that personnel and property are adequately protected against fire or related incidents. Interagency agreements between Los Alamos County and DOE are in place to share water supplies, equipment, and personnel as required to perform facility fire protection.

Gas and electric services to LANL and the surrounding communities were shut off or were interrupted during the fire. Utility services to LANL facilities were mostly unchanged by the fire although several of the short electric feeder lines were destroyed and some phone lines were melted. During the Cerro Grande Fire, a total of 86 power pole structures at LANL were destroyed or damaged and the Static Var Compensator was shut down. Because water tanks were drained during the fire by firefighters, mineral deposits were drawn into the lines at LANL. No other utility services received any major damage. Approximately 240 structures (including trailers, transportables or other storage buildings, and miscellaneous structures, such as electric power pole structures) were damaged during the fire. Of this number, about 40 were totally destroyed (LANL 2000e).

3.11 Socioeconomics

Section 4.9.1 of the 1999 LANL SWEIS describes socioeconomic conditions at LANL before the Cerro Grande Fire. The impacts on the socioeconomic conditions in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.5.9.1 of the 1999 LANL SWEIS.

The ROI for socioeconomic issues includes the geographic area most affected by LANL and is the region comprised of Los Alamos, Santa Fe, and Rio Arriba counties. Demographic, social, and economic conditions are summarized here and described in detail in the 1999 LANL SWEIS in Section 4.9.1. Population data from the most recent

1990 Census show about 18,000 people in Los Alamos County, 99,000 people in Santa Fe County, and 34,500 people in Rio Arriba County. UC remains the largest employer in the tri-county region. For fiscal year (FY) 1997, the DOE operations funding amount for LANL was $1,105.4 million (actual cost); this funding supported 6,855 full-time equivalent personnel (LANL 1998). During FY 1997, UC spent a total of $723.0 million for external subcontracts and procurements. Of this total, $294.0 million were spent on small and disadvantaged businesses. A detailed description of the community infrastructure and social services, which includes (pre-Cerro Grande Fire) data on local government finances, the number of housing units, public schools, health services, police protection, fire protection, and utilities, is included in the 1999 LANL SWEIS.

No long-term or major effects on the socioeconomic condition of the region resulted because of the fire. During and subsequent to the Cerro Grande Fire, about 230 residential structures were destroyed or damaged and utility services burned in the western and northern portions of Los Alamos. Businesses were closed for at least a week resulting in economic loss to them and the County. Federal legislation for funds is anticipated to provide some recompense to individual homeowners, renters, and business operators. There will be short-term increases in employment generated by construction activity to rebuild houses destroyed or damaged by the fire, primarily within the townsite.

Employment at LANL during and subsequent to the Cerro Grande Fire remained constant. DOE, UC, its subcontractors, and other contract staff were paid during the shutdown from the fire and no jobs were lost.

3.12 Noise

Section 4.1.3 of the 1999 LANL SWEIS provides a definition of noise and a description of the noise environment at LANL before the Cerro Grande Fire. The impacts on the noise environment in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.1.3 of the SWEIS.

Activities associated with the Cerro Grande Fire resulted in localized, minor, and temporary increases in noise levels. However, the fire damaged or destroyed approximately 43,000 ac (17,200 ha) of forest land, of which about 7,650 ac (3,000 ha) were located within the boundaries of LANL (see Figure 1.2, page 1-3). The damage or loss of large forest areas has an adverse effect on the ability of the surrounding environment to absorb noise. However, the types of noise and noise levels associated with operations at LANL and from activities in surrounding communities have not changed significantly as a result of the fire.

3.13 Environmental Justice

Environmental justice impacts are assessed for a 50-mi (80-km) area surrounding LANL (the ROI for environmental justice issues). Detailed minority and low-income distribution data are available in the 1999 LANL SWEIS in Section 4.7 and have not changed as a result of the Cerro Grande Fire. The impacts on environmental justice in the region under the Preferred Alternative selected in the SWEIS ROD are described in

detail in Section 5.3.7. Maps showing the distribution of both low-income and minority populations are shown on pages 4-150 and 4-151 of the 1999 LANL SWEIS.

3.14 Human Health

Section 4.6 of the 1999 LANL SWEIS provides a detailed summary of public and worker health in and around LANL before the Cerro Grande Fire. The ROI for human health issues and affected workforce is also described in this section. The impacts on human health under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.6. The *Wildfire 2000* publication (LANL 2000b) includes a detailed comparison of the SWEIS analysis of the wildfire accident scenario and the actual Cerro Grande Fire event.

The Cerro Grande Fire had a minimal effect on public and worker health. The fire produced large amounts of smoke; however, most of the nearby community had been evacuated before the fire reached DOE-administered lands. One smoke inhalation related injury to a LANL employee was recorded during the fire suppression period. No specific fire-related injuries or fatalities occurred to any members of the public or to DOE employees. Two minor injuries occurred to emergency response personnel. Preliminary estimates of radiation dose to the public indicate that members of the public received less than 1.0 millirem (mrem) from smoke exposure from the fire (LANL 2000b). In addition, preliminary and limited results from storm water runoff monitoring indicate that concentrations of plutonium-239 and other radionuclides are below allowable concentrations for public drinking water (LANL 2000f). Although storm water runoff is not used for drinking water at or in the vicinity of LANL, this standard is applied for the sake of perspective and as a conservative resource management measure.

UC expanded its soil and produce monitoring program for local farms downwind from the Cerro Grande Fire and from LANL. Based on available sample data for radionuclides, radioactivity, trace elements, and organic constituents, there were no significant impacts to soils at local farms.

Based upon actual recorded injuries, estimated radiation doses, and concentrations of radionuclides in storm water, the affected environment for public and worker health did not change appreciably as a result of the Cerro Grande Fire from the status described in the 1999 LANL SWEIS.

3.15 Environmental Restoration and Waste Management

3.15.1 Environmental Restoration at LANL

The Environmental Restoration Project at LANL was established by DOE in 1989 to assess and remediate (clean up) potentially contaminated sites that either were, or are, under DOE administration at LANL. Approximately 2,120 sites have been identified at LANL. These sites are a combination of solid waste management units identified in the RCRA permit for LANL or potentially contaminated sites called areas of concern (AOCs). Some AOCs may contain radionuclides and hazardous constituents that are not

regulated under RCRA. As of September 1997, 1,370 of these sites have been identified as requiring no further action based on human health concerns.

PRSs at LANL include past material disposal areas (MDAs, landfills), canyons, drain lines, firing sites, outfalls, and other random sites such as spill locations. The primary mechanisms for contaminant release from these sites are surface water runoff carrying potentially contaminated sediments and soil erosion exposing buried contaminants. The main pathways by which released contaminants can travel off-site are through infiltration into alluvial aquifers, airborne dispersion of particulate matter, and sediment migration from surface water runoff. The contaminants involved include volatile and semivolatile organics, polychlorinated biphenyls (PCBs), asbestos, pesticides, herbicides, heavy metals, beryllium, radionuclides, petroleum products, and high explosives. The 1999 LANL SWEIS contains additional contaminant information.

A total of 626 PRSs were in the area burned by the Cerro Grande Fire. Of these, 308 PRSs were actually burned. In some cases, existing BMPs were damaged and vegetation was removed by the fire. In addition, some of the 77 PRSs outside the fire perimeter within floodplains were determined to be of increased risk of potential flood or erosion damage.

3.15.2 Waste Management

Section 4.9.3 of the 1999 LANL SWEIS describes the waste management activities in and around LANL before the Cerro Grande Fire. The impacts on waste management in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.9.3 of the SWEIS.

UC employs a variety of strategies to manage waste generated at LANL. Solid waste, including construction rubble, goes primarily to the Los Alamos County Landfill; certain classified waste goes to a classified landfill at TA-54. The SWEIS ROD included the expansion of the current on-site disposal of LANL-generated low-level waste that used the existing footprint at the Area G low-level waste disposal area and expanded disposal capacity into Zones 4 and 6 at Area G. Hazardous waste is shipped off-site. Low-level radioactive waste is disposed of at TA-54, Area G, or shipped off-site. Transuranic waste is stored at TA-54 before being shipped to the Waste Isolation Pilot Project plant near Carlsbad, New Mexico, if defense related. Mixed waste is stored at TA-54 pending development of suitable waste disposal alternatives.

The Cerro Grande Fire resulted in an increased volume of solid waste at the Los Alamos County Landfill and other regional landfills from cleanup and removal of burned residential and other utility structures in Los Alamos. Solid waste volumes from commercial and residential areas and LANL during the period of the fire were negligible because of the two- to three-week period that LANL and the townsite were shut down or evacuated. Sanitary waste water volumes were similarly affected by the fire.

3.16 Transportation

Section 4.10 of the 1999 LANL SWEIS 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.

Regional and site transportation routes are the primary methods used to transport LANL-affiliated employees, commercial shipments, and hazardous and radioactive material shipments. Bladed (unpaved) fire roads are located in many areas of LANL and are often used as access roads for maintaining utility services. During fire protection maintenance operations, some road closures were necessary. The Cerro Grande Fire damage to the transportation system was minimal; some guard rails were damaged or destroyed by the fire along SR 4 and SR 501.

This Page Intentionally Left Blank

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This section describes the environmental impacts or changes that occurred as a result of DOE, DOE-authorized, or DOE-funded actions that were taken at or nearby the LANL facility during the fire suppression and post-fire periods of the Cerro Grande Fire. Environmental impacts are described and discussed across the various resource areas that were directly, indirectly, or cumulatively affected by DOE emergency response actions. A sliding-scale approach was employed so that environmental resources are discussed at a level of detail commensurate with the level of impacts. The primary beneficial effects of DOE's suppression activities were that the fire was extinguished, no lives were lost, and property and environmental damage was minimized. The primary beneficial effects of the post-fire activities were that LANL quickly returned to operating conditions, burned areas were rehabilitated, and the risk of further damage was reduced to protect operations, property, the downstream environment, and the lives and well-being of workers and residents.

The ROI varies across resource areas but generally includes the entire area affected by the Cerro Grande Fire. Section 2 of this SEA describes DOE actions taken; Section 3 describes the LANL and ROI environment before and after the fire. The information presented in Sections 2 and 3 is the foundation for understanding and evaluating the environmental impacts of DOE emergency response actions discussed in Section 4.

The methodologies used to determine impacts in this chapter differ from typical NEPA documents because of the emergency nature of the actions actually undertaken by or on behalf of DOE. For the most part, impacts are based on events or activities that have already occurred and not on planned or proposed actions. For example, the acreage affected by constructing the flood retention structure in Pajarito Canyon (10 ac [4 ha]) is not an estimate but the actual area disturbed. Therefore, impacts to certain resources such as the Pajarito Canyon floodplain, have already occurred and are simply reported as fact in their appropriate sections. However, the potential impact of this disturbance on other media, such as biological resources, is estimated based upon many variables in addition to habitat disturbance.

In addition to reporting or describing impacts that have already occurred, efforts were made to assess the level or significance of the impacts. Although 10 ac (4 ha) of Pajarito Canyon floodplain were disturbed by constructing the flood retention structure, the amount of disturbance was minimal in comparison to the amount of benefit the structure provides in terms of human health and safety. Adherence to existing and emergency permit conditions (e.g., air emissions and storm water runoff) were also factored into estimating the actual or potential impacts of response actions. Numbers of actual sites affected (e.g., cultural resources and PRSs) and the degrees of damage were also provided to quantify the extent of certain impacts. Actual numbers of workers injured were provided, but potential radiation doses to workers and the public were estimated based on limited monitoring data.

In this SEA, impacts are addressed as occurring from activities either during the fire suppression or the post-fire time period. Short-term impacts are defined as those occurring within the next five years; long-term impacts are those occurring beyond this five-year period. Furthermore, impacts are addressed as either occurring across the entire facility or within defined watersheds at LANL. The major contributors to impacts during the fire suppression were fire road or firebreak construction and tree cutting. The major contributor to impacts during the post-fire period was the construction or modification of various flood control structures, contaminated sediment removal, and demolition actions taken in certain canyon areas at or near LANL. In general, DOE actions had localized or limited individual adverse impacts and were designed to protect life and property from the effects of the fire and subsequent soil erosion and surface water runoff caused by seasonally heavy rainfalls. In this respect, the actions had a significant positive cumulative impact at LANL and within the ROIs for most resources.

4.2 Land Use

4.2.1 Effects of Fire Suppression Activities

Land uses in the region and at LANL are expected to return to post-fire status within three to five years. Fire suppression involved the removal of trees within LANL to reduce fuel around buildings, roads, and utilities. A new, temporary use of the Cache Facility site was established during the fire suppression period. A short-term rest camp for firefighters and support crews was established within the Cache Facility site. This rest camp was about 58 ac (23 ha) in size.

4.2.2 Effects of Post-fire Activities

No long-term changes in land use in the region or at LANL have occurred as a result of post-fire activities taken by DOE. Post-fire activities involved the additional removal of hazard trees within LANL. This activity enhanced the safety and security buffer zones around certain burned portions of LANL, particularly along SR 501. The 58-ac (23-ha) rest camp site returned to its prior use as a LANL buffer zone. Certain recreation trails within LANL were closed and will remain closed until cleanup and flood mitigation measures are completed and vegetation is reestablished.

4.2.3 Cumulative Effects

The ROI for consideration of cumulative effects on land use encompasses the communities of Los Alamos and White Rock, the National Forest and National Park areas surrounding LANL, and LANL. Fire suppression and post-fire activities in these areas had short-term adverse effects on the use of many recreation trails in this area. A temporary additional residential area has been established by the Federal Emergency Management Agency in Los Alamos townsite until former residential properties can be cleared and rebuilt, which may take an additional 18 to 24 months. No long-term adverse cumulative effects on land use at LANL or in surrounding areas are expected.

4.3 Geology and Soils

4.3.1 Effects of Fire Suppression Activities

None of the fire suppression activities included actions that could have significantly affected local geology. Fire suppression activities that could result in soil erosion include disturbance from construction of firebreaks, access roads, and staging areas, and from backfires, and slurry drops. Firebreak construction and other activities involving heavy machinery on mesa tops could have exposed mineral soils and resulted in increased soil erosion. In addition, these activities could have had some temporary adverse effects on slope stability.

Other fire suppression activities such as slurry drops and water drops would have caused minor soil erosion.

4.3.2 Effects of Post-fire Activities

Permanent roads and firebreaks have been properly stabilized and are being maintained. New temporary roads, firebreaks, and staging areas have been stabilized and rehabilitated by raking and seeding actions. No significant soil erosion is anticipated as a result of the construction of these temporary features. Contour raking, straw mulching, contour tree felling, construction of log erosion barriers, installation of straw wattles, aerial seeding, and hydromulching are treatments that have been implemented during the post-fire period to stabilize soils and reduce soil erosion and surface runoff effects from burned and bladed areas. Hazard trees have been felled throughout LANL to alleviate immediate threats to lives and property. Of these activities, only the soil stabilization treatments are intensive or extensive enough to cause significant soil erosion. The expected result of the watershed treatments, however, is to stabilize soils and reduce surface runoff, in some cases by more than 50 percent after two years and 70 percent after three years (BAER 2000). These measures will also enhance slope stability, which is a beneficial geological impact.

DOE implemented BMPs to protect PRSs and other areas. Rehabilitation techniques similar to those used within the rest of the area burned in the Cerro Grande Fire were used with similar effects. No significant soil erosion was observed as a result of these activities. However, significant beneficial impacts are expected from the revegetation of slopes and watersheds, which will significantly reduce soil erosion.

4.3.3 Effects of Post-fire Activities by Watershed

Table 4.1 shows the approximate area of watershed treatments for LANL/DOE property as a whole and by watershed.

TABLE 4.1—*Watershed Treatment Areas (ac/ha)*

	Watersheds					
Treatment	**Water**	**Pajarito**	**Mortandad**	**Los Alamos**	**Sandia**	**Total LANL area treated**
seed/rake/mulch	135/55	840/340	163/66	0	0	1,196/484
hydromulch	85/34	265/107	91/37	0	0	441/176

Seven engineered actions for the purpose of addressing soil erosion and storm water control were implemented (Table 2.5, page 2-20). The four largest engineered structures are those in the Los Alamos Canyon and Pajarito Canyon watersheds: the flood retention structure in Pajarito Canyon, a low-head weir in Los Alamos Canyon, reinforcement of the Los Alamos Reservoir dam, and the Anchor Ranch Road reinforcement and spillway construction.

Although substantial soil erosion could occur from the newly disturbed backfill around these structures, soil stabilization activities performed in these areas should reduce adverse soil erosion impacts. However, the greatest beneficial impact will be that these structures will protect downstream lives and property and will prevent or minimize downstream impacts of soil erosion, the potential downstream transport of sediments and contaminants, and potential flooding.

The other three engineered activities listed in Table 2.5 (page 2-20) affected very small land areas and are predicted to have insignificant adverse impacts on soil erosion, especially since they involve soil stabilization activities (beneficial impacts) at culverts within canyon road crossing areas along SR 501.

4.3.4 Cumulative Effects

The following paragraph discusses soil impacts by fire suppression and post-fire activities. The ROI for soil issues is defined as the entire area burned by the Cerro Grande Fire. Soil erosion and flooding processes are highly dependent on runoff conditions throughout the entire watershed, not just the area within the boundaries of LANL.

Cumulative impacts to geology and soils are assessed by evaluating the impacts of the implementation of the Cerro Grande Fire BAER Plan on neighboring properties together with DOE activities at LANL. The implementation of emergency watershed protection and rehabilitation treatments proposed in the BAER and ERT plans would not result in any adverse effect on the burned area or areas downstream. Implementation of these plans would be expected to result in a significant cumulative beneficial effect by reducing the extent and intensity of potential erosion, potential downstream transport of sediments and contaminants, and potential flooding. DOE activities will, therefore, have a cumulative significant beneficial effect in combination with BAER activities on geology and soils.

4.4 Water Resources

4.4.1 Effects of Fire Suppression Activities

No major effects on water quality are anticipated as a result of the construction of fire access roads, firebreaks, or staging areas. Fire suppression actions that could affect surface water quality and quantity include disturbance from the construction of firebreaks, access roads, and staging areas. Such construction exposes mineral soil and increases the potential for soil erosion and for increases in total suspended solids (TSSs) in surface waters.

No major effect on surface water quality is anticipated as a result of slurry and water drops during fire suppression. The fire-retardant slurry used on the Cerro Grande Fire was an ammonium polyphosphate solution, which is a common agricultural fertilizer. The slurry contains small amounts of other chemicals including sodium ferrocyanide as a rust inhibitor. The U.S. Department of Transportation does not classify sodium ferrocyanide as a hazardous material. Both ammonium and sodium ferrocyanide, however, can be toxic to aquatic organisms if applied to surface waters. Within the LANL burned area, only Los Alamos and Sandia Canyons contain perennial surface water. The sections of these canyons that contain surface water did not burn and are not known to have received direct slurry drops. In laboratory tests, mortality associated with ferrocyanide occurred within the first 48 hours and high levels were evident after 96 hours (Little and Calfee 2000). No information, however, on the long-term effects of ferrocyanide in the environment is available. Ammonium applied to soils is rapidly converted to nitrate or volatilized to the atmosphere. Nitrates from slurry could potentially find their way into the surface or groundwater systems. However, an increase in nitrates is expected following fire because of the conversion of organic nitrogen in vegetation to ammonium and subsequent microbial conversion to nitrate. To distinguish the source of an adverse increase in nitrates in the LANL area would be very difficult. Nitrate from slurry drops is most likely to be assimilated by plants or microorganisms and is unlikely to contaminate groundwater. None of the other previously described fire suppression activities is anticipated to have major effects on perched groundwater resources.

4.4.2 Effects of Post-fire Activities

No significant adverse effects on surface water quality and quantity are expected from post-fire watershed treatment actions. The focus of this assessment of hydrologic impacts from post-fire activities on water resources is the LANL portion of the burned area. Permanent roads and permanent firebreaks created during the fire suppression period have been properly stabilized and are being maintained. New temporary roads, firebreaks, and staging areas have been stabilized and rehabilitated by raking and seeding activities. These actions are expected to reduce the soil erosion potential, thereby protecting surface water quality. Contour raking, straw mulching, contour felling, log erosion barriers, straw wattles, aerial seeding, and hydromulching are watershed treatments that have been implemented during the initial post-fire period to stabilize soils and reduce surface storm water runoff from burned areas. Hazard trees have been felled throughout LANL to alleviate immediate threats to life and property. Of these activities, only the soil stabilization treatments are likely to be intensive or extensive enough to potentially affect surface water quantity and quality. Soil stabilization treatments are expected to reduce storm water runoff and erosion from burned areas by more than 50 percent within two years and 70 percent after three years (BAER 2000). Storm water runoff and concentrations of TSSs are expected to be lower than they would be downstream from untreated burned areas. Revegetation is, therefore, expected to have a significant beneficial effect on both water quality and quantity as a result of DOE taking these actions.

In addition to watershed treatments, USACE installed various engineered structures to control storm water flow and hold back sediment and debris. Since these engineered structures are designed to reduce sediment transport and flooding damage, the overall effect on surface water quantity and quality should be a significant beneficial impact. The SWPP Plan for these projects was designed to minimize the potential for reduction in surface water quality from disturbance of soils and sediment during construction activities. Minor contaminant transport off-site from LANL could occur during flood events in some canyon areas. This is not expected to have a significant adverse effect on water quality. Actions taken by DOE to reduce the potential for sediment and contaminant transport should have a beneficial effect on surface water quality.

No adverse effects to the quality or quantity of perched groundwater or springs are anticipated as a result of post-fire actions. Watershed treatments could lead to increased infiltration of precipitation and subsequent shallow groundwater recharge. If this happens, there is the potential for increased discharge via springs. Recharge will be negated, in part, by the seeded grasses and resprouting vegetation that will transpire soil water. Flood retention structures designed to temporarily retain and slowly release water could lead to increased short-term groundwater recharge depending on the location of the structure, the substrate, and the amount of water retained temporarily.

4.4.3 Cumulative Effects

The ROI for consideration of cumulative effects of water resources issues encompasses the entirety of the watersheds that cross LANL, from the headwaters in the Jemez Mountains to Cochiti Reservoir. Non-DOE actions that may affect surface water and groundwater quality and quantity include fire suppression and post-fire actions taken by the BAER Team on Forest Service- and Park Service-administered property in the watersheds above LANL. Essentially, the ROI actions and the potential effects are the same as those discussed for LANL in this assessment. The impact of the non-DOE actions in the ROI has been to reduce storm water runoff, including sediment and debris, onto LANL and other properties. Together with LANL's actions, these measures are expected to cumulatively reduce runoff into the Rio Grande and result in a beneficial effect on water resources including overall water quality. These effects include reducing potential downstream flooding and TSSs.

4.5 Floodplains and Wetlands

4.5.1 Effects of Fire Suppression Activities

Because of the small area of floodplain disturbed, there was no significant adverse effect to LANL floodplains as a result of fire suppression activities. No wetlands were affected. Fire suppression on LANL was very similar to activities conducted on nearby Forest Service land. Many of these activities took place within floodplains, and a few activities took place within wetlands. These activities had a small adverse effect on floodplains where vegetation removal and ground-disturbing activity occurred. Indirect effects to floodplains include a reduction in the capacity of the floodplains to retain water and an enhanced likelihood of soil erosion.

During fire suppression activities, five new fire roads or breaks were cut across the floodplains. The firebreak activities disturbed less than 1.0 ac (0.4 ha) of the floodplains at LANL. As a result of these activities, there was some vegetation loss that will lead to a slight increase in soil erosion. The vegetation loss from firefighting activities was minimal. There were no new fire roads or breaks placed in wetlands. As a result, no wetlands were affected by fire suppression activities.

4.5.2 Effects of Post-fire Activities

Following the fire, there were seven major storm water control projects and numerous minor construction projects within the floodplains. As a result of these actions, approximately 20 ac (8 ha) of floodplain were directly disturbed or permanently altered. These storm water controls will protect downstream floodplains and wetlands from erosion that would occur with the anticipated higher than normal storm water runoff. The effect of this construction is significantly beneficial. For example, the estimated 10-fold (Table 3.2, page 3-7) increase in runoff for the six-hour, one-hundred year flood event in some of the watersheds will be reduced to near normal levels in Pajarito Canyon with the addition of the flood retention structure. Additional storm water controls in the Los Alamos Canyon, Pajarito Canyon, and other watersheds will also reduce the amount of floodplain and wetland disturbance compared to untreated watersheds.

Adverse effects to floodplains occur when vegetation is removed and soil is disturbed or removed. These actions reduce the capacity of the floodplain to retain water and increase the likelihood that the floodplain soils will be eroded away. Wetlands may be adversely affected by vegetation removal and by erosion or sedimentation that kills vegetation or changes the hydrology of the wetlands. Either erosion or sedimentation could result in a decrease in size of the wetlands and loss of wetland habitat for various species. Actions that moderate peak flows from storm water runoff, reducing flows to near normal levels, and that reduce the potential for sedimentation or erosion, on the other hand, have a beneficial effect on both floodplains and wetlands.

Los Alamos Canyon Watershed

The suite of activities in the Los Alamos Canyon watershed is likely to result in the significant beneficial preservation of floodplains, wetlands, and riparian areas. These activities would limit flooding and sedimentation despite disturbance of a few acres of floodplains.

Several actions taken in the Los Alamos Canyon watershed are designed to reduce the amount of runoff and sediment transport. Water was emptied from the Los Alamos Reservoir to improve silt and debris retention and to reduce the danger from the transport of debris down the canyon. Although construction activities disturbed up to 1 ac (0.4 ha) of the floodplain, these actions will reduce runoff, silt, and debris that could be transported onto LANL from the upper watershed.

Near the confluence of Los Alamos Canyon and DP Canyon, contaminated soils were removed to avoid potential contamination movement off-site. The action reduces the

amount of contaminants available to be moved downstream, which is a beneficial impact. No wetlands were affected by this action.

Roads in lower Los Alamos Canyon were improved with the addition of gravel to the drainage crossings. This action did not adversely affect floodplains or wetlands.

The weir in Los Alamos Canyon is designed to dissipate storm water flow rate energy and trap sediment in the event of flooding. A small area of floodplain (about 1 ac, 0.4 ha) was disturbed by the construction. A SWPP Plan was implemented to control soil erosion. No wetlands were lost during construction of the weir. Very little soil erosion is expected from the disturbance around the construction site that would not be trapped by the weir itself. Wetlands may develop upstream of the weir as it fills with sediment and retains moisture.

At TA-2 and TA-41, building demolition and the installation of fences, rock gabions, and concrete barriers, as well as road grading activities disturbed about 2.0 ac (0.8 ha) of floodplains, a small adverse effect. The overall beneficial effect of the projects is to greatly reduce potential damage from runoff and erosion compared to untreated burned watershed.

Pajarito Canyon Watershed

Post-fire activities in this watershed had both adverse and beneficial impacts on floodplains and wetlands. Several actions taken in the Pajarito Canyon watershed are designed to reduce the effects of storm water runoff and sediment and debris transport. The largest and most significant project in the watershed is a flood retention structure constructed in middle Pajarito Canyon. In substantial flood events, water, sediment, and debris that is held back behind the structure could cause sedimentation of the upstream floodplain. Water may back up temporarily during a severe flood event (i.e., a six-hour storm with a return rate of once in one-hundred years) up to about 2,000 linear feet (600 linear meters) from the structure. The area upstream from the flood retention structure is likely to begin to develop wetland characteristics and vegetation over several years. Although about 10 ac (4 ha) of vegetation were removed or disturbed by construction, no wetlands were affected. The flood retention structure will provide beneficial protection of downstream floodplains and wetlands from erosion.

Less than 1.0 ac (0.4 ha) of floodplain was disturbed by road reinforcements at Two Mile and Pajarito Canyons along SR 501 and at Two Mile Canyon and Anchor Ranch Road. Additionally, culvert replacement and cleaning at SR 501 within Pajarito Canyon disturbed less than 1.0 ac (0.4 ha) of floodplains. No wetlands were affected by these actions.

Implementation of the storm water control projects is expected to greatly reduce the amount of sedimentation in downstream wetlands compared to untreated canyons. There should be a significant beneficial impact on the downstream wetlands and floodplains.

Two projects, the enlargement of culverts in lower Pajarito Canyon, one about 0.25 mi (0.4 km) downstream from TA-18 and the other at SR 4, resulted in removal of about 1.5

ac (0.6 ha) of wetland vegetation composed primarily of willow trees. This wetland habitat was part of the habitat area for the southwestern willow flycatcher at LANL. The habitat removed, however, was not confirmed nesting habitat and was of marginal quality for use by southwestern willow flycatchers. Wetland vegetation is likely to regenerate over the next several years if the area is not silted in or scoured away by floodwaters.

Other Watersheds

Activities in the Sandia Canyon watershed had negligible effects on floodplains and wetlands. In the Sandia Canyon watershed, there was only one action taken to reduce the effects of storm water runoff. Concrete encasement and gabions were added to an existing RLW pipeline that crosses Sandia Canyon to stabilize side slopes and prevent erosion. Only an area the width of the line (3 ft [0.9 m]) crossing the canyon bottom was disturbed in the upgrade of this structure. Less than 1.0 ac (0.4 ha) of floodplain and no wetlands were affected. The effect to the overall floodplain in Sandia Canyon was negligible.

Sediments in three existing sediment traps, covering about 0.5 ac (0.2 ha), in the lower portion of Mortandad Canyon were excavated. This action resulted in minor soil disturbance within the floodplain. No wetlands were affected. Wetlands could develop in the sediment traps in the future, although none have developed there in the past.

Activities in the Water Canyon watershed had slight adverse effects on floodplains and no adverse effects on wetlands. In upper Water Canyon, the SR 501 crossing was improved to reduce the potential of road damage from water retention behind the road banks. Just to the west of SR 501 in Water Canyon, less than 1.0 ac (0.4 ha) of wet meadow was buried by fire debris during the June 28, 2000, flood event, before the crossing was improved. The small amount of work performed in this area had no adverse effect on the wetland. Less than 1.0 ac (0.4 ha) of floodplain was disturbed, a slight adverse impact.

4.5.3 Cumulative Effects

Actions conducted by DOE and others within the ROI have resulted in a loss of a few acres of wetlands, but additional wetlands may be created behind the flood retention structures. The overall effect of these actions is to protect wetlands downstream in the ROI from serious erosion or sedimentation, which is a significant beneficial impact.

Storm water runoff in the aftermath of the Cerro Grande Fire could increase the size and extent of floodplains at LANL and elsewhere in the ROI, depending on the location, amount, and duration of rain events. Although the fire suppression and post-fire actions in the floodplains have disturbed floodplains and have resulted in increased localized runoff, these adverse changes are minor compared to changes caused by the fire. Cumulatively, the flood retention structure, storm water controls, and soil erosion control measures taken by DOE and other agencies will have significant beneficial impacts. These actions will moderate peak flows of storm water runoff and reduce sediment transport throughout the ROI compared to taking no action to reduce storm water effects.

Cumulatively, actions will help to maintain downstream wildlife habitat as well as to protect property and operational functions at LANL and real property in White Rock.

4.6 Biological Resources

4.6.1 Effects of Fire Suppression Activities

The DOE's fire suppression activities resulted in transient and long-term effects to biological resources. The clearing of about 130 ac (52 ha) understory plants and the removal of trees associated with the fire suppression activities temporarily displaced local wildlife. Deer, elk, birds, and small mammals would be expected to have left the sites. This displacement may have ranged from a few days to several weeks, depending on the species involved. However, wildlife rapidly returned to the affected areas and, with an anticipated return of plant cover over the next several years, wildlife use and diversity could be expected to return to pre-fire conditions. Use of the areas affected by fire suppression activities (for nesting, foraging, and cover) by some bird species may be expected to decline long term on a local basis while other species would remain unchanged. Fire suppression activities are not likely to have disturbed federally-listed T&E species at LANL; nor are they likely to have had any effect on state-listed species. Only one pair of birds that are federally listed as threatened were known to have been present at LANL at the time of the fire. Their nesting area was burned and they fled the area in front of the fire. This pair of birds has since returned to their nesting site area.

4.6.2 Effects of Post-fire Activities

The DOE's post-fire construction of storm water control and retention structures and implementation of soil erosion control measures produced an array of biological effects. These effects ranged from transient to long term; some of these effects may be considered beneficial and some adverse. In the long term, the major beneficial effect is the protection of wildlife habitat from further degradation from flooding and the restoration of vegetation on burned areas within LANL. Additionally, the activities taken at LANL will potentially reduce the transport of contaminants into wildlife habitats.

In general, protection of habitat from flood damage will have a beneficial effect on federally-listed T&E species and other wildlife. However, destruction of core nesting and roosting potential habitat in Pajarito Canyon due to construction of the flood retention structures will have a minimal long-term adverse effect on the quality of the potential Mexican spotted owl habitat and the associated partially burned AEI. Minor removal of cliff face area (up to about 75 ft [12.5 m] from the canyon bottom and about 50 ft [15 m] in width) on both sides of Pajarito Canyon also occurred during the construction of the flood retention structure and associated road. This is a permanent adverse effect to that potential habitat area. Trees in a stressed condition that are within the retention structures pooling area may die if repeated flooding events occur over the same growing season. The Pajarito Canyon flood retention structure removed up to about 5 percent of the Mexican Spotted Owl AEI and will result in wildlife habitat fragmentation for game animals. However, this construction is not expected to have an adverse effect on individual Mexican spotted owls or designated critical habitat for the species. New Mexico State-listed T&E species are not likely to have been affected by

post-fire activities since they have not been found in the areas where actions had taken place on LANL.

The clearing of about 20 ac (8.0 ha) understory plants and the removal of trees associated with the post-fire emergency measures had transient as well as long-term effects on local wildlife. The general disturbance and removal of vegetation resulting from implementing the post-fire activities may have temporarily displaced local wildlife. For example, deer, elk, birds, and small mammals would be expected to have left the project sites. This displacement could range from a few days to several weeks, depending on the species involved. Wildlife, however, rapidly returned to the affected areas and, with an anticipated return of plant cover over the next several years, wildlife use and diversity could be expected to return to pre-fire conditions. Use of the affected areas (for nesting, foraging, and cover) by some bird species may be expected to substantially decline on a local basis while other species would remain unchanged. Although draining Los Alamos Reservoir displaced all the fish in the reservoir, many fish were removed from the reservoir and relocated before it was drained. Draining the reservoir also results in a temporary loss of 2.2 ac (0.9 ha) of surface water for wildlife use.

4.6.3 Cumulative Effects

Habitat changes from the fire suppression and post-fire emergency actions within the ROI will primarily result in significantly beneficial, long-term impacts to biological resources. Examples of these beneficial changes include decreased soil erosion, restoration of understory vegetation, and a minimization of contaminant transport within habitats. The most severe adverse effect to habitats will be a result of elimination of both understory and overstory vegetation over about 13 ac (5.2 ha) during construction of the flood retention structure, the low-head weir, and the Mortandad Canyon sediment trap together with the resulting fragmentation of those habitats.

Restoration of understory vegetation by reseeding over the ROI is likely to be the greatest beneficial impact to habitat areas (Photos 4.1a and 4.1b). Because the seed mixture being used for reseeding contains two nonnative annual species, these species may dominate the initial colonization of the burned area for the first growing season. Perennial species in the seed mix will dominate in the burned areas in the subsequent year(s) as the nonnative species are expected to reseed themselves only for one or two years. Vegetative composition and abundance in the burned area will be different than it would have been without the reseeding effort. However, the protection from erosion and runoff provided by the reseeding effort is considered a significant beneficial effect. In the long term, suitable native plants will return to a balanced condition through normal plant succession.

4.7 Climatology, Meteorology, and Air Quality

4.7.1 Effects of Fire Suppression Activities

The use of ground and air equipment for fire protection and suppression produced emissions of criteria air pollutants. Because of the closure of LANL and the evacuation of the townsite, normal vehicle emissions of criteria air pollutants were greatly reduced.

PHOTOS 4.1a and 4.1b—*Understory Regeneration in Seeded and Mulched Areas, August 3, 2000*

Emissions from fire protection and fire suppression ground equipment were roughly 20 percent to 80 percent of emissions from typical LANL vehicle traffic for a two-week period, which is a negligible adverse effect on air quality and less than that expected under typical LANL operating conditions.

4.7.2 Effects of Post-fire Activities

The primary air quality effects from post-fire activities are from construction activities and contaminant disturbance and removal. These activities, except for operation of the concrete batch plant, are exempt from permitting requirements of applicable regulations. The adverse effects on air quality were of short duration—ranging from a few days to a few months.

Ground-disturbing construction and excavation of PRSs were responsible for temporary localized increased concentrations of particulate matter, including some radioactive particulates (Table 4.2). Doses to the nearest offsite receptor (e.g., residences, schools, or offices) from airborne radioactive emissions associated with work in PRSs were estimated not to exceed 0.1 mrem. Heavy equipment used for post-fire construction activities produced carbon monoxide (about 23 tons/21 t), hydrocarbons (about 2 tons/1.8 t), oxides of nitrogen (NO_x) (about 1 ton/0.9 t), and other criteria pollutants. These emissions are estimated to be less than one percent of expected annual emissions from typical LANL vehicle traffic.

Air emissions were estimated for an emergency permit to operate the concrete batch plant used in construction of the flood retention structure. Particulate emissions were estimated at less than 3.0 pounds per hour. The batch plant was permitted to operate continuously for up to 90 days. An equipment malfunction caused emission to increase to an estimated 7.0 pounds per hour over a three-day period. After construction of the flood retention structure was complete, the batch plant was disassembled and removed. The effect to air quality from the operation of the batch plant was a temporary slight adverse impact.

TABLE 4.2—*Radiological Emissions from Construction Activities in Areas with Contaminated Soils*

Activity	Air Emission (curies [Ci])								Total Soil Excavated (tons)
	Am-241	Pu-238	Pu-239,240	Cs-137	Sr-90	U-234	U-235	U-238	
Los Alamos Canyon weir	4.78E-07	N/A	3.11E-07	1.63E-06	3.57E-07	N/A	N/A	N/A	13,000
Excavation of sediments in Mortandad Canyon sediment traps	7.10E-06	2.36E-06	8.78E-06	1.49E-05	1.20E-06	5.38E-07	3.34E-08	5.04E-07	380
Excavation of contaminants in Los Alamos Canyon	2.39E-06	1.37E-07	5.68E-06	2.02E-04	4.15E-05	N/A	N/A	N/A	1,000

Source: Hurtle 2000

4.7.3 Cumulative Effects

Air emissions from post-fire activities in the ROI were temporary and localized. When all sources of emissions were combined, they did not constitute a significant adverse effect on regional air quality.

4.8 Visual Resources

4.8.1 Effects of Fire Suppression Activities

The principal effect on visual resources resulting from fire suppression activities at LANL was the cutting of firebreaks and fire roads. These features interrupt the landscape with linear scars but are typically not visible from publicly accessible areas. This is a temporary adverse effect to visual resources at LANL.

4.8.2 Effects of Post-fire Activities

The various construction activities had minor adverse effects on visual resources at LANL. New firebreaks and fire roads constructed during the fire suppression period that are not needed for long-term fire protection have been revegetated. Over a period of years, the vegetation will blend with the surrounding area and the revegetated area will become less noticeable. Increased suspended particulate matter from construction and heavy equipment use may have resulted in decreased visibility within small areas for short periods of time but would be expected to quickly return to normal conditions. Storm water retention and flood control construction activities such as road bank reinforcement along SR 501 and SR 4 at Los Alamos Canyon are highly visible and introduced non-natural elements (construction vehicles, rock gabions, etc.) into otherwise minimally disturbed areas. The visual disruption associated with heavy equipment use was limited to the construction period. The visual effects of the rock weirs and similar features will continue until they are removed or until native vegetation covers them. Other construction activities, such as the flood retention structure in Pajarito Canyon and the associated concrete batch plant, are located in areas that are generally out of sight of major viewing locations such as public roadways. Runoff from burned areas will cause ashy, black sediment to be deposited in stream channels and behind the storm water control structures. These deposits will be visible for a period of a few years and will be a slight adverse effect to visual resources (Photo 4.2). The primary beneficial effect of the post-fire activities is the restoration of understory vegetation through reseeding. Vegetation recovery will reduce the contrast between the burned and unburned areas.

4.8.3 Cumulative Effects

The primary beneficial cumulative impact of activities within the ROI to visual resources is the restoration of understory vegetation, which will reduce the contrast between burned and unburned areas. The adverse effects to visual resources are small-scale and localized and do not constitute a cumulatively adverse effect.

PHOTO 4.2—*Charcoal-laden Sediment Deposited by Runoff from Burned Areas*

4.9 Cultural Resources

4.9.1 Effects of Fire Suppression Activities

Most ground-disturbing activity areas such as firebreaks, fire roads, and staging areas were partially or completely surveyed by professional archaeologists before the actions occurred; no cultural resource sites were identified in the surveyed areas and, thus, none were affected. In the early days of the Cerro Grande Fire, however, three prehistoric archaeological sites at TA-49 were adversely affected by leveling a staging area in conjunction with the construction of the rest camp. One cultural resource site was destroyed, two others were damaged. Although this is considered an adverse effect, these three sites constitute less than one percent of the total number of LANL archaeological sites.

4.9.2 Effects of Post-fire Activities

Post-fire activities resulted in adverse effects to some historic properties but also reduced the likelihood that other cultural properties would be adversely affected by erosion, a beneficial impact.

Ground-disturbing activities have the potential to adversely affect cultural resources sites. UC cultural resources specialists reviewed post-fire activities, including raking and seeding projects and major construction projects. Any cultural resources in the areas of effect were demarcated in the field with flagging tape to prevent inadvertent impact by

project activities. No adverse effects to archaeological sites occurred as a result of ground-disturbing activities. At Anchor Ranch Road, a trench constructed to temporarily divert water from a pond to the drainage channel while the culvert under the road was being replaced affected an historic pond. The effect from this activity is not considered to be adverse.

The complex of historic buildings at TA-2 was affected by the decision to remove these structures from the floodplain. The structures removed as part of DOE's post-fire actions in Los Alamos Canyon (Section 2.3.2.1) were scheduled for decontamination, decommissioning, and demolition before the Cerro Grande Fire. That schedule was accelerated to prevent the structures from becoming water-borne debris during a major runoff event. The two significant historic structures affected by the removal action are the rod storage facility (TA-2-4) and the cooling tower (TA-2-49). The cooling tower had been documented and DOE had consulted with the State Historic Preservation Office (SHPO) before the Cerro Grande Fire. Although UC cultural resources specialists documented the buildings before they were dismantled, the removal of the buildings is considered an adverse effect to historic properties.

Effects to TCPs from the full range of post-fire actions are likely but there is insufficient information about the locations of these sites to analyze the impacts fully at this time. Consultation with the Accord Pueblos, as noted in Section 1, was incorporated into the ERT process. In some cases, activities were modified in response to Native American concerns.

The extensive erosion and storm water control efforts have had a beneficial effect on most cultural resources. In particular, these measures have decreased the likelihood that other cultural resources would be adversely affected by erosion. At TA-18, the historic Pond Cabin and at TA-2, the historic Omega-West Reactor were surrounded with concrete barriers and sandbags to prevent damage from debris carried by storm water runoff. Construction of the flood retention structure upstream will provide the Pond Cabin additional protection from flooding.

4.9.3 Cumulative Effects

Together with BAER Team rehabilitation measures on Santa Clara and San Ildefonso Pueblos land and on burned areas of Santa Fe National Forest, DOE erosion and storm water controls are expected to further reduce downstream erosion and sedimentation that could adversely affect cultural resources. Therefore, these erosion and storm water control measures will have a significant beneficial effect on prehistoric and historic cultural resources and TCPs that are located in, or downstream from, areas burned by the Cerro Grande Fire.

4.10 Utilities and Infrastructure

4.10.1 Effects of Fire Suppression Activities

The fire suppression activities had a beneficial effect on water, gas, and electric utilities at LANL by minimizing damage to utilities and infrastructure. The lowest level of

electricity usage ever recorded, which was about 35 megawatts of power, was imported through the Norton and Reeves Power Lines during this period. Normal LANL operational use is about 55 megawatts. At the LANL Sanitary Wastewater Treatment Plant, the lowest volumes during this period were about 60,000 gal. (227,400 l) per day. Normal sanitary wastewater volume is 300,000 to 350,000 gal. (1,137,000 to 1,326,500 l) per day. Total water usage during May 2000 was about 50.4 million gal. (191 million l). The previous month's water usage was about 31.6 million gal. (116 million l). Two temporary water supply stations, "pumpkin tanks," were brought in to LANL and supplied water for water-tanker helicopters. Helicopter pilots used these 3,000-gal. (11,400-l) tanks to fill the helicopters' buckets. Gas service was cut off to TAs 22, 40, 15, 8, 9, 16, 33, and 39 and Bandelier National Monument during the fire. About 30 mi (48.3 km) of new or upgraded access roads were bladed, although most of these were of temporary nature so effects to infrastructure were also temporary in nature.

4.10.2 Effects of Post-fire Activities

Beneficial impacts on utilities and infrastructure occurred from the installation of flood control and flood retention structures, such as the Pajarito Canyon flood retention structure, the low-head weir in Los Alamos Canyon (Photo 2.16, page 2-26), and the TA-18 steel diversion wall with backfill. Flood control concrete barriers were placed around the bases of all power poles located within potential flood areas.

The post-fire activities to control storm water runoff have a beneficial effect on facilities, use of roadways, and other infrastructure such as communication and security systems. Benefits include improved access to both utilities and infrastructure from additions of new firebreaks and improved maintenance of existing firebreaks in and around utility lines and facilities. Post-fire hazard tree removal activities have also improved access to buried water and gas lines as well as electric and communication lines that are located in areas that were overgrown with vegetation. These areas are particularly difficult to reach to perform maintenance or, in the event of an emergency, to perform repairs. Hazard trees in forested areas bordering roadways were removed, which in turn improved visibility and reduced the potential for vehicular collisions with wildlife and forest debris on roadways.

4.10.3 Cumulative Effects

The ROI for consideration of cumulative effects on utilities and infrastructure encompasses the communities of Los Alamos and White Rock, the National Forest and National Park areas surrounding LANL, and LANL. Overall implementation of these activities will have a beneficial effect on utilities and infrastructure by reducing the extent and intensity of potential flooding damage downstream of the burned area.

4.11 Socioeconomic

4.11.1 Effects of Fire Suppression Activities

No substantial changes to either the local or regional populations or economies are expected as a result of fire suppression and post-fire mitigation activities. Short-term increases in employment (about 180 UC subcontractors) occurred at LANL.

4.11.2 Effects of Post-fire Activities

UC employees and subcontractors worked substantial amounts of overtime during this period. Under an interagency agreement, the USACE and their subcontractors worked onsite for about four months. Congress appropriated about $342 million for DOE's post-fire activities. Some of these actions will occur over the next two years and will be the subject of additional NEPA compliance review.

4.11.3 Cumulative Effects

The ROI for consideration of cumulative effects on socioeconomics encompasses the communities of Los Alamos and White Rock and northern New Mexico. Fire suppression and post-fire activities in these areas cumulatively will result in a short-term unstable labor market resulting from changes in the demands for specialized construction workers primarily that will be brought on-site for limited duration and will leave at the completion of the job. Additional appropriations by Congress for rebuilding the Los Alamos Community will also provide a beneficial infusion of money into the local economy during this three-year period (2000 to 2003).

4.12 Noise

4.12.1 Effects of Fire Suppression Activities

Actions authorized by DOE during the fire suppression and the post-fire response periods of the Cerro Grande Fire had a minimal effect on the types of noise and the typical noise levels found at or in the vicinity of LANL. During the conduct of fire suppression activities, the types of noise and increased noise levels resulting from DOE-authorized actions were similar to noises produced from routine operations at LANL or in the surrounding area, the Los Alamos County Airport. Activities conducted for fire suppression generated noise from the use of emergency response and firefighting equipment such as trucks, helicopters, and airplanes. This equipment operated on a continuous basis during daylight hours at LANL. Emergency response and firefighting vehicles also operated around the clock. Helicopters and airplanes were not used to fight the fire at night. In addition, earthmoving equipment and chain saws generated noise during the construction of 473 ac (189 ha) of firebreaks, fuelbreaks, and new or improved access roads. The combined effect of these activities resulted in minor and localized increases in noise levels. Work at a particular location was generally completed in a matter of hours or a few days and noise generation subsequently ceased.

Fire suppression activities that generated noise or increased noise levels occurred for about two weeks during May 2000 until mid-August. During most of May, the

workforce at LANL and the residents of Los Alamos had been evacuated and were not exposed to any noise associated with fire suppression. The removal of vegetation during the fire suppression period on 100 ac (40 ha) of LANL land could result in a moderate reduction in the ability of certain areas to attenuate noise from routine operations. This could expose workers in the vicinity of these areas to a slightly higher noise level from any operations that infrequently or routinely produce elevated noise levels. Because of the distance between the burned areas at LANL and most residential areas, vegetation removal conducted during the suppression period should not increase the noise levels experienced by most members of the public so impacts should be negligible. As vegetation recovers, ambient noise levels should return to pre-fire levels.

4.12.2 Effects of Post-fire Activities

The types of noise and the changes in noise levels that occurred in conjunction with the post-fire activities were similar to those that occurred during the fire suppression activities. Various vehicles, earthmoving equipment, helicopters, and airplanes continued to operate in and around LANL on a more frequent basis during daylight hours than what occurred before the fire. This equipment was used to finalize fire suppression, move supplies, reseed areas, and generally rehabilitated burned areas. Various vehicles and earthmoving equipment operated around the clock to construct flood control structures in remote areas or canyon drainages within the boundaries of LANL, Los Alamos County, or nearby pueblos. Chain saws were used to remove burned trees or to clear areas for flood control structures.

The types of noise and levels of noise from these post-fire response actions were typical of on-going construction activities and maintenance operations routinely performed at LANL. Most of these activities were conducted in remote areas where there were few, if any, permanent LANL workers and no nearby residences. The workers performing the actual work were exposed to noise, but all exposures were maintained within safe levels consistent with construction health and safety plans. Vehicular traffic noise increased in proportion to the increase in the number of construction related vehicles. Vehicle noise on public roads associated with this period was concentrated in July and August 2000. Vegetation thinning occurred in additional locations in and around LANL during this period that would further reduce the ability of the environment to attenuate noise. However, because of the remote location and short duration of most activities and the expected recovery of the vegetation, noise levels have quickly returned to background levels and impacts should be minimal.

4.12.3 Cumulative Effects

The cumulative adverse effects on noise levels from activities that occurred in response to the Cerro Grande Fire on DOE and adjacent federal- and local government-administered lands within the ROI for noise resources were relatively minor and temporary. Noise producing activities were similar in nature and in duration to those occurring on DOE lands only, but also affected residential areas. These activities occurred during both the Cerro Grande Fire suppression period and the post-fire period in burned, remote, and residential areas primarily to the north, west, and south of LANL. Most burned or remote areas were not located near residential areas. During the fire

suppression period, the local population was not affected because they had been evacuated. During the post-fire period, routine activities at LANL, the Los Alamos County Airport, and in residential areas around LANL resumed and contributed to the cumulative effects on noise levels. An increase in the use of the Los Alamos County Airport was noticeable. However, most post-fire activities either occurred in remote areas or did not exceed typical noise levels for local residential areas. Aircraft use over LANL and nearby areas is usually restricted. During the fire suppression and post-fire activities this restriction was lifted. Fire suppression activities and post-fire activities involving aircraft use, such as aerial application of mulch, were of a minor and temporary nature. The air space restriction over LANL was reinstated on August 1, 2000.

4.13 Environmental Justice

4.13.1 Effects of Fire Suppression Activities

Environmental justice impacts occur when there are disproportionately high and adverse human health or environmental effects on minority or low-income populations that could result from the actions undertaken by DOE. The fire suppression actions had no disproportionately high and adverse human health or environmental effects on minority and low-income populations.

4.13.2 Effects of Post-fire Activities

Post-fire activities will have a beneficial effect on environmental justice issues as the risk of soil erosion and flood damages are significantly reduced to downstream communities due to LANL post-fire activities. Air and water quality monitoring stations at LANL were repaired or replaced. Ongoing air, water, soil, and produce monitoring data will continue to be collected and effects observed.

4.13.3 Cumulative Effects

Implementation of fire suppression and post-fire flood and erosion control measures within the ROI are expected to have a cumulatively beneficial effect in terms of environmental justice. Actions taken by DOE and others are expected to reduce the extent and intensity of potential flooding downstream for the Pueblos of Santa Clara and San Ildefonso, the towns of Española, Los Alamos, and White Rock, and other small communities in this area. This is a beneficial impact to TCPs and other properties of low-income and minority populations.

4.14 Human Health

4.14.1 Effects of Fire Suppression Activities

Actions authorized by DOE during the performance of fire suppression activities relative to the Cerro Grande Fire had a minimal to moderate adverse effect on emergency response worker (i.e., worker) health and a potentially significant beneficial effect on public health. Non-emergency response workers at LANL were either evacuated or excluded from areas where fire suppression occurred. Therefore, there were no adverse health effects on non-emergency response workers from DOE-authorized actions.

During the fire suppression period, workers were exposed to smoke and fire from burning vegetation, structures, and PRSs. Workers also faced hazards associated with the thinning of vegetation, construction of firebreaks, helicopter and fixed-wing aircraft operations, and emergency response vehicle traffic. Chemicals used during the fire suppression period (e.g., foam and slurry) were either considered to be of low toxicity or were used in a manner so as to limit worker exposures. Fire suppression activities occurred on a continuous basis for about two weeks in May 2000 until the Emergency Operations Center at LANL returned to routine operations. About 2,000 workers were directly or indirectly involved in fire suppression activities during this period.

Members of the public living in the vicinity of LANL had been evacuated during this period and were therefore not directly affected by DOE-authorized actions taken in response to the fire. However, authorized actions taken during this period prevented the spread of fire to additional residential areas located north and east of LANL and helped to contain the extent of the fire on San Ildefonso Pueblo lands. In addition, the sharing of emergency response resources among DOE, Forest Service, Park Service, Los Alamos County, and nearby Pueblos contributed significantly to preventing injury or loss of life to members of the public and further damage to personal property from the fire.

Only relatively minor injuries or exposures to workers were actually recorded or estimated to have occurred during the fire suppression period. Fire suppression activities resulted in four recordable fire related worker injuries ranging from a fractured heel to smoke inhalation during May 2000. All injured workers are expected to recover fully. Fire suppression activities, including wildfire, facility, and PRS firefighting, and firebreak construction exposed workers to minimal amounts of radioactive materials. Preliminary worker dose estimates indicate that individual worker doses did not exceed 0.2 mrem and were generally much less than this (LANL 2000g). DOE regulations allow for annual worker doses up to 5,000 mrem. Since worker doses were far below allowable annual doses (about 0.004 percent of the allowable worker dose), no adverse health effects to workers from radiation exposures should result from fire suppression activities.

Members of the public living in communities outside of Los Alamos County received minimal radiation doses (much less than 1.0 mrem) from smoke associated with the Cerro Grande Fire (LANL 2000b). Typical background levels of radiation produce annual doses to members of the public living in these areas of about 350 mrem. Therefore, the total contribution to the public dose from the Cerro Grande Fire is about 0.3 percent of the typical background dose. It is unlikely that any activities authorized by DOE to suppress the fire resulted in a dose to the public. However, any activities that might have indirectly contributed to public dose would have resulted in a dose that is much less than the total contribution made by the fire. Since the total dose to the public from smoke associated with the fire is minimal, any public doses associated with fire suppression activities that produced smoke would also be minimal.

4.14.2 Effects of Post-fire Activities

Effects on worker health that resulted from the post-fire response period were less than or similar to those that occurred during the fire suppression period. Workers were not

exposed to smoke from an active fire during this period but continued to be exposed to hazards associated with the removal of vegetation, construction activities, helicopter and fixed-wing aircraft operations, and vehicle traffic. Other activities made use of typical construction materials or materials that are not considered to be hazardous to workers or the public when used according to directions. A total of about 1,800 workers were involved in DOE-authorized post-fire activities.

Post-fire activities resulted in one reported worker injury from a fall associated with managing inventories for aerial seeding operations. The injured worker is expected to fully recover. Post-fire activities, including PRS and soil stabilization activities, flood control structure construction, and facility cleanup, exposed workers to minimal amounts of radioactive materials. Preliminary worker dose estimates indicate that individual worker doses did not exceed 1.2 mrem and were generally much less than this. DOE regulations allow for annual worker doses up to 5,000 mrem. Since worker doses were far below allowable annual doses (about 0.024 percent of the allowable worker dose), no adverse health effects to workers from radiation exposures should result from post-fire activities.

In general, members of the public were not directly affected by post-fire activities conducted at LANL because of the distance between these activities and residential areas. Increases in vehicular traffic associated with construction activities resulted in some congestion on publicly accessible roads in and around LANL, particularly during July and August 2000. No radioactive materials were released off-site as a result of post-fire activities. Wood removed from construction sites that was determined to be free of contamination was released for public use. Any contaminated or potentially contaminated material was retained for appropriate management and disposal.

Indirectly, members of the public benefited significantly from post-fire activities. PRS and soil stabilization activities and the construction of flood control structures reduced or eliminated the risk to residential areas, including San Ildefonso Pueblo, of a catastrophic flood crossing LANL and reaching these populated areas. In addition, the potential for a large amount of contamination moving off LANL and reaching populated areas or the Rio Grande was also reduced.

4.14.3 Cumulative Effects

The cumulative adverse effects on worker and public health from activities that occurred in response to the Cerro Grande Fire on DOE and adjacent federal- and local government-administered lands were relatively minor. Workers that fought the fire on LANL lands and off-site were exposed to a greater amount of smoke- and fire-related hazards than those involved with LANL-only activities. However, no serious injuries or fatalities were reported. Since members of the public had been evacuated from Los Alamos County, the fire suppression period did not result in any serious health impacts on the general public.

Cumulative adverse health effects to workers and the public during the post-fire period were similar to those encountered during the fire suppression period. Although health

hazards to workers and the public from exposure to smoke and fire were practically eliminated during this period, work with potentially hazardous equipment (e.g., earthmoving equipment, axes, wood chippers) increased. Members of the public returned to their communities but were generally excluded from areas where post-fire activities were conducted. No serious injuries or fatalities to either workers or the public were reported during this period.

The cumulative effects of fire response actions on DOE and nearby lands also had a significant beneficial effect on LANL non-emergency response worker health and safety and members of the public. DOE facilities in flood prone areas were either protected from potential flooding or operations and workers were relocated to higher ground. The construction of flood control structures and related actions also reduced the amount of sediments and potential contaminants that could be transported off of LANL into nearby communities or the Rio Grande. These structures also reduced the potential for floods to damage personal property downstream from LANL and other affected communities and pueblos.

4.15 Environmental Restoration and Waste Management

4.15.1 Effects of Fire Suppression Activities

There were no effects on environmental restoration and waste management from fire suppression activities during the fire suppression stage.

4.15.2 Effects of Post-fire Activities

One MDA required extensive fire suppression efforts to control a subsurface smoldering fire. BMPs for the 91 PRSs have been completed. These sites and their specific BMP requirements are listed in Table 2.4 (page 2-19; LANL 2000h). As of July 21, 2000, 47 accelerated actions were either in progress or had been completed.

BMPs have been used throughout LANL to assure that stabilization is achieved. Channels and floodplains containing contaminated sediments have been stabilized by contamination removal or installation of catchment basins in order to minimize the potential for off-site transport of potential contaminants beyond pre-fire runoff rates. Impacts to existing streams and drainages have been minimized. BMPs were implemented in an ordered fashion to achieve the greatest reduction in contaminant transport risks from the most likely events (summer flooding) (LANL 2000h).

Performing BMPs on 91 PRSs and initiating 47 accelerated cleanup actions will have a significant beneficial impact on limiting the spread of contaminants within and outside of LANL. The BMPs listed in Table 2.4 (page 2-19) will prevent or reduce contaminated soil erosion and runoff from PRSs directly affected by the Cerro Grande Fire. In addition, these PRSs have been stabilized so that a long-term cleanup strategy can be implemented without the potential for conditions at these sites to deteriorate or for these sites to become larger in size. The accelerated cleanup actions will result in the long-term stabilization, reduction, or removal of contaminants around facilities and in canyon drainages and floodplains at LANL. Contaminant removal, reduction, or stabilization

reduces or prevents the spread of hazardous materials in the environment and facilitates the ultimate DOE cleanup strategy for LANL. In addition, fish and wildlife and residential communities that are located downstream of accelerated cleanup sites in canyon drainages have a reduced probability of being exposed to these contaminants over time.

DOE actions taken during the post-fire period resulted in the generation of additional low-level radioactive and nonhazardous solid waste. The low-level waste that was generated during the post-fire activities (mostly from environmental restoration cleanup) was sent to TA-54, Area G, for disposal. To date, most of the PRSs affected by the fire have been mitigated and BMPs applied. The volume of waste sent to TA-54 was about 1,071 yd^3 (900 m^3), with only a small number of pieces of equipment from TA-41 and no transuranic waste. An additional 595 yd^3 (500 m^3) are anticipated to be stored at TA-54 by the November time period (Personal Communication, Julia Minton-Hughes). About 1,200 yd^3 (912 m^3) of landfill material from building demolitions, 800 yd^3 (608 m^3) of clean fill, and 100 yd^3 (76 m^3) of debris at TA-16 (MDA-R site) are yet to be characterized and disposed of.

The amounts of nonroutine RCRA hazardous waste generated as a result of post-fire activities did not create volumes outside the normal range. These activities also did not result in volumes exceeding LANL's RCRA permit limits for on-site storage. All hazardous materials were accumulated and rapidly shipped off-site for treatment and disposal.

The additional amount of nonhazardous solid waste from LANL that was generated as a result of post-fire activities included material such as clean rubble from the dismantling of buildings and from campsites that were set up at TA-49 for firefighters. Of the 40 buildings either damaged or destroyed by the fire and the 10 structures removed from TA-02, waste volumes of 25,375 ft^3 (761 m^3) for only two structures have been calculated (a trailer in TA-46 and a structure in TA-2). The remaining 48 structures include other buildings and storage structures of varying sizes. The additional solid waste was sent to the Los Alamos County Landfill. Most of the clean building rubble has been sent to TA-60, Sigma Mesa, to an existing rubble storage site. Rubble mostly in the form of crushed rock and dirt from USACE project sites was stockpiled and left on site. The total volume has been estimated as 40,000 yd^3 (30,400 m^3).

4.15.3 Cumulative Effects

The ROI for consideration of cumulative effects on waste includes the communities of Los Alamos and White Rock, LANL, and northern New Mexico. PRSs at LANL were the only PRSs directly affected by the Cerro Grande Fire. Activities occurring on Forest Service lands that are upstream from LANL could have an indirect but cumulative impact on PRSs at LANL. In general, these cumulative impacts would be beneficial because they would reduce the potential for soil erosion and storm water runoff impacts. No other activities within the ROI are expected to have a cumulative effect on PRSs at LANL.

The Northeast New Mexico Regional Landfill near Wagon Mound and Los Alamos County Landfill received the majority of the solid waste that was generated primarily as a result of the cleaning effort of destroyed homes and structures in the Los Alamos townsite. The effect is that the Los Alamos County Landfill will reach capacity sooner than anticipated, probably within the next 10 years. The need for a new regional landfill site to receive solid waste from LANL and the surrounding communities has increased.

4.16 Transportation

4.16.1 Effects of Fire Suppression Activities

Effects on both the regional and internal LANL transportation system as a result of fire suppression were minimal. Some limited-period road closures were necessary during the fire suppression period to prevent access to LANL and to the communities of Los Alamos and White Rock for safety and security purposes. LANL and the townsites were evacuated during the fire suppression period. In addition, road closures enabled firefighters and other emergency personnel to have clear and easy access for moving people and equipment efficiently and safely.

4.16.2 Effects of Post-fire Activities

Effects on both the regional and internal LANL transportation system as a result of post-fire activities were minimal. During the post-fire period, SR 501 was reinforced with concrete at the crossings with Pajarito, Two Mile, and Water Canyons to prevent erosion. This work involved the installation of ACM materials on the upslope side or grading and shaping the downstream side of the roadway or both. Some limited-period road closures were necessary during mitigation activities to support repair work and replacement of culverts. Also, additional road closures were required to allow movement of hazardous materials from areas at risk from potential flooding.

Short-term effects resulted from construction activity primarily along Pajarito Road and SR 4. A total of 400 loads of aggregate material were transported daily along these two roads during July and August 2000 from Albuquerque. This material was transported by 20 trucks during the day bringing in eight loads each and 30 trucks at night bringing in eight loads each for a total of 400 loads each day.

4.16.3 Cumulative Effects

The ROI for consideration of cumulative effects on transportation encompasses the communities of Los Alamos and White Rock, the Forest Service and Park Service areas surrounding LANL, and internal LANL roads. Cumulative effects on transportation did not create a long-term adverse effect on the transportation system at LANL or in this region.

4.17 Summary of Impacts

4.17.1 Impacts at LANL

The actions covered in this SEA encompass a wide range of activities—ranging from fire suppression to major post-fire construction. The individual projects had a series of adverse effects, such as loss of cultural resources and habitat for T&E species and other wildlife, primarily resulting from soil and vegetation removal. The beneficial impacts however, include protection of cultural resources, of substantial areas of floodplains and wetlands, and of government, tribal, and private property. The beneficial effects are expected to outweigh the adverse effects. Table 4.3 summarizes the effects of the fire suppression and post-fire activities.

TABLE 4.3—*Summary of Impacts*

Resources	Fire Suppression	Post-Fire
Land Use	No long-term changes in land use as a result of this effort. Short-term reduction in trees within LANL buffer areas. Temporary expansion of TA-49 Cache Facility for firefighters and support crews.	No long-term changes as a result of this effort. Additional removal of trees by LANL. Certain recreation trails within LANL remain closed until cleanup and flood mitigation areas are complete and vegetation is reestablished.
Geology/Soils	None of the fire suppression activities included actions that could significantly affect the local geology. Activities included construction, firebreaks, access roads, and staging areas, backfires and slurry drops that exposed mineral soil and increased the likelihood of soil erosion.	None of the post-fire activities included actions that could significantly affect the local geology of these activities, only the soil stabilization treatments are intensive or extensive enough to significantly cause soil erosion. However, the expected result of the watershed treatments is to stabilize soils and reduce surface runoff.
Water Resources	No major effects on water or surface water quality is anticipated as a result of fire suppression activities. The fire-retardant slurry used was an ammonium polyphosphate solution. Ammonium and sodium ferrocyanide can be toxic to aquatic organisms if applied to surface waters. Perennial surface water areas of Los Alamos did not burn and are not known to have received slurry drops.	No significant adverse effects to the quality or quantity of surface water or perched groundwater or springs are anticipated from post-fire actions. These actions are designed to control water flow and hold back sediment and debris. Flood retention structures that temporarily retain and then slowly release water could lead to increased short-term groundwater recharge in some locations.
Floodplains and Wetlands	Fire suppression activities had a small adverse effect on floodplains where ground-disturbing activity occurred. No fire roads or breaks were in wetlands, so no wetlands were affected by fire suppression activities.	The construction of seven major and numerous minor storm water control projects resulted in approximately 20 ac (8 ha) of floodplains being directly disturbed or permanently altered. These controls will protect downstream floodplains and wetlands from erosion.
Biological Resources	The fire suppression activities resulted in transient and long-term effects to biological resources. The clearing of about 130 ac (52 ha) temporarily displaced local wildlife. Use of the affected area by some bird species may be expected to decline on a local basis while other species would remain unchanged.	Post-fire activities produced an array of biological effects. In general, protection of potential T&E species habitat from flood damage will be beneficial for T&E species and other species. However, destruction of Mexican spotted owl core nesting and roosting habitats will have a minimal long-term adverse effect.

TABLE 4.3—*Continued*

Resources	Fire Suppression	Post-Fire
Climatology, Meteorology, and Air Quality	The use of equipment for fire suppression activities produced criteria air pollution emissions. Because of the closure of LANL and the townsite, these emissions were roughly 20 percent to 80 percent of typical LANL vehicle traffic for a two-week period—which is a negligible adverse effect.	The adverse effects on air quality from construction activities and contaminant disturbance and removal were of short duration. Doses to the nearest offsite receptor from airborne radioactive emissions associated with work in the PRSs were estimated not to exceed 0.1 millirem.
Visual Resources	The principal effect on visual resources from fire suppression activities was the cutting of firebreaks and fire roads. This is a temporary adverse effect to visual resources at LANL.	The various construction activities had minor adverse effects on visual resources. There was short-term increased suspended particulate matter, new structures in previous minimally disturbed areas, and deposition of black sediment where runoff accumulates behind storm water control structures.
Cultural Resources	The leveling of a staging area in TA-49 destroyed one and damaged two other cultural resource sites. Although this is considered an adverse effect, these three sites constitute less than one percent of the total LANL archaeological sites.	Post-fire activities resulted in adverse impacts to two significant historic structures at TA-02. Although UC cultural resource specialists documented the buildings before they were dismantled, the removal of the buildings is considered an adverse impact. Post-fire activities also created a beneficial impact by reducing the likelihood that other cultural properties would be adversely affected by erosion.
Utilities and Infrastructure	The fire suppression activities had a temporary beneficial effect on water, gas, and electric utilities at LANL by minimizing damage from the fire. About 30 mi (48.3 km) of new or upgraded access roads were bladed, although most of the these were of temporary nature so effects were also temporary.	Beneficial impacts occurred from the installation of flood control and flood retention structures. Major benefits include improved access and maintenance to both utilities and infrastructure at LANL.
Socioeconomics	No substantial changes to either the local or regional populations or economics are expected as a result of fire suppression activities.	No substantial changes to either the local or regional populations or economics are expected as a result of post-fire mitigation activities.
Noise	Actions authorized by DOE during the fire suppression period had a minimal effect on the types of noise and the typical noise levels found at or in the vicinity of LANL. These activities were temporary and during the period when LANL and the townsite were evacuated.	The types of noise from post-fire response actions were typical of on-going construction activities and maintenance operations routinely performed at LANL. Noise levels increased in and around LANL during this period.
Environmental Justice	The fire suppression activities had no disproportionately high and adverse human health on environmental effects on minority and low-income populations.	Post-fire activities will have a positive effect on environmental justice issues as the risk of soil erosion and flood damages are significantly reduced to downstream communities.

TABLE 4.3—*Continued*

Media	Fire Suppression	Post-Fire
Human Health	Fire suppression activities had a minimal to moderate adverse effect on emergency response workers health due to exposure to smoke and fire, firefighting hazards, and exposure to chemicals used. A potentially significant benefit to public health was the prevention of further spread of the fire to additional residential areas.	Effects on worker health that resulted from post-fire activities were less than or similar to those that occurred during the fire suppression period. Workers were not exposed to fire and smoke, but continued to be exposed to other hazards, such as the removal of vegetation, construction activities, helicopter, and vehicle traffic. There was one reported worker injury from a fall associated with managing inventories for aerial seeding operations. The worker is expected to fully recover.
Environmental Restoration and Waste Management	There were no effects (due to no activity) on environmental restoration and risk management from fire suppression activities.	Best Management Practices for 91 PRSs affected by the fire were completed. As of July 21, 2000, 47 accelerated actions were either in progress or had been completed. DOE actions taken during this period also resulted in the generation of additional low-level radioactive waste sent to TA-54 and nonhazardous solid waste sent to approved landfill sites.
Transportation	Effects on both the regional and internal LANL transportation system as a result of fire suppression were minimal. Some limited-period road closures were necessary during this period to prevent access to LANL and to adjacent communities for safety and security purposes.	Effects on both the regional and internal LANL transportation system were minimal. Some limited-period road closures were necessary during this period to support repair work and replacement of culverts, delivery of construction material, and to allow for movement of hazardous material.

4.17.2 Impacts on Watersheds within the ROI

The fire suppression activities at LANL and in the ROI typically had negligible effects on the ROI. The principal adverse effect was soil and vegetation disturbance that damaged a few archaeological sites and could have led to increased erosion and decreased water quality. Most adverse effects were localized and temporary.

The primary impacts of post-fire activities at LANL and in the ROI were beneficial soil stabilization, revegetation, reduction of storm water runoff, and moderation of the expected decline in surface water quality due to the fire.

These impacts are most pronounced when viewed at the level of the watershed. Cumulatively, actions to control storm water runoff and erosion in the watersheds will meet DOE's objective of protecting lives, property, and the environment within the boundaries of LANL and in neighboring areas downstream.

BAER Team rehabilitation treatments were implemented in the upper portions of all three of LANL's major watersheds (Los Alamos Canyon, Pajarito Canyon, and Water Canyon watersheds). DOE treated burned areas within the LANL portions of these watersheds with measures similar to those of the BAER Team. Summer rains have generally been moderate, allowing seeds to germinate without eroding away and producing new understory vegetation, particularly at the higher elevations of the watersheds. The BAER Team rehabilitation measures may be as successful as could be expected during the first growing season after the fire. The LANL portions of the watersheds generally received

less rainfall than the higher elevations and seed germination and understory regeneration may be somewhat less effective than that in the upper parts of the watersheds. Nevertheless, the overall cumulative effect of post-fire treatments has been to encourage vegetation regrowth and limit storm water runoff and erosion.

In the Los Alamos Canyon watershed, DOE's actions contributed to substantially reducing the impacts of storm water runoff. Draining and reinforcing the Los Alamos Reservoir provided about 28 ac-ft of water storage capacity for storm water runoff and allows accumulated water and debris to be released downstream at lower, and less erosive, energies. Installing trash racks and removing structures that could wash away in a severe rain event has reduced the likelihood that water-borne debris will damage downstream property. Removal of contaminated sediments near the junction of Los Alamos and DP Canyons has reduced the likelihood that storm water runoff would carry contaminated sediments offsite. Finally, the construction of the Los Alamos Canyon low-head weir provides a catchment for sediments carried by storm water and would dissipate the energy of storm water runoff that reached that far downstream. The result of these measures, both DOE's and those on neighboring properties, is to reduce the potential damage from storm water runoff, erosion, and contaminant transport and to protect downstream surface water quality, floodplains, wetlands, habitat, cultural resources, and property.

DOE's actions also contributed to substantially reducing the impacts of storm water runoff in the Pajarito Canyon watershed. Reinforcing SR 501 and Anchor Ranch Road not only protects the roads from high-energy storm water runoff but would also allow storm water to pond upstream from the road embankments temporarily and would dissipate the energy of the runoff to some degree. Water reaching the flood retention structure in middle Pajarito Canyon would be retained and released at a reduced energy level. The structure is designed to protect downstream government and private property from damage from high-energy storm water runoff and floating debris. Peak flows would be reduced to near normal and debris would be contained behind the flood retention structure. The trash rack upstream from the flood retention structure would also capture water-borne debris that could damage government facilities. The trash rack and the steel diversion wall upstream from TA-18 serve the same purpose of protecting government facilities from the effects of high-energy storm water flows and water-borne debris. Although culvert cleaning downstream from TA-18 disturbed a small amount of wetland vegetation, the flood retention structure is expected to protect the remaining floodplains and wetlands from excessive runoff. The result of these measures in the Pajarito Canyon watershed, both DOE's and those on neighboring properties, is to reduce the potential damage from storm water runoff, erosion, and contaminant transport and to protect downstream surface water quality, floodplains, wetlands, habitat, cultural resources, and property.

In Mortandad Canyon, DOE cleaned the existing sediment traps to provide catchments for potentially contaminated sediments that might be suspended and transported by higher than normal storm water runoff. Since estimated peak flows for Mortandad Canyon, however, are relatively low, no other engineered storm water controls were implemented. Together with the reseeding and mulching operations, DOE's actions in

the Mortandad Canyon watershed are expected to minimize the likelihood that storm water runoff would transport existing contaminated sediments offsite.

DOE's actions in the Water Canyon watershed consisted of extinguishing the fire at MDA-R and stabilizing the site and reinforcing SR 501. The road reinforcement serves to protect the road from damage from storm water runoff and floating debris. The road would also pond storm water temporarily and dissipate the energy of the runoff. These actions, together with the BAER Team rehabilitation measures in the upper part of the watershed, would reduce the potential damage from storm water runoff, erosion, and contaminant transport and protect downstream surface water quality, floodplains, wetlands, habitat, cultural resources, and property.

DOE's actions in other watersheds primarily consisted of small-scale erosion prevention measures, such as rock gabions and wattles, and various seeding and mulching operations. These actions will reduce storm water runoff damage downstream from LANL. Together with BAER Team rehabilitation measures in other parts of the burned area, the DOE activities will contribute to reversing the effects of the Cerro Grande Fire on surface water quality, wildlife habitat, wetlands, and floodplains. Since the watersheds affected by the Cerro Grande Fire drain into the Rio Grande, the beneficial impact of the combined rehabilitation efforts may include reducing storm water runoff damage to the Rio Grande.

5.0 REGULATORY CONSULTATION AND COMPLIANCE

DOE and UC maintain regulatory compliance with environmental laws and regulations as an integrated element of conducting work at LANL. The processes used have continued to ensure compliance and improve the relationships with the regulatory and consulting agencies. Because emergency actions needed to be implemented immediately, DOE and UC initiated emergency permit processes and consultations under appropriate regulations. DOE reiterated the importance of maintaining compliance while emergency actions were being conducted as evidenced in communications to UC (June 22, 2000, memo) and to the USACE (June 22, 2000, letter). DOE, UC, and USACE entered into a memorandum of understanding (MOU) to ensure that all parties maintained environmental compliance during the emergency. Routine compliance processes will continue for non-emergency actions and will be the only compliance processes conducted after actions taken under emergency permits and consultations are completed before or by November 30, 2000.

5.1 U.S. Fish and Wildlife Service

Under Section 7 of the Endangered Species Act, agencies must consult with the USFWS regarding actions that they may undertake that could adversely affect federally-listed T&E species. Regarding emergency actions taken by DOE in response to the Cerro Grande Fire, emergency consultation provisions (50 CFR Part 402.05) were followed. In addition, the Forest Service, Park Service, and USACE were involved in certain compliance activities.

On May 11, 2000, DOE Los Alamos Area Office (LAAO) initiated emergency consultation via telephone with USFWS in Albuquerque, New Mexico. This was followed up with multiple conversations and updates between DOE and the USFWS. On June 1, 2000, DOE/LAAO submitted a letter report documenting actions and requesting a concurrence on effect determinations from the USFWS. The USFWS staff visited LANL and toured affected habitat areas on June 13, 2000. The Service observed the impacts of the fire, fire suppression activities, and limited post-fire activities, e.g., reseeding, mulching, etc. A determination of "may affect but not likely to adversely affect" threatened or endangered species was made concerning the scope of DOE activities known and on-going at that time and concurred upon by the USFWS.

On July 11, 2000, DOE requested a reopening of the Cerro Grande Fire emergency consultation because of new construction activities planned for storm water and silt retention structures at LANL. Representatives of the USFWS field office subsequently revisited LANL and the construction sites. On July 25, 2000, USFWS staff toured the storm water retention structure and sites proposed by DOE for implementation by the USACE. Representatives from DOE, UC, USFWS, and USACE were present during the tour. The DOE submitted additional correspondence to the USFWS on July 28, 2000, requesting USFWS concurrence with a finding that construction activities "may affect; not likely to adversely affect" T&E species and critical habitat. On July 28, 2000, USFWS concurred with DOE's determination of effect to T&E species and to their critical habitat as a result of new DOE activities.

5.2 New Mexico State Historic Preservation Office

In response to the Cerro Grande Fire, DOE initiated compliance actions consistent with the emergency provisions of Section 106 of the NHPA as codified in 36 CFR Part 800.12. The NHPA typically recognizes emergency provisions for a 30-day period only from the date the event is declared a disaster. Therefore, DOE applied for an extension of emergency provisions as provided under 36 CFR 800.12(d) to address soil erosion and storm water control activities completed on or before November 30, 2000. This November date is the date used by DOE in the June 21, 2000, Notice of Emergency Action as the end date for actions to define emergency undertakings. The NHPA also allows for an expedited 7-day comment period for the SHPO and Tribal Government reviews regarding any DOE-authorized activities that may have an adverse effect on significant historic properties. This comment period has been complied with as appropriate.

The first NHPA compliance action taken was a notification on June 1, 2000, to the Advisory Council on Historic Preservation (ACHP) that the President had declared the Cerro Grande Fire a major disaster. Under this notification, ACHP and SHPO were informed that during the fire and for a period of five months after the fire, corresponding to the annual rainy season, DOE would be engaging in fire suppression and soil erosion and flood control activities. DOE would review these activities and make a good faith effort to avoid impacts to significant historic properties resulting from fire-related undertakings. The review process would follow the stipulations in the Programmatic Agreement among DOE, SHPO, and ACHP on management of historic properties at LANL. At the end of the emergency period, DOE would provide SHPO a written report on the implemented activities.

To date, only one action has resulted in adverse effects to historic properties. This action was the removal of Building TA-2-4, a former reactor fuel rod storage facility for the Omega-West Reactor (TA-2-1). This building was demolished to reduce the risk from radioactive contamination migrating downstream and off-site in the event of a 100-year 6-hour flood event. This undertaking was reported to SHPO on June 23, 2000. During the fire suppression period, three archaeological sites were damaged or destroyed at TA-49. This information will be reported to the SHPO.

5.3 Clean Air Act

On July 6, 2000, a permit application was submitted to the NMED requesting an emergency permit to construct and operate a temporary concrete batch plant in the immediate vicinity of TA-66 in Pajarito Canyon. The request was submitted under the provisions of air quality regulation Title 20, New Mexico Administrative Code, Chapter 2, Part 72, Section 215, Emergency Permit Process. The permit was subsequently issued by NMED on July 10, 2000.

The batch plant was used to supply concrete to construct a large flood retention structure across Pajarito Canyon at TA-66. The temporary plant was owned and operated by Sundt Construction, Inc., who was under contract to the USACE. The plant ran continuously for about 30 days during the construction of the flood retention structure.

The batch plant required an air quality permit under NMED regulations. To ensure compliance with state and federal air regulations, the permit included conditions that limited the emissions, production rate, and duration of the permit. The maximum particulate emissions for the batch plant were estimated at less than three pounds/hour. Dispersion modeling was conducted to assess off-site impacts from particulate emissions from the operation of the batch plant. The results of this modeling analysis showed no exceedances of any ambient air quality standards. The permit was valid for up to 90 days after which the plant was dismantled and removed from LANL. Emissions were estimated to be seven pounds/hour for three days due to an equipment malfunction. NMED approved continued operation of the plant during this period because air quality standards would not be exceeded.

The *Clean Air Act* regulations (40 CFR Part 61) require the filing of a 10-day advance notice for asbestos removal and disposal for routine operations. However, because of the emergency nature of the fire response activities, LANL was exempt from these reporting requirements. Although the reporting requirements for demolition and asbestos removal as specified in the regulations did not apply to the fire response activities, LANL continued to notify the NMED of all such activities that would normally come under the purview of the regulations.

5.4 Clean Water Act

On June 6, 2000, a MOU concerning emergency work control roles and responsibilities for flood control responses to the Cerro Grande Fire was signed by DOE, USACE, and UC. This MOU specifically identified the USACE as being responsible for obtaining any necessary permits or approvals for storm water management facilities under Section 404 (dredge and fill) of the *Clean Water Act*.

On June 21, 2000, DOE issued a Notice of Emergency Action in the Federal Register describing emergency actions that had been or were anticipated to be taken at LANL in response to the Cerro Grande Fire. This notice served as the Public Notice and Statement of Findings regarding DOE's intention to take actions involving construction and other actions within floodplains and wetlands pursuant to DOE's regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR Part 1022). As provided in 10 CFR 1022.18, and because there was an immediate need to take emergency flood control and hazard reduction actions, DOE waived the public review periods that would otherwise apply before DOE took such actions in floodplains and wetlands at LANL.

On July 18, 2000, the USACE determined that the flood retention structure in Pajarito Canyon near TA-18 was a storm water management facility located in non-tidal waters of the United States and was subject to Section 404 permit requirements. Upon further review by USACE, it was ultimately decided that Nationwide Permit No. 43 was applicable to this project and that compliance with this nationwide permit would satisfy the Section 404 requirements of the *Clean Water Act*. In addition to the flood retention structure in Pajarito Canyon, USACE determined that smaller scale activities involving construction of retention/detention ponds, reservoir dredging, and embankment armoring

were subject to the conditions and limitations contained in Nationwide Permit Nos. 3 and 18.

In addition to Section 404 requirements, National Pollutant Discharge Elimination System (NPDES) storm water general permit requirements for construction activities also apply. In particular, flood control and mitigation projects constructed by DOE and USACE at LANL were subject to these requirements. A primary component of the general permit is a requirement to develop a site-specific SWPP Plan. In general, these plans require the use of various techniques or BMPs to control erosion or to limit the amount of sediment or contaminants that can enter waterways from disturbed areas and construction sites. A SWPP Plan was developed for this work in accordance with the U.S. EPA Region 6 General Permit for Construction Activity.

On July 25, 2000, a Notice of Intent for Storm Water Discharges Associated with Construction Activity under a NPDES General Permit was submitted to the EPA. In accordance with applicable regulations, the permit was considered to be in effect on July 27, 2000. Submittal of the Notice of Intent to operate in compliance with the general permit, including adherence to the SWPP Plan, satisfies the NPDES storm water compliance requirements of the *Clean Water Act* for this project.

5.5 Resource Conservation and Recovery Act

Hazardous, mixed, and nonhazardous solid waste produced as a result of DOE or DOE-authorized actions in response to the Cerro Grande Fire were subject to the requirements of RCRA. Hazardous and mixed solid wastes generated as a result of fire suppression or post-fire activities were managed in accordance with the existing RCRA permit for routine operations at LANL. Forty-seven accelerated cleanup actions were initiated during the response to the Cerro Grande Fire. Accelerated cleanup actions were coordinated with NMED. No permit modifications were required for the accelerated cleanup actions or for the treatment, storage, or disposal of these wastes. Nonhazardous solid wastes generated as a result of fire suppression and post-fire activities were also managed in accordance with the existing solid waste management program for routine operations at LANL.

6.0 REFERENCES

BAER 2000 — U.S. Interagency Burned Area Emergency Rehabilitation Team, Cerro Grande Fire Burned Area Emergency Rehabilitation Plan, National Park Service, June 9, 2000.

10 CFR Part 1021 — U.S. Department of Energy, "National Environmental Policy Act Implementing Procedures," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of January 1, 1999.

10 CFR Part 1022 — U.S. Department of Energy, "Compliance with Floodplain/Wetlands Environmental Review Requirements," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of January 1, 2000.

36 CFR Part 60 — U.S. Department of Energy, "National Register of Historic Places," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

36 CFR Part 800.12 — U.S. Department of Energy, "Protection of Historic Properties; Emergency Situations," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 61 — Environmental Protection Agency, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 270 — Environmental Protection Agency, "EPA Administered Permit Programs: The Hazardous Waste Permit Program," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1500 — U.S. Department of Energy, "Purpose, Policy, and Mandate," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1501 U.S. Department of Energy, "NEPA and Agency Planning," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1502 U.S. Department of Energy, "Environmental Impact Statement," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1503 U.S. Department of Energy, "Commenting," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1504 U.S. Department of Energy, "Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1505 U.S. Department of Energy, "NEPA and Agency Decisionmaking," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1506 U.S. Department of Energy, "Other Requirements of NEPA," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1507 U.S. Department of Energy, "Agency Compliance," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

40 CFR Part 1508 U.S. Department of Energy, "Terminology and Index," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999.

50 CFR Part 402.05 — U.S. Department of Energy, "Interagency Cooperation–Endangered Species Act of 1973, as amended; Emergencies," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U. S. Government Printing Office, Washington, DC, revised as of July 1, 1999

DOE 2000 — U.S. Department of Energy, *A Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites at Los Alamos National Laboratory*, Los Alamos Area Office, Los Alamos, NM, August 2000.

DOE 1999 — U.S. Department of Energy, *Site-wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory*, DOE/EIS-0238, Albuquerque Operations Office, Albuquerque, NM, 4 volumes. January 1999.

Eklund 2000 — Memorandum from Eklund, B., URS/Radian, to Dewart, J., and Stockton, M., regarding "Results of Ambient Air Monitoring for VOCs at MDA-R," July 12, 2000.

65 FR 141 — Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Mexican Spotted Owl," *Federal Register*, Washington, DC, July 21, 2000.

Hurtle 2000 — Internal LANL e-mail from J. Hurtle, ESH-17 to P. Powers, ESH-20, regarding radiological emissions from Construction Activities in Areas with Contaminated Soils. Los Alamos National Laboratory. Los Alamos, NM. July 28, 2000.

LANL 2000a — Los Alamos National Laboratory, "Emergency Rehabilitation Project Plan Update," LA-UR-00-3085, Los Alamos, NM, August 11, 2000.

LANL 2000b — Los Alamos National Laboratory, "A Special Edition of the SWEIS Yearbook: Wildfire 2000," LA-UR-00-3471, Los Alamos, NM, August 2000.

LANL 2000c — Los Alamos National Laboratory, "Comprehensive Site Plan 2000," LA-UR-99-6704, Los Alamos, NM, January 31, 2000.

LANL 2000d — Los Alamos National Laboratory, "Estimation of Wildfire-Induced Surface Soil Erosion Hazards," LA-UR-00-3530, Los Alamos, NM, 2000.

LANL 2000e — Los Alamos National Laboratory, "Fire Damaged Facilities List," Emergency Response Team, July 12, 2000.

LANL 2000f — Los Alamos National Laboratory, Presentation by K. Mullen, LANL ESH-18, at the Weekly Rehabilitation Team Meeting, DOE Los Alamos Area Office, July 14, 2000.

LANL 2000g — Los Alamos National Laboratory, "Inhalation Doses from the Cerro Grande Fire," LA-UR-00-3941, Los Alamos, NM, August 2000.

LANL 2000h — Los Alamos National Laboratory, Presentation by J. Canepa, LANL ER Project, at the Weekly Rehabilitation Team Meeting, DOE Los Alamos Area Office, August 11, 2000.

LANL 1998 — Los Alamos National Laboratory, *Institutional Plan FY1999-FY2004*, LALP-98-66, Los Alamos, NM, 1998.

Little and Calfee 2000 — Little, E.F. and R.D. Calfee, "The Effects of UVB Radiation on the Toxicity of Fire-fighting Chemicals." Final report submitted to USDA Forest Service, Wildland Fire Chemical Systems, Fort Missoula, Missoula, MT 59804, 2000.

NMSA 1978a — New Mexico Wildlife Conservation Act, in New Mexico Statutes Annotated, 1978, Chapter 17, Game and Fish, Pamphlet 33, 1995 Replacement Pamphlet, Sections 17-2-37 through 17-2-46.

NMSA 1978b — New Mexico Endangered Plants. In New Mexico Statutes Annotated, 1978, Chapter 75, Miscellaneous Natural Resource Matters, 1994 Replacement Pamphlet, Section 75-6-1.

Rae 2000a — Memorandum from Rae, S., Los Alamos National Laboratory ESH-18 to T. Stanford, Los Alamos National Laboratory FWO-DO, regarding "Flood Flows," Los Alamos National Laboratory memorandum ESH-18/WQ&H:00-0188. June 5, 2000.

Rae 2000b — Memorandum from Rae, S., Los Alamos National Laboratory ESH-18 to T. Stanford, Los Alamos National Laboratory FWO-DO, regarding "Re-calibration of Model and Determination of Flood Flows and Flood Volumes for Pajarito Canyon," Los Alamos National Laboratory memorandum ESH-18/WQ&H:00-0222. July 6, 2000.

Rea nd — Rea, K., unpublished data regarding the effects of wildfires, available from Los Alamos National Laboratory, P.O. Box 1663, MS M889, Los Alamos, New Mexico, 87545.

USACE 1987 — U.S. Army Corps of Engineers Wetlands Delineation Manual, Department of Army, Waterways Experiment Station, COE PO Box 631, Vicksburg, MI 39180-0631, Technical report V-87-1, Wetlands Research Program.

APPENDIX A

Federal Register Notice of Emergency Action and Correspondence with the Council on Environmental Quality

This Page Intentionally Left Blank

resources can be committed); (4) brief description of your organization; (5) description of how your investment or involvement in the event compliments your organization's mission; and (6) reasons for supporting the Solar Decathlon.

Letters of interest, clearly marked ''2002 Solar Decathlon,'' are requested by August 16, 2000 and should be submitted in writing to Ruth E. Adams, DOE Golden Field Office, 1617 Cole Boulevard, Golden, CO 80401–3393; transmitted via facsimile to Ruth E. Adams at 303–275–4788; or sent electronically to ruth_adams@nrel.gov.

Issued in Golden, Colorado, on June 12, 2000.

Jerry L. Zimmer,

Procurement Director, Golden Field Office.

[FR Doc. 00–15682 Filed 6–20–00; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

National Nuclear Security Administration; Emergency Activities Conducted at Los Alamos National Laboratory, Los Alamos County, New Mexico in Response to Major Disaster Conditions Associated With the Cerro Grande Fire

AGENCY: Department of Energy.

ACTION: Notice of emergency action.

SUMMARY: The U.S. Department of Energy (DOE) is issuing this notice of emergency activities conducted at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico, in response to the recent Cerro Grande Fire. DOE's emergency response activities began with certain preventive actions undertaken immediately before the wildfire entered LANL boundaries in early May 2000, and include those actions taken while the fire burned within LANL boundaries, as well as related subsequent actions (as described below) that are ongoing since the fire was contained and extinguished to address the extreme potential for flooding damage.

About 7,500 acres of land administered by DOE at LANL burned during the Cerro Grande Fire, while another 35,500 acres burned along the mountain flanks above LANL and to the north of the site making this New Mexico's most destructive fire in recorded history. With such large areas of burned vegetation, including areas of bare ash along the steep slopes and canyon sides above LANL, there is a very high risk for flooding within the LANL facility and in residential communities downstream all the way to the Rio Grande. About 36 percent of the annual precipitation for the Los Alamos area falls in the form of rain, primarily during intense thunderstorms that occur in July and August each year, but which may occur as early as June and as late as in October. The time period for the DOE's Cerro Grande Fire emergency actions discussed in this Notice, therefore, extends through November 2000.

Flood control measures of temporary, semi-permanent, and permanent natures must be taken immediately to prevent the potential loss of life and property damage from this threat, and also to protect sensitive cultural resources and potential habitat for Federally-listed threatened and endangered species present within floodplain areas. Moreover, there are 74 potential contaminant release sites (PRSs) and two nuclear facilities at LANL that contain hazardous and radioactively contaminated soils and materials that are vulnerable to flooding. The PRSs and nuclear facilities have the potential to release contaminants downstream. Some 10,000 residents live in communities located downstream from LANL; lands of Pueblo de Cochiti lie to the south along the Rio Grande, as does Cochiti Reservoir, which is a popular recreation and fishing site. Until enough vegetation is established to cover the hillsides and canyons to act as a deterrent to soil erosion and flooding, the potential for flooding will exist for the next several years to decades in some locations.

DOE would normally prepare an environmental impact statement analyzing the actions described for public review and comment pursuant to its National Environmental Policy Act (NEPA) implementing regulations (10 CFR part 1021). However, due to the urgent nature of the actions required to address the effects of the Cerro Grande Fire and the potential for severe flooding impacts, DOE prepared this notice regarding emergency actions pursuant to 10 CFR 1021.343. Because the cumulative impacts of these actions are significant, DOE has consulted with the Council on Environmental Quality about alternative arrangements with regard to NEPA compliance for its emergency actions pursuant to the Council NEPA regulation at 40 CFR 1506.11. Consistent with those consultations, DOE will prepare a special environmental analysis of known and potential impacts from wildfire and flood control actions as the ''alternative arrangement'' contemplated by the Council on Environmental Quality regulation. The special environmental analysis is scheduled to be completed in September 2000 and will be available to the public. DOE will continue to employ a variety of mechanisms, as explained below, to facilitate public involvement. DOE will consider public comments received on this Notice of Emergency Action and will also consider public comments received on the special environmental analysis in planning future mitigation actions. This compliance strategy may be modified or altered as conditions warrant.

This notice also serves as the Public Notice and Statement of Findings regarding DOE's intention to take action involving construction and other actions within floodplains and wetlands pursuant to DOE's regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR part 1022). As provided in 10 CFR 1022.18, and because there is an immediate need to take emergency flood control and hazard reduction actions, DOE is waiving the public review periods that would otherwise apply before DOE would take such actions in a floodplain or wetland.

FOR FURTHER INFORMATION AND TO SUBMIT COMMENTS, CONTACT: For further information on these activities or other information related to this Notice, contact: Elizabeth Withers, NEPA Compliance Officer, U.S. Department of Energy, Los Alamos Area Office, 528 35th Street, Los Alamos, NM 87544, phone (505) 667–8690, fax (505) 665–4872.

For information on the DOE National Environmental Policy Act (NEPA) process, contact: Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance (EH–42), U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585, (202) 586–4600, or leave a message at (800) 472–2756.

For more information regarding activities related to the Cerro Grande Fire and the LANL Emergency Rehabilitation Team, including relevant phone numbers, visit the LANL web site at *www.lanl.gov.*

SUPPLEMENTARY INFORMATION: On the evening of May 4, 2000, employees of the Department of the Interior, National Park Service, Bandelier National Monument, ignited a prescription burn within the boundaries of Bandelier National Monument at a location identified as the Cerro Grande. This fire was quickly pushed by winds outside the boundaries of the prescription area and was declared by the National Park Service to be a ''wildfire'' on May 5, 2000. The fire spread rapidly in a generally northeastern/eastern direction

across land administered by the Department of Agriculture, Forest Service, Santa Fe National Forest. Starting late on May 7, through May 8 and 9, while winds were somewhat moderate, shrubs and trees were cut and back fires were ignited in an effort to hold the fire line at New Mexico State Road 501, which is located at the northwestern side of LANL. A very narrow strip of land a few hundred feet wide is present within that back fire area that is administered by DOE as a part of LANL property. The wind speed increased dramatically on May 10, 2000, and spread sparks over a mile in advance of the wildfire fronts and well beyond the established fire lines, igniting forested areas within the heart of LANL and residential areas within the Los Alamos townsite located nearby.

From May 10 until about May 17, the fire burned within LANL and the townsite area before its spread was stopped and it was considered contained. About 7,500 acres of land administered by DOE at LANL burned during the Cerro Grande Fire; another 35,500 acres burned along the mountain flanks above LANL and to the north of the site. Over 200 residential units occupied by over 400 families burned within the Los Alamos townsite. This fire has consumed more forest acreage and resulted in more property loss than any other fire in New Mexico's recorded history. Small spot fires that periodically flare up, as well as subsurface smoldering, continue to be extinguished within LANL's boundaries and nearby.

During the efforts undertaken to contain and extinguish the fire within LANL, various fire lines were created at several locations within the LANL boundaries using hand tools and heavy machinery to establish clearings; fire access roads were bladed or existing roads were improved for use by heavy transport equipment and fire trucks; trees were mechanically felled to protect exposed utility lines and structures; small back fires were set in locations around LANL to protect buildings and utilities; and water drops and fire-retardant slurry drops were made over LANL from low flying helicopters and airplanes.

After the fire was controlled and had been extinguished (except for occasional flare ups and smoldering hot spots), DOE's planning for stormwater runoff damage was initiated through a cooperative effort with the U.S. Forest Service; the U.S. Army Corps of Engineers; the Department of the Interior's National Park Service and Bureau of Indian Affairs, Northern Pueblos Agency; Pueblo of San Ildefonso; Pueblo of Santa Clara; Pueblo of Jemez; Pueblo de Cochiti; the State of New Mexico's Department of Game and Fish and Department of the Environment; the County of Los Alamos; and various other federal, state and local government agencies and entities, including representatives of the University of California (which currently manages and operates LANL under contract to the DOE). This ongoing effort is coordinated and facilitated by the U.S. Forest Service's Burned Area Emergency Rehabilitation (BAER) Team, a multidisciplinary team of individuals experienced in such planning exercises and in the implementation of erosion and flood control measures.

About 36 percent of the annual precipitation for LANL falls in the form of rain, primarily during intense thunderstorms occurring in July and August of each year, though the rainy season may start as early as June and extend through October. With large areas of burned vegetation, including areas of bare ash along the steep slopes and canyon sides above LANL, there is a very high risk for flooding within the LANL facility and to area residential communities downstream all the way to the Rio Grande. There are 74 potential contaminant release sites (PRSs) and two nuclear facilities at LANL that contain hazardous and radioactively contaminated soils and materials that are vulnerable to flooding. These PRSs and nuclear facilities have the potential to release contaminants downstream. Canyon stormwater discharge flow measurements for a six-hour storm event time period at LANL typically are in the range of about 35 to 590 cubic feet per second; post-fire modeling estimates the canyon discharge flows (unmodified) to be in the range of 90 to 2182 cubic feet per second for the same duration storm events. Some canyons are expected to have even greater flow amounts over some areas due to location specific site conditions after the fire.

It is extremely important that erosion and flood control measures be implemented immediately to protect lives and property from damage by soil erosion and flooding, and also to protect sensitive cultural resources and potential habitat for Federally-listed threatened and endangered species present within floodplain areas. Some 10,000 residents live in communities located downstream from LANL; lands of Pueblo de Cochiti lie to the south along the Rio Grande, as does Cochiti Reservoir, which is a popular recreation and fishing site. The planned flood control measures are of temporary, semi-permanent and permanent natures. The potential for flooding will exist for the next several years to decades in some locations until enough vegetation is established to cover the hillsides and canyons to act as a sufficient deterrent to the soil erosion and flooding threat.

The potential for a wildfire occurring at LANL and its subsequent impacts was considered in the LANL Site-wide Environmental Impact Statement (LANL Site-wide EIS) issued by DOE in February 1999. In that analysis, a wildfire scenario was considered that was similar in intensity and nature to the actual Cerro Grande Fire. The identified impacts in that document that correlate with the real fire include the actual path of the fire into the LANL facility and its consumption of about 8,000 acres of forest; the burning over of identified potential contaminant release sites and subsequent airborne contaminant fraction (during and subsequent to the actual fire, however, air monitoring stations did not detect and have not detected any contaminant releases above the normal background levels of naturally occurring elements and common substances associated with burning trees); the loss of protective groundcover and subsequent increase in soil erosion and flooding; the potential for movement downstream of contaminants in silt and soil; adverse effects on wildlife and biological systems; and adverse effects on cultural resources.

Various impact mitigations were identified through the LANL Site-wide EIS analysis, including the need to remove vegetation and combustibles around certain high risk buildings and structures around LANL (this action was completed before the fire occurred); and interagency efforts to reduce vegetation fuel loading within neighboring lands administered by Bandelier National Monument, the Santa Fe National Forest and DOE (the prescribed fire that ignited the Cerro Grande Fire was a part of this LANL-area effort).

In late 1999, DOE notified LANL stakeholders, including local pueblos and tribes, and various identified interested parties of its intent to prepare an Environmental Assessment (EA) for a proposed wildfire hazard reduction and forest health improvement management program at LANL. This draft EA was scheduled to be released to the stakeholders for review during the week of May 8, 2000. This proposed long-term management program would allow DOE to thin forest vegetation to an appropriate level and then maintain it at that level in the long term to accomplish both the reduction of wildfire hazards and to improve the overall health of the forest resources at LANL. This

management program still has merit and changes are therefore now being made to the draft EA to reflect the changed environmental conditions since the Cerro Grande Fire. This EA will not analyze the environmental impacts resulting from actions discussed in this Notice of Emergency Action. The draft EA is now scheduled to be issued for review and comment at the end of June 2000.

Emergency Actions To Address Cerro Grande Fire Impacts

The following paragraphs list the activities undertaken by DOE during the Cerro Grande Fire, assessment activities taken immediately thereafter, and actions that have been initiated and which will be completed over about the next five months to address the adverse impacts of the fire and subsequent potential erosion and flooding. These measures have been designed to protect the various natural and cultural resources at LANL, as well as the LANL structures, operations, infrastructure, and employee population, and to protect the citizens and their properties within the communities of White Rock, Pueblo of San Ildefonso, and Pueblo de Cochiti located downstream of LANL, and, finally, to protect the water quality of the Rio Grande and nearby Cochiti Reservoir.

I. Fire Suppression Response Activities Conducted on DOE-Administered Lands

Routine operations at LANL were suspended from May 8, 2000 until May 23, 2000, when non-emergency response employees were allowed to return. The restriction to low-flying aircraft over the LANL reserve was rescinded to allow fire fighting measures from the air to be undertaken most advantageously. Non-DOE fire response personnel were permitted access to DOE-administered lands to suppress fire and protect property. DOE-controlled roads were closed to public use for more than two weeks. Fire breaks and fire access roads were bladed at several LANL locations using heavy equipment and by hand-held tools. Tree cutting ahead of the fire was performed around buildings, utility lines and infrastructure locations. Back-burn fires were set ahead of the main fire and around buildings and utilities to help suppress the fire. A temporary water supply station (a ''pumpkin tank'') to supply water for water-tanker helicopters was brought in and used during the fire suppression stage. Frequent helicopter over-flights to deliver water onto the fire during the daytime hours were made. Single nighttime over-flights by airplane to assess fire size using infrared imagery were employed. DOE and New Mexico Environment Department environmental sampling stations were set up to monitor smoke, ash, and contaminants.

II. Immediate Follow-on Response and Stabilization Activities on DOE-Administered Lands, Including Preliminary Assessment of Environmental Damage From Fire and Potential Erosion and Flooding

Field surveys were conducted on-foot and by helicopter and airplane as soon as possible after fire suppression to determine the extent of fire damage to LANL facilities and forest resources, post-fire condition of soils and vegetation, potential for stormwater runoff, presence of threatened or endangered species and other wildlife, and cultural resources damages. The following actions were identified as needing to be undertaken to control potential erosion and abate flooding risks. Steps to conduct these activities are already underway, and it is expected that these actions will be completed over the next five months.

Environmental Monitoring Stations

Damaged air and surface water monitoring stations are being repaired or replaced. Groundwater monitoring wells are being protected from potential floods. Rain and stream flow gauges are being installed as needed to monitor for flood conditions.

Contaminant monitoring of key watersheds for sediment transport, surface water flow, alluvial water, and ash flow, are being continued and will be expanded as necessary, as will air monitoring and groundwater monitoring stations outside LANL within surrounding community areas.

Potential Release Sites or PRS (Resource Conservation and Recovery Act regulated sites) and Potential Contamination Issue Areas

The condition of any known PRS potentially affected by the fire or related flooding actions are being identified and assessed. Actions are on-going to stabilize damaged sites or treat, remove, and dispose of contaminants, if prudent.

Potential contamination issue areas, such as canyon bottoms, are being assessed. Excavation and removal of potentially contaminated soils or sediments may be required.

Cultural Resources

The number and extent of damage to cultural resources and historic properties at LANL are being determined and documented. Protection or stabilization of damaged or vulnerable sites is being conducted if required. The LANL burned areas include at least 430 known archeological sites, an unknown amount of traditional cultural properties, several historic homesteader cabins, and several Manhattan Project buildings and structures. The Advisory Council on Historic Preservation, New Mexico State Historic Preservation Officer, the Governors of the Pueblo de Cochiti, Pueblo of Jemez, Pueblo of Santa Clara and Pueblo of San Ildefonso, and the President of the Mescalero Apache Tribe were notified in accordance with the Emergency Situation procedures contained in the implementing regulations of section 106 of the National Historic Preservation Act of 1966 as amended (36 CFR 800.12) and invited to comment on DOE's anticipated erosion and flood control measures and cultural and historic property treatments. No comments were received. An assessment of the detailed effects of the fire on cultural resources will be compiled and provided to these stakeholders. Members of the Advisory Council on Historic Preservation visited LANL on June 14, 2000.

Threatened and Endangered Species

A determination of fire and any post-flooding effects on nesting Mexican spotted owls and their habitat is being made through field visits. Similar effects on Southwestern willow flycatcher and bald eagle habitat are also being determined. Emergency consultation with the U.S. Fish and Wildlife Service was initiated by DOE as required under section 7 of the Endangered Species Act and the Department of the Interior and Department of Commerce interagency cooperation regulations (50 CFR 402.05). The consultation was conducted as a cooperative effort with the Department of Agriculture, Santa Fe National Forest; Department of the Interior, Bandelier National Monument, and the Bureau of Indian Affairs, Santa Clara Pueblo Tribal Counsel. DOE determined that emergency actions taken at LANL to suppress the fire and those emergency actions already taken and to be taken as flood control measures may affect, but are not likely to adversely affect, individuals of Federally-listed threatened or endangered species or their potential critical habitat. To date, U.S. Fish and Wildlife Service staff have expressed oral concurrence with that determination, and they are expected to provide written concurrence soon. Staff of the New Mexico Ecological Services Field Office, U.S. Fish and Wildlife Service, visited LANL on June 13, 2000.

Utilities and Infrastructure

Routine LANL mission operations are being re-initiated using a phased start-up approach, including replacement of various filters, monitors, alarms, cables, and other facility health and safety features; cleaning of all buildings and structures; and replacement of equipment and furnishings, such as computers and carpets, damaged by fire or smoke.

Damage to buildings and structures are being repaired, including repair to roofs, walls, doors and windows.

DOE-controlled roads are being reopened to public access; hazardous trees along these roads and in other occupied areas at LANL are being cut and removed from the site; hazard signs are being installed in potential flood-prone areas; hiking and running trails and paths are being repaired or closed to public use.

Damaged utility, security, and communication lines, poles, transformers, and other related structures will be repaired or replaced, and new lines and systems or equipment such as emergency generators are being installed where needed to provide a redundancy of service to vulnerable or critical areas.

Damaged road surfaces, guard rails, temporary structures, small storage structures or facility equipment and automobiles/trucks are being repaired or replaced.

New fire-breaks and fire access roads have been bladed and existing breaks and roads are being repaired or restored.

Helicopters and ground fire-fighting equipment are being used at LANL to fight hotspots; and helicopters are being used to deliver supplies into difficult to reach forested hillside areas. Upon total fire suppression and completion of forest rehabilitation activities, the LANL fly-over restriction by low flying aircraft will be reinstated.

The potential for flooding from rain and stormwater runoff is being assessed. Types of actions to be taken to mitigate these potential effects include the redirection or reduction of water flow using comb and contour tree felling; hill-side raking, localized terracing or contour trenching; installation and use of mulching material by hand or machinery (including hydro-mulching measures), silt fences, straw bale and straw wattles, sandbags, log erosion barriers, concrete barriers, earthen berms, pre-fabricated debris catchers, culverts, sediment traps, dams, catchment and overflow basins, and the installation of other temporary or long-term flood and erosion devices and use of other control techniques. These actions that are on-going to prevent life-threatening flooding to downstream communities may involve the use of hand-held tools (such as rakes for hillside terracing) or heavy machinery (such as in the case of creating earthen berms and dams) and may involve large acreages.

Miscellaneous Hazard Reduction Actions

Mechanical means, such as hand-held tools and small machinery, are being used to break-up hydrophobic soils and stabilize soils. Steep slope areas have been seeded using hand methods and small airplanes.

Both un-contaminated and contaminated wastes resulting from the fire are being removed and disposed of as appropriate, including removal of asbestos and lead paint as needed.

Some unpaved facility access roads are being re-graded and repaired as needed.

Culverts are being evaluated, cleaned, replaced or enlarged as needed and existing rock gabions (usually formed of wire mesh forms containing rocks or boulders) are being upgraded and repaired, and new ones installed as needed; any potential water flow impediments are being removed as necessary (such as pedestrian foot bridges in some stream-bed locations).

Emergency community alert alarm systems and remote automated weather stations are being installed near roadways or where needed.

Water storage tanks and pipes at LANL are being drained and flushed, including waste treatment lines, as needed.

Stormwater runoff from Pajarito Canyon may be diverted into Water Canyon as determined necessary to protect White Rock residents and LANL facilities. This may involve the cutting of trenches or similar devices into areas that are presently undisturbed.

Planning for the possible temporary relocation of hazardous materials, special nuclear material and related operations within LANL is being conducted and any removal of such materials and operations deemed necessary is being undertaken using appropriate packaging and transportation methods. Receiving facilities will be compatible with the materials and operations removed there or will undergo appropriate modification to enable them to function appropriately.

Planning for the possible relocation of employees out of vulnerable facilities will be conducted; some relocation of employees into temporary quarters, as deemed necessary, is on-ongoing. This may involve the placement of trailers or similar structures within already developed areas where utilities are available, or the leasing of available off-site office facilities, or similar actions.

Damaged, dying, or dead trees near structures, buildings, drainages and roads are being cut and removed along with trees cut during fire suppression efforts. These trees are being felled in place to perform erosion control.

Other Miscellaneous Recovery Actions

A permit(s) for the use of DOE-administered land will be issued to private parties and/or local government entities for community recovery efforts and measures, including staging of equipment, building materials, temporary housing units (such as mobile homes and trailers), temporary storage facilities, and similar actions, and the use of some land tracts (such as the DP Road Tract and the White Rock Tract) for up to three years for temporary residences. It is possible that up to 200 temporary housing units would be installed on DOE-managed land, which would be occupied by about 500 persons. The permitted parties could install permanent and temporary utility infrastructure as well as other infrastructure such as roads and sidewalks.

The effects of reseeding and revegetation efforts, as well as other hazard reduction actions, will be monitored annually for at least the next five years. Repair, replacement or repetition of these actions will be undertaken as needed. Assessments and reevaluations of management plans for various natural and cultural resources within LANL will be undertaken and implemented as appropriate.

Environmental Impacts

These listed actions have resulted, or will result, in localized and general environmental impacts that range from beneficial to significantly adverse. The following qualitative discussions briefly identify anticipated impacts that are or could be associated with these actions.

Fire suppression response activities undertaken while the fire front raged through LANL property likely resulted in relatively minor impacts that were environmentally beneficial from the standpoint of reducing fire intensity and severity and suppressing the fire. The suspension of routine operations at LANL, and the closing of roads to public use, during the fire significantly reduced the potential for employee and public health risks and enhanced the ability of the Los Alamos townsite and White Rock to be evacuated quickly, thereby aiding in the overall protection

of human life for the residents of the local communities.

During the fire DOE allowed aircraft to fly over LANL lands and allowed fire fighters to enter the facility and engage in fire suppression activities. These actions may have had localized adverse environmental effects including the impacts of water dropping from a height onto exposed soil, vegetation and possibly onto cultural resources; soil disturbance, tree damage, and cultural resource damage may have resulted. Fire retardant slurry was also dropped from aircraft; the slurry is typically a fertilizer compound that actually aids in the establishment of plants during the recovery period after a fire while, like the water drops, it acted as a retardant to fire spread.

The blading of firebreaks and access roads, while being a means for firefighters to stop the spread of the fire, resulted in adverse impacts from the removal of swaths of vegetation. The removal of this vegetation has resulted in additional disturbed acreage vulnerable to erosion and that is unpleasant in appearance. The acreage involved at LANL has not yet been calculated. It is known that about 40 miles of fuel break line was created using heavy machinery and about 15 miles of fuel break line were created by the use of hand tools around the fire fronts, with about 17 miles of line created both by hand means and using heavy machinery being within the LANL boundaries. The width of these lines varied depending on site conditions and suppression needs. Tree cutting in front of the fire line decreased the amount of vegetation and habitat for small animals and birds, while at the same time helping to control the spread of the fire and thereby protecting infrastructure and buildings from loss or damage. Back fires set intentionally to suppress the wildfire had similar impacts.

The installation and use of a temporary water supply station had minimal environmental effects and helped the firefighters to extinguish the fire and protect property. Over-flights for the purpose of using infrared imagery to access the fire progress resulted in minimal effects and aided firefighters in determining the best locations from which to fight the fire and stage equipment. The installation and use of portable air monitors resulted in minimal environmental effects and provided valuable information.

The post-fire actions, both on-going and to be undertaken in the near term, are more likely to result in major adverse impacts, and will be discussed herein in terms of the bounding significant adverse impacts for which an environmental impact statement would normally have been prepared. Lesser impacts (not likely to be of individually significant nature) would be expected for those activities not specifically identified. The actions most likely to result in significant adverse impacts include the actions taken to remove potential release site legacy environmental contaminants (either in the soil and silt, or buried beneath a soil covering) if this removal involves a large spatial area, and especially if it involves the removal of contamination located within a canyon bottom area within the floodplain. (This would likely result in the removal of additional vegetation and create additional potential for soil erosion; however, it would also decrease the potential for movement downstream of contaminants and the increased spreading out of the contaminant materials.)

Other actions involving significant adverse impacts include the installation of flooding control and hazard reduction structures such as several large earthen berms, dams, sediment traps, and catchment and overflow basins. These would be installed using heavy equipment within floodplain areas and would likely involve the permanent removal of vegetation and soil and possibly substrate removal over tens of acres for each structure; and the local drainage pattern and ecology of each site will be altered. In addition, the potential diversion of stormwater from Pajarito Canyon into Water Canyon (or another canyon) would involve either trenching through tens of feet of rock material comprising the mesa that lies between the two canyons or the tunneling through the mesa to form a subsurface passageway for the water. Impacts would include the use of heavy machinery, trucks, and drilling equipment; the removal and disposal of tons of soil and rock material, part of which potentially could be used elsewhere on site for erosion control and the removal of vegetation and destruction of habitat.

The subsequent diversion of water from one canyon system into another would affect the ecology of both canyons, as well as increase the erosion in Water Canyon (or another similar canyon), including possible scouring and vegetation destruction. Contaminants could move downstream, potentially into the Rio Grande, though these would be expected to be small quantities that may not be readily detectable and would not be expected to result in adverse health effects.

This list of DOE actions is not intended to be all-inclusive. As the assessment of fire effects continues and as the summer rainy season develops, various restoration, flood control and hazard reduction measures may be found to be inadequate or in need of replacement or reinforcement. The list of actions may accordingly be expanded or modified to meet additional needs for repair, replacement, modifications or additional activities.

Most of the actions taken by DOE will result in minor environmental effects similar to those actions conducted by neighboring government agencies (including federal agencies, the pueblos, the State of New Mexico, and local county governments) and private land owners in response to the Cerro Grande Fire and to protect the lives of area residents and workers and the real property located along the path of the fire and within downstream areas. The actions being taken on neighboring lands are limited in nature to those with individually and cumulatively insignificant effects due to extreme site topographical constraints and conditions, together with an implementation time deadline of July 1, 2000. Some of DOE's actions will result in individually significant impacts to the human environment. Further more, the sum of DOE's actions, when considered in conjunction with other actions conducted on neighboring lands, will have cumulatively significant impacts. The overall effects of these cumulative impacts will be positive if the risk of flooding is sufficiently lessened to achieve the desired results, and neutral or adverse if the risk of flooding remains unchanged. It is likely that overall water quality will be slightly adversely affected farther away from the burned areas. By the time the water enters the upper end of Cochiti Reservoir the water quality should be sufficiently good so that no adverse effects may be expected. The nearer to the burned areas one comes, the surface water will become of increasingly poorer quality due to fine particle suspension of ash material and silt, and the transport of larger pieces of charcoal and logs. There are no plans to use surface water to furnish individuals or communities with potable water within the area of concern, however, so potable supplies will not be adversely affected. Some use of the Rio Grande for irrigation, however, may result in slightly adverse effects, or, depending upon the concentration of nutrients, the surface water may have slight positive effects on crops. Contaminants that preferentially adhere to charcoal, or to silt, may move down stream into the Rio Grande and through the Cochiti

Reservoir, but due to dilution may not be readily detectable and are not expected to be harmful to the environment or to human health.

If there is flooding, the overall removal of many tons of topsoil over the burn area will be an adverse irreversible effect. The cumulative impact to vegetation, cultural resources, sensitive or threatened and endangered species, wildlife, infrastructure and utilities, recreational use resources, socioeconomic resources, environmental justice issues, and visual resources effects would be significantly adverse if severe flooding were to occur. And the loss of human life due to flooding would be an unacceptable, irreplaceable, and irreversible adverse impact.

Mitigations

Mitigation actions that have been and will continue to be employed when undertaking the flood control, hazard reduction and various recovery actions include: use of certified seed mixes to reduce the potential for the introduction of non-native plant species; use of standard dust suppression means, such as water sprays on construction sites; avoidance of cultural resource sites (trained archeologists are on-site during earth moving activities near known cultural resource sites to help avoid any adverse effects); avoidance of potential habitat areas for Federally-listed threatened and endangered species (trained biologists are on-site during earth moving activities near potential sensitive habitat areas to help avoid any adverse effects); avoidance of PRSs during earth moving activities (unless specifically associated with the planned removal, protection or stabilization of these sites); and the use of best management industry practices when engaged in construction actions.

DOE will continue to monitor the effectiveness and the environmental effects of the emergency actions that it is undertaking and will make appropriate modifications during implementation to mitigate adverse effects.

Compliance Actions

Pursuant to Council on Environmental Quality regulations implementing NEPA under emergency circumstances (40 CFR 1506.11) and DOE's own NEPA implementing regulations (10 CFR 1021.343), DOE has consulted with the Council regarding alternative NEPA compliance arrangements for emergency actions having significant environmental impacts. Because of the urgent need to take action, without delay, to employ flood control and hazard reduction measures before the annual rainy season begins, DOE, consistent with Council on Environmental Quality consultations, will prepare a special environmental analysis of impacts from the emergency fire suppression and the flood control actions taken by DOE. DOE is scheduled to issue the special environmental analysis in September 2000 to LANL stakeholders, including pueblos and tribes, and make it otherwise publicly available through the Internet and in DOE and LANL reading rooms and local public libraries in the following New Mexico communities, towns and cities: Los Alamos, Santa Fe, Espanola, and Albuquerque. The availability of the document will be published in local area newspapers. All subsequent or other actions undertaken by DOE will be subject to NEPA under the normal compliance process.

This notice also serves as the Public Notice and Statement of Findings regarding DOE's intention to take action involving construction and other actions within floodplains and wetlands pursuant to DOE's regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR part 1022). As provided in 10 CFR 1022.18, and because there is an immediate need to take emergency flood control and hazard reduction actions, DOE is waiving the public review periods that would otherwise apply before DOE would take such actions in a floodplain or wetland.

Public Involvement

DOE will continue to participate in public outreach efforts, including those sponsored by DOE and those coordinated by the BAER Team. Two public meetings have been held at which technical specialists discussed issues of concern with the public, and additional meetings are anticipated as the emergency response actions continue. DOE will continue to employ a variety of mechanisms, including Web sites, press releases, information telephone line, and informal consultations with stakeholders, to facilitate public involvement. A Public Advisory Group is being established that will focus specifically on communications issues as they relate to potential runoff and flood mitigation activities.

The BAER Team has provided information to the public and opportunities for public involvement through several mechanisms including, the establishment of a Web site (www.baerteam.org), regular press releases, an information line (505–603–8942), and individual contacts with members of the public. DOE will continue to coordinate its fire recovery and flood control actions with the interagency team and other stakeholders, and will continue to participate in public meetings.

The public is invited to provide comments on this notice to Elizabeth Withers, NEPA Compliance Officer, at U.S. Department of Energy, Los Alamos Area Office, 528 35th Street, Los Alamos, NM 87544, phone (505) 667–8690 or fax (505) 665–4872. Comments would be considered in developing the special environmental analysis on the emergency actions that have been and are being undertaken.

DOE's emergency action plans will be modified, as appropriate, in response to new information and changing conditions. Monitoring results of the effectiveness and the environmental effects of the emergency actions will be made available to the public. DOE will consider any comments, to the extent practicable, in pursuing adaptive mitigation measures. DOE welcomes comments at any time and will address them to the extent practicable.

Requests for a copy of the special environmental analysis, when available, may be directed to Elizabeth Withers (see above). Copies will also be available on the DOE NEPA Web at *http://tis.eh.doe.gov/nepa/*. The analysis will be made available to the public and DOE will consider comments received in pursuing adaptive mitigation measures.

Issued at Washington, DC, June 16, 2000.

Henry K. Garson,

NEPA Compliance Officer, Office of the Assistant Administrator for Defense Programs.

[FR Doc. 00–15797 Filed 6–19–00; 1:04 pm]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Rocky Flats

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: This notice announces a meeting of the Environmental Management Site-Specific Advisory Board (EM SSAB), Rocky Flats. The Federal Advisory Committee Act (Pub. L. No. 921–463, 86 Stat. 770) requires that public notice of these meetings be announced in the **Federal Register**.

DATES: Thursday, July 6, 2000; 6 p.m.–9:30 p.m.

ADDRESSES: College Hill Library, Front Range Community College, 3705 West 112th Avenue, Westminster, CO.

Department of Energy
Washington, DC 20585

June 15, 2000

Ms. Dinah Bear, General Counsel
Council on Environmental Quality
Executive Office of the President
722 Jackson Place, NW
Washington, DC 20503

Dear Ms. Bear:

The purpose of this letter is to document the Department of Energy's (DOE) consultations with the Council on Environmental Quality (CEQ) regarding emergency DOE actions at the Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico, as a result of the May 2000 Cerro Grande Fire. We thank you and Horst Greczmiel, Associate Director for NEPA Oversight, for your prompt and helpful guidance as we proceed to address the devastating effects of the wildfire on LANL and the surrounding communities. As outlined below, DOE has undertaken a range of emergency response actions--and will continue to do so--that have significant environmental impacts, without observing all of the ordinary provisions of CEQ's National Environmental Policy Act (NEPA) regulations. Therefore, DOE is pursuing alternative arrangements to comply with NEPA, as provided in Section 1506.11 of the CEQ regulations.

As you are aware, DOE representatives spoke with Mr. Greczmiel in late May regarding the DOE's emergency actions at LANL, and also with Richard Hadley, the NEPA Coordinator for the Cerro Grande Fire Interagency Burned Area Emergency Rehabilitation (BAER) Team, of which DOE is a member. DOE representatives met with you and Mr. Greczmiel on June 8, and on June 12 they met again with Mr. Greczmiel and headquarters NEPA liaisons from the Federal agencies participating in the BAER Team. As a result of these discussions and the best information available from the BAER Team, DOE and LANL onsite technical experts, and ongoing coordination and consultation with stakeholders, we propose the following alternative arrangements:

1. Issuance of a Federal Register Notice, in accordance with DOE's NEPA regulations at 10 CFR 1021.343.

   The enclosed draft Federal Register Notice, which we have coordinated with you, outlines the emergency actions that DOE has taken, is undertaking, and intends to pursue in the near term to address the effects of the fire, including the serious, immediate threat of flood damage. The Notice also addresses the potential environmental impacts of these emergency actions and possible mitigation measures, as well as DOE's plans for continuing public involvement and preparation of a special environmental analysis, discussed below.

2. Continuing Public Involvement Opportunities

As explained in the Notice, DOE will continue to participate in public outreach efforts, including those sponsored by DOE and those coordinated by LANL and the BAER Team. Two public meetings have been held, which provided information and responses to public issues and concerns, and additional meetings are anticipated as the emergency response actions continue. DOE will continue to employ a variety of mechanisms, including Web sites, press releases, information telephone line, and informal consultations with stakeholders, to facilitate public involvement. A Public Advisory Group is being established that will focus specifically on communications issues as they relate to potential runoff and flood mitigation activities. DOE will invite public comment on the Federal Register Notice and welcomes further comment at any time. All substantive comments will be considered and addressed to the extent practicable.

3. Preparation of Special Environmental Analysis

DOE will prepare a Special Environmental Analysis, scheduled to be issued in September 2000, that will evaluate the environmental impacts of the completed and ongoing emergency actions. This document will address public comments received on the Notice to the extent practicable and discuss mitigation measures that may be available. The Analysis will be available to the public. DOE will consider any comments received on the Analysis in planning future mitigation actions.

4. Monitoring and Adaptive Mitigation

DOE will continue to monitor the effectiveness and the environmental effects of the emergency actions that it is undertaking and will make appropriate modifications during implementation to mitigate adverse effects. Monitoring results will be made available to the public and DOE will consider any comments received in pursuing adaptive mitigation measures.

5. Future NEPA Documents

Any future non-emergency actions will comply fully with NEPA regulatory requirements. In this regard, a draft environmental assessment on a site-wide Wildfire Management Plan will be issued for public comment shortly. The Special Environmental Analysis will cover only those emergency actions anticipated to be initiated through approximately November 2000.

Despite the urgency of the situation, described in detail in the Notice, DOE is taking all steps possible to comply with the substantive requirements of NEPA in the short time available. We would appreciate any further suggestions you may have regarding our efforts to comply with NEPA under these emergency circumstances. Thank you again for your assistance.

Sincerely,

Henry K. Garson
NEPA Compliance Officer
Office of the Assistant Administrator
for Defense Programs
National Nuclear Security Administration

Enclosure

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20503

June 15, 2000

Henry K. Garson
NEPA Compliance Officer
Office of the Assistant Administrator
For Defense Programs
National Nuclear Security Administration
Department of Energy
Washington, DC 20585

Dear Mr. Garson:

I am writing in response to your letter of June 15, 2000, documenting recent consultations between the Council on Environmental Quality (CEQ) and the Department of Energy (DOE) regarding alternative arrangements for compliance with the National Environmental Policy Act (NEPA) to deal with emergency circumstances under 40 C.F.R. §1506.11 that make it necessary for DOE to continue taking immediate actions at the Los Alamos National Laboratory in New Mexico. The CEQ regulations implementing the procedural provisions of NEPA provide that where emergency circumstances make it necessary to take an action without observing the provisions of those regulations, the federal agency taking the action should consult with the Council about alternative arrangements. Alternative arrangements are limited to those actions necessary to control the immediate impacts of the emergency.

The emergency exists due to the May 2000 Cerro Grande Fire that burned over 43,000 acres of land in May, 2000, including about 7,500 acres on the DOE administered lands at the Los Alamos National Laboratory. There is a serious threat of soil erosion and flooding and debris flows that could threaten lives and property of the 10,000 residents in the communities of White Rock, the Pueblo of San Ildefonso and the Pueblo de Conchiti located downstream of the DOE lands. The threat of soil erosion and flooding has the potential to move contaminants from several potential contaminant release sites. DOE's response activities to the fire began with certain actions taken immediately before the fire crossed into the Los Alamos National Laboratory boundaries and have continued since that time. DOE has indicated that many, if not most, of the actions taken to date have resulted in, at most, minor impacts. DOE believes that the actions most likely to result in significant effects include actions proposed to be taken to remove contaminants and to install certain flood control and hazard reduction structures, which notably could include the diversion of water from one canyon system to another. DOE is committed to mitigating adverse effects of these actions to the extent possible while undertaking actions it deems necessary to avoid catastrophic flooding.

CEQ has had several meetings and conference calls with representatives of the DOE, as well as with employees of other federal agencies represented on the Cerro Grande Fire Interagency Burned Area Emergency Rehabilitation Team (BAER). Those discussions have resulted in the formulation of the alternative arrangements set forth in your letter. We commend DOE for its commitment to provide for continuing public involvement, including soliciting comment on the Notice of Emergency Action, the special environmental analysis, and on

monitoring results and prospective mitigation. Within the realistic constraints faced by DOE as it works to avert flooding, we urge DOE to be creative in its outreach to interested parties as new information, ideas and proposals are identified and considered. We also note DOE's on-going consultation with the U.S. Fish and Wildlife Service regarding affects of actions on species listed under the Endangered Species Act, and with officials of the Advisory Council on Historic Preservation, the New Mexico State Historic Preservation Office, representatives of the Pueblo de Conchiti, Pueblo of Jemez, Pueblo of San Ildefonso and the Mescalaro Apache tribe.

CEQ agrees that the process as set forth represents appropriate alternative arrangements for compliance with NEPA for actions taken to respond to this emergency situation. We would appreciate receiving a copy of the special environmental assessment. Please notify CEQ at the earliest feasible time if a need to extend these arrangements for NEPA compliance is identified. Additionally, we ask that you provide us with a brief report summarizing the conduct of the alternative arrangements and identifying any lessons learned or recommendations that DOE thinks would be useful to consider in future emergency situations within six months after the termination of the alternative arrangements. Please do not hesitate to contact CEQ immediately if we can be of further assistance.

Sincerely,

Dinah Bear

Dinah Bear

General Counsel

This Page Intentionally Left Blank

Glossary

Accord Pueblos Accord refers to the written agreements signed by DOE and the four Pueblos on December 8, 1992, stating the basic understanding and commitments of the parties and describing the general framework for working together. Subsequently, cooperative agreements between each Pueblo and DOE, and between each Pueblo and the University of California, have been signed, which specify further details related to the accord agreements.

archaeological sites (resources) Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

articulated concrete mattress (ACM) A concrete and steel flexible barrier or blanket that is used to stabilize soils or steep slopes that are prone to erosion.

best management practices (BMPs) Structural, nonstructural, and management techniques, other than effluent limitations, to prevent or reduce pollution of surface water. They are the most effective and practical means to control pollutants. BMPs can include schedules of activities; prohibitions of practices; maintenance procedures; treatment requirements; operating procedures; and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Burn Area Emergency Rehabilitation (BAER) Team A multidisciplinary, multiagency team of individuals experienced in recovery planning exercises and in the implementation of erosion and flood control measures.

burn severity A relative measure of the degree of change in a watershed that relates to the severity of the effects of a fire on watershed conditions.

contamination The deposition or discharge of chemicals, radionuclides, or particulate matter above a given threshold.

controlled burn See prescribed burn.

Council on Environmental Quality (CEQ) The CEQ coordinates federal environmental efforts and works closely with agencies in the development of environmental policies and initiatives.

crown fire A fire that advances rapidly from tree to tree primarily through the tops of trees or shrubs.

cultural resources Any prehistoric or historic sites, buildings, structures, districts, or other places or objects (including biota) considered to be important to a culture, subculture, or community for scientific, traditional, or religious purposes or for any other reason.

cumulative impacts Cumulative effects on the environment result from the incremental effect of an action when added to other 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.

dam An artificial barrier, together with its appurtenant works, constructed for the purpose of impounding or diverting water.

earthen dam A small water retention structure constructed of excavated natural materials, usually soil, placed with sloping sides.

ecological resources For the purposes of the analyses presented in this document, ecological resources include all flora and fauna, sensitive species, threatened or endangered species, and wetlands that could have been affected by the actions taken during a major disaster emergency.

effluent A waste stream flowing into the atmosphere, surface water, groundwater, or soil. Most frequently the term applies to waste discharged to surface waters.

Emergency Response Team (ERT) The ERT is a rapid response team created to respond to the Cerro Grande Fire. The team is composed of representatives of DOE, the University of California (as management and operations contractor for LANL), and the U.S. Army Corps of Engineers (working under an Interagency Agreement to construct stormwater control structures in the field).

environmental assessment (EA) A written environmental analysis that is prepared pursuant to the *National Environmental Policy Act* to determine whether a major federal action could significantly affect the environment and thus require preparation of an environmental impact statement. If the action would not significantly affect the environment, then a finding of no significant impact is issued.

environmental impact statement (EIS) A document required of federal agencies by the *National Environmental Policy Act* for proposals for legislation or major federal actions significantly affecting the quality of the human environment. A tool for decision-making, it describes the positive and negative environmental impacts of the proposed action and alternative actions.

Environmental Restoration (ER) Project The project at LANL responsible for investigation and remediation of solid waste management units or potential release sites (PRSs).

finding of no significant impact A formal declaration that a specific federal action that is subject to NEPA has been determined not to have an adverse impact on the environment.

firebreak A generally linear stretch of land that is completely cleared of all flammable growth, usually by bull dozer. The purpose of a firebreak is to create a barrier that is devoid of fuels to contain the spread of a wildfire.

floodplain The relatively flat canyon or valley bottoms next to and formed by rivers that are subject to overflow or flooding.

fuel break A generally linear stretch of land that is cleared of down and dead wood and that is thinned to reduce the number of trees per acre. Fuel breaks are designed to prevent the spread of a fire without the clearing of all vegetation.

hazard trees Trees that have been damaged and are a physical hazard to personnel or property.

height of flood retention structure The vertical measurement expressed in feet as measured from the downstream toe of the structure at its lowest point to the elevation of the top of the structure.

hydrophobic soil layer Soils that become impermeable to water movement as a result of high temperatures often associated with wildfires.

low-head weirs Permeable rock dams designed to maintain a low level of flood water flow to limit erosion and contain sediments.

jersey bouncers Portable concrete barriers usually about 10 ft (3 m) long by 3 ft (0.9 m) high that are temporarily placed to prevent flood damage.

kiva One of the remote-controlled critical assembly buildings associated with the Los Alamos Critical Experiment Facility located in TA-18 in Pajarito Canyon.

low-head weir A permeable rock dam placed across a water course to regulate or reduce water flow.

low-level waste (LLW) All radioactive waste that is not classified as high-level waste, transuranic waste, spent nuclear fuel or "11e(2) by-product material" as defined by DOE Order 4820.2A, Radioactive Waste Management.

material disposal area (MDA) Areas at LANL used to treat or dispose of hazardous materials and wastes.

National Environmental Policy Act (NEPA) A law that requires federal agencies to consider the environmental impact of their activities—including the impact on cultural resources; endangered, threatened, or sensitive species; and floodplains or wetlands—before deciding to proceed with those activities.

natural resources For the purposes of this document, lands providing natural, recreational, and economic opportunities for various users.

one-hundred year flood The flood magnitude expected to be equaled or exceeded on the average of once in 100 years. It may also be expressed as an exceedance frequency with a 1 percent chance of being exceeded in any given year.

particulate matter Matter in the form of liquid or solid particles.

potential release sites (PRSs) Sites potentially contaminated with hazardous or mixed wastes that are subject to the requirements of RCRA.

prescribed burn A controlled fire intentionally or naturally ignited under specific environmental conditions that is confined to a predetermined area.

radionuclides Radioactive isotopes of various elements that are specifically or collectively regulated under certain federal and state laws.

record of decision The official agency determination that usually follows the completion of an environmental impact statement.

region of interest The area most likely to be affected by an agency action as defined under NEPA.

remediation The decontamination of facilities or sites to an acceptable level of contamination suitable for general or specific use.

Resource Conservation and Recovery Act (RCRA) RCRA is an amendment to the first federal solid waste legislation, the *Solid Waste Disposal Act of 1965*. Under RCRA, Congress established directives and guidelines for the regulation of solid and hazardous wastes.

riparian area Area directly adjacent to a stream bottom that requires water to be present only temporarily during the year.

rock dam A small water retention structure constructed of local stones and soil, placed horizontally across drainages to slow down water flow.

rock gabion A box formed with chain-link fence filled with stones placed in drainage channels and used for flood and erosion control.

sensitive species Species of concern at the federal and/or state level are referred to as "sensitive species."

site-wide environmental impact statement (SWEIS) A type of programmatic EIS that analyzes the environmental impacts of all or selected functions at a DOE site. As part of its regulations for implementation of NEPA, DOE prepares SWEISs for certain large, multiple-facility DOE sites; it may prepare EISs or EAs for other sites to assess the impacts of all or selected functions at those sites (10 CFR Part 1021.330 [c]).

slurry bomber A large airplane that drops fire-retarding chemicals to suppress or slow the movement of a wildfire.

solid waste management unit Any unit from which hazardous constituents may migrate, as defined by RCRA. A designated area that is, or is suspected to be, the source of a release of hazardous materials into the environment that will require investigation and/or corrective action.

special environmental analysis (SEA) A special environmental analysis report provides an assessment of the impacts that have resulted because of actions undertaken by DOE (or undertaken for DOE by other parties at DOE's direction) to address actions taken during a major disaster emergency. A special environmental analysis report includes descriptions of the actions, the resulting impacts from the actions, mitigation measures taken for these actions, and an analysis of cumulative impacts.

stakeholder Any member of the public, federal or state government agencies, and Indian tribes that may be affected by an agency action.

straw wattle Long (~30 ft) tube-shaped nylon mesh stuffed with straw used on slopes and drainages to reduce rainwater flow and soil erosion.

stormwater discharge Run-off from rainwater events that are generally subject to the NPDES storm water permit requirements of the *Clean Water Act*.

storm water retention structure Structures of various designs intended to moderate storm water runoff, especially in areas of high runoff potential.

technical area (TA) A geographically defined area at LANL containing land and facilities dedicated to one or more functions.

threatened and endangered species Mammals, birds, fish, plants, or other living organisms threatened with extinction by human-produced or natural changes in their environment. Requirements for declaring species threatened or endangered are contained in the *Endangered Species Act of 1973*.

transuranic waste Radioactive waste containing certain concentrations of plutonium that require disposal at the DOE Waste Isolation Project Plant Facility in New Mexico.

U.S. Department of Energy (DOE) The Federal agency that sponsors energy research and regulates nuclear materials used for weapons production.

watershed An area of land where precipitation collects into one flow that drains into a river or other body of water.

wetland Land or areas exhibiting hydric (requiring considerable moisture) soil concentrations, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

wildfire A forest fire that is not under human control.