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Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory



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Cover photo: Mexican Spotted Owls at Los Alamos National Laboratory



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1.0 THREATENED AND ENDANGERED SPECIES HABITAT MANAGEMENT PLAN GENERAL OVERVIEW

1.1 Introduction

The Los Alamos National Laboratory (LANL) Threatened and Endangered Species Habitat Management Plan (HMP) fulfills a commitment made to the U.S. Department of Energy (DOE) in the “Final Environmental Impact Statement for the Dual-Axis Radiographic Hydrodynamic Test Facility Mitigation Action Plan” (DOE 1996). The HMP received concurrence from the U.S. Fish and Wildlife Service (USFWS) in 1999 (USFWS consultation numbers 2-22-98-I-336 and 2-22-95-I-108). This 2022 update retains the management guidelines from the 1999 HMP for listed species and updates some descriptive information.

1.2 Role of Site Plans in the HMP

The purpose of the HMP is to provide a management strategy for Endangered Species Act (ESA) compliance through the protection of threatened and endangered species and their habitats on LANL property. The HMP consists of site plans for federally listed threatened or endangered species that have a moderate or high probability of occurring at LANL. The following federally listed threatened or endangered species currently have site plans at LANL: Mexican Spotted Owl (*Strix occidentalis lucida*), Southwestern Willow Flycatcher (*Empidonax traillii extimus*), and Jemez Mountains Salamander (*Plethodon neomexicanus*). Site plans provide guidance to ensure that LANL operations do not adversely affect threatened or endangered species or their habitats.

The Black-footed Ferret (*Mustela nigripes*) is federally listed as endangered; however, no sightings of Black-footed Ferrets have been reported in Los Alamos County for more than 70 years. In addition, no large prairie dog towns—prime habitat for Black-footed Ferrets—have been observed at LANL; therefore, there is no site plan for this species.

The New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*) and western distinct population segment of the Yellow-billed Cuckoo (*Coccyzus americanus*) do not require a site plan because they do not have breeding habitat on LANL property. In Keller (2015), it was concluded that if any LANL work activities—onsite or offsite—might affect habitat for these two species, those activities would be reviewed for impacts.

1.3 Description of Areas of Environmental Interest

Suitable habitats for federally listed threatened and endangered species have been designated as areas of environmental interest (AEIs), which are geographical units at LANL that are managed for the protection of federally listed species and consist of core habitat areas and buffer areas. The purpose of the core habitat is to protect areas essential for the existence of the specific threatened or endangered species. This includes the appropriate habitat type for breeding, prey availability, and micro-climate conditions. The purpose of buffer areas is to protect core areas from undue disturbance and habitat degradation.

Site plans identify restrictions on activities within the AEIs. The USFWS reviewed allowable activities and provided concurrence that these activities are not likely to adversely affect federally listed species. Activities discussed in site plans include day-to-day activities that cause disturbance (hereafter referred to as “disturbance activities”), such as access into an AEI, and long-term impacts, such as habitat alteration.

1.3.1 Definition and Role of Developed Areas in AEI Management

Developed areas include all building structures, paved roads, improved gravel roads, paved and unpaved parking lots, and firing sites. The extent of developed areas in each AEI was determined using two methods. First, LANL geographic information system (GIS) analysts placed a 15-meter (m; 49-foot [ft]) border around all buildings and parking lots. For paved and improved gravel roads, the developed area was defined as the area to a roadside fence if one exists within 9 m (30 ft) of the road or 5 m (15 ft) on each side of the road if there is no fence within 9 m (30 ft). If an area of highly fragmented habitat was enclosed by roads, a security fence, or connected buildings, that area was also classified as developed. Developed areas at firing sites were defined as a circle with a 91-m (300-ft) radius from the most centrally located firing pad. Second, LANL GIS analysts overlaid scanned orthophotos onto a map of the Los Alamos area and digitized all areas that appeared developed. These two information sources were overlaid and combined so that areas classified as developed by either method were considered developed in final maps and analyses. Some areas were confirmed by ground surveys.

Developed areas occur in the core and/or buffer of all AEIs; however, developed areas do not constitute suitable habitat for federally listed species. Current ongoing activities in developed areas constitute a baseline condition for the AEIs and are not restricted. New activities, including further development within already existing developed areas, are not restricted unless they impact undeveloped portions of an AEI core. For example, if light or noise from a new office building in a developed area were to raise levels in an undeveloped core area, those light and noise levels would be subject to the guidelines on disturbance or habitat alterations.

1.3.2 General Description of Buffer Areas and Allowable Buffer Area Development

The purpose of buffer areas is to protect core areas from undue disturbance or habitat degradation. The 1999 levels of development in buffer and core areas represent baseline conditions for this HMP. No further development is allowed in the core area under the guidelines of this HMP. A limited amount of development may be allowed in buffer areas. Each species' site plan details the allowable levels. Under the guidelines of this HMP, individual development projects are limited to 2 hectares (ha; 5 acre [ac]) in size, including a 15-m (49-ft) developed-area border around structures and a 5-m (15-ft) developed-area border around paved and improved gravel roads. Projects greater than 2 ha (5 ac) in size require individual review for ESA compliance (see exceptions for fuels management activities and utility corridor maintenance).

1.3.3 Emergency Actions

Managers may activate emergency actions if safety and/or property is immediately threatened by something occurring within an AEI (e.g., wildfire, water line breakage). Contact a LANL biologist (<https://int.lanl.gov/environment/bio/index.shtml>), the Environmental Stewardship Group (505-665-8855), or the DOE/National Nuclear Security Administration (NNSA) Los Alamos Field Office (505-667-7014) as soon as possible. If the emergency occurs outside of regular business hours, contact the Emergency Operations Support Center (505-667-2400); this office will then communicate with the appropriate LANL and DOE/NNSA Field Office personnel.

1.4 Implementation of Site Plans

1.4.1 Roles and Responsibilities

LANL's facility managers and operational staff are responsible for ensuring that activities are reviewed for compliance with all applicable site plans. Figure 1-1 illustrates the process for utilizing site plans. If

activities follow approved Site Plan guidelines, there is no requirement for additional ESA regulatory compliance; however, if proposed activities fall outside of the requirements of the Site Plan(s), then the project must fund a biological assessment for their activity.

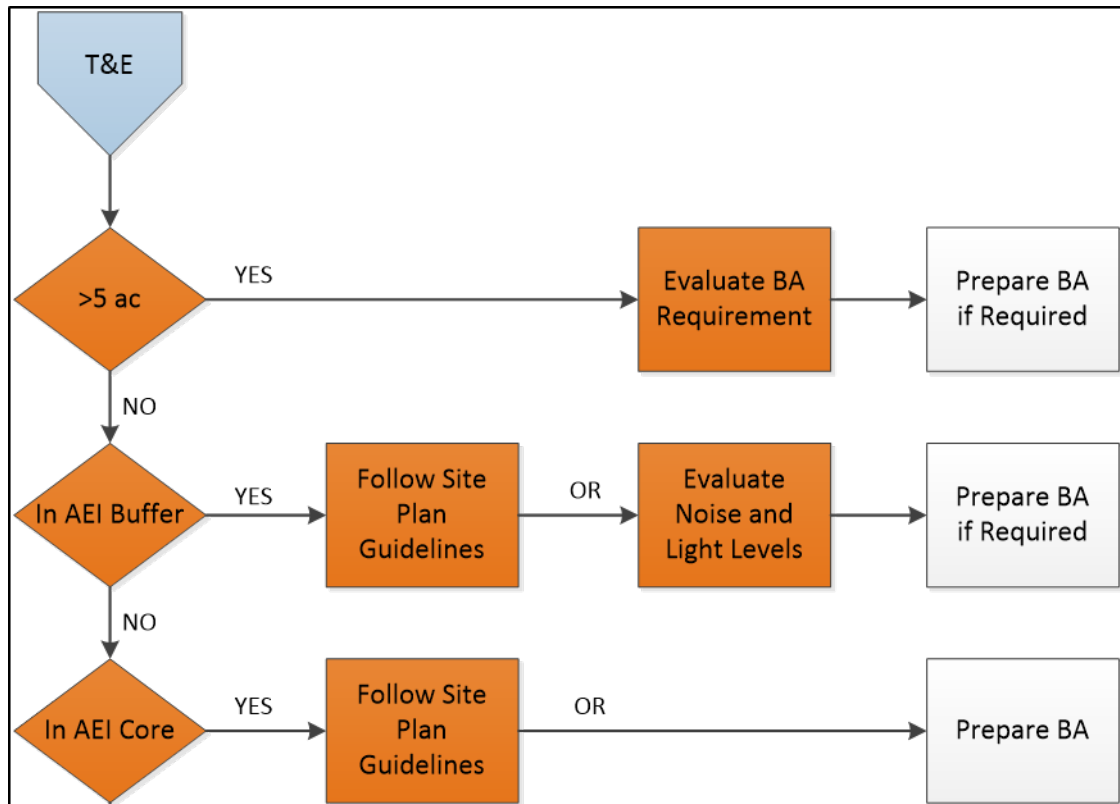


Figure 1-1. Process flowchart for determining site plan requirements

If an activity or project occurs outside of all LANL AEIs and will not impact habitat within an AEI, it does not have to be reviewed for ESA compliance unless it is a large project in an undeveloped area that could have impacts on nearby habitat. Projects that are larger than 2 ha (5 ac) or cost more than \$5 million require an individual ESA compliance review even if they are not located within an AEI.

LANL’s facility managers are responsible for determining if operations within their geographic and/or programmatic areas of responsibility comply with the guidelines in these site plans. Submission of a project into the integrated review tool for a new or modified project is required under *Environmental Management System, System Description (SD) 400* (LANL 2021) and allows managers to identify the requirements within their project areas. Deployed environmental professionals and core LANL biologists are available to support facility managers. If activities follow site plan guidelines, they do not require any additional ESA regulatory compliance action; however, NEPA, cultural resources, wetlands, or other regulatory compliance actions are not addressed in site plans, and additional compliance actions may be required for these actions. It is the responsibility of the project leader or facility management staff to ensure that all requirements are satisfied. If you have questions, contact biological, cultural, NEPA, or other environmental subject matter experts.

A single facility may have one or more AEIs within its boundary, and the AEIs may be for different species. Some AEIs overlap. In areas where overlap occurs, project managers must follow the guidelines for AEIs of all involved species.

1.4.2 Activities that Do Not Meet Site Plan Guidelines

If a project reviewer determines that an activity or project cannot meet the guidelines in applicable site plans, LANL biologists evaluate that activity individually for compliance with the ESA. Results of the evaluation of potential impacts allow LANL biologists to make recommendations to the DOE/NNSA Field Office Biological Resources Program Manager regarding the need for USFWS consultation. An evaluation may result in a DOE/NNSA Field Office

- determination that there is no effect and the activity may proceed,
- suggestion for modifications of the action to avoid adverse effects so that it may proceed, or
- decision to prepare a biological assessment for the activity and submit it to the USFWS for concurrence.

Fieldwork and preparation of a biological assessment can take several months, with an additional 2 to 12 months for DOE/NNSA Field Office review and then final USFWS concurrence.

1.4.3 Dissemination of Information

Habitat locations of threatened and endangered species are not considered sensitive; however, it is in the best interest of threatened and endangered species to restrict specific knowledge about their locations.

1.5 Changes in the HMP since Implementation

The HMP received concurrence from USFWS and was first implemented in 1999. Since that time, both the Peregrine Falcon (*Falco peregrinus*) and the Bald Eagle (*Haliaeetus leucocephalus*) have been delisted. Site plans for those species have been removed from LANL's HMP. Both species are protected at LANL under the Migratory Bird Treaty Act, and the Bald Eagle is also protected under the Bald and Golden Eagle Protection Act.

In 2005, the USFWS concurred with DOE's proposal for updated Mexican Spotted Owl habitat boundaries based on a revised analysis of Mexican Spotted Owl habitat quality within DOE property around LANL (USFWS consultation number 22420-2006-I-0010).

In 2012, the USFWS concurred with DOE's proposal to modify the habitat boundaries for the Los Alamos Canyon Mexican Spotted Owl AEI due to changes from the fire response activities after the Las Conchas wildfire (USFWS consultation number 02ENNM00-2012-IE-0088).

In 2013, the USFWS concurred with the DOE's new site plan for the Jemez Mountains Salamander and its addition to LANL's HMP (USFWS consultation number 02ENNM00-2014-I-0014).

In 2015, the USFWS concurred with the DOE's addition of the New Mexico Meadow Jumping Mouse and Yellow-billed Cuckoo to LANL's HMP (USFWS consultation number 02ENNM00-2015-I-0538).

In 2017, the USFWS concurred with DOE's proposal to modify the habitat boundaries for the lower section of Water Canyon Mexican Spotted Owl AEI due to habitat degradation that resulted from long-term drought and fire effects (USFWS consultation number 02ENNM00-2017-I-0255).

In 2022, the HMP was revised for formatting and updated language and to revise Section 5.0 in the Mexican Spotted Owl site plan. This effort was a required mitigation in a recent consultation (USFWS consultation number 02ENNM00-2020-I-1412).

1.6 Data Management

The data used in the implementation of the HMP are stored in a geodatabase at LANL. The current map of all of the AEIs at LANL is shown in Figure A-1 in the appendix.



2.0 AREA OF ENVIRONMENTAL INTEREST SITE PLAN FOR THE MEXICAN SPOTTED OWL

2.1 Species Description—Mexican Spotted Owl

2.1.1 Status

In 1993, the USFWS determined the Mexican Spotted Owl to be a threatened species under the authority of the ESA, as amended (58 Federal Register [FR] 14248). In 1995, the USFWS released its final recovery plan for the owl (USFWS 1995), which was revised in 2012 (USFWS 2012). The USFWS most recently designated critical habitat for Mexican Spotted Owl in 2004 (69 FR 53182).

2.1.2 General Biology

The Mexican Spotted Owl is found in northern Arizona, southeastern Utah, and southwestern Colorado south through New Mexico, west Texas, and into Mexico. It is the only subspecies of Spotted Owl recognized in New Mexico (USFWS 1995).

The Mexican Spotted Owl generally inhabits mixed conifer and ponderosa pine- (Pinus ponderosa; Lawson & C. Lawson) Gambel oak (Quercus gambelli; Nutt.) forests in mountains and canyons. High canopy closure, high stand diversity, multilayered canopy resulting from an uneven-aged stand, large mature trees, downed logs, snags, and stand decadence as indicated by the presence of mistletoe are characteristics of Mexican Spotted Owl habitat. Some owls have been found in second-growth forests (i.e., younger forests that have been logged); however, these areas were found to contain characteristics typical of old-growth forests. Mexican Spotted Owls in the Jemez Mountains prefer cliff faces in canyons for their nest sites (Johnson and Johnson 1985). The recovery plan for the Mexican Spotted Owl recommends that mixed conifer and pine-oak woodland types on slopes greater than 40 percent be protected for the conservation of this owl.

A mated pair of adult Spotted Owls might use the same home range and general nesting areas throughout their lives. A pair of owls requires approximately 800 ha (1,976 ac) of suitable nesting and foraging habitat to ensure reproductive success. Incubation is carried out by the female. The incubation period is approximately 30 days, and most eggs hatch by the end of May. Most owlets fledge in June, 34 to 36 days after hatching (USFWS 1995). The owlets are “semi-independent” by late August or early September, although juvenile begging calls have been heard as late as September 30. Young are fully independent by early October. The non-breeding season runs from September 1 through February 28. Although seasonal movements vary among owls, most adults remain within their summer home ranges throughout the year.

The diet of Mexican Spotted Owls who nest in canyons consists primarily of woodrats (*Neotoma spp.*) and deer mice (*Peromyscus spp.*), with fewer numbers of rabbits, birds, reptiles, and arthropods (Willey 2013). The relative abundance of prey types in Mexican Spotted Owl pellets collected at LANL is listed in Table A-1 in the appendix. Ganey and Balda (1994) found that core areas of individuals (i.e., where owls spent 60 percent of their time) averaged 134 ha (331 ac), and core areas for pairs averaged 160 ha (395 ac).

2.1.3 Threats

The Mexican Spotted Owl was listed as threatened because of destruction and modification of habitat caused by timber harvest, wildfires, increased predation on owls associated with habitat fragmentation, and a lack of adequate protective regulations.

2.2 Impact of Human Activities

2.2.1 Introduction

The primary threats to Mexican Spotted Owls on LANL property are (1) impacts to habitat quality from LANL operations and (2) disturbance of nesting owls. This section provides a review and summary of scientific knowledge of the effects of various types of human activities on the Mexican Spotted Owl and provides an overview of the current levels of activities at LANL.

2.2.2 Impacts on Habitat Quality

2.2.2.1 Development

The type of habitat used by Mexican Spotted Owls—late seral stage forests with large trees—is usually not found in large quantities near developed areas or near areas that have experienced recent agricultural or forest product extraction land uses; therefore, Mexican Spotted Owls generally are not found near developments. Whether it is the development or a lack of suitable habitat that discourages colonization of these areas by Mexican Spotted Owls is unknown.

Areas of LANL vary from remote, undeveloped areas to heavily developed and/or industrialized facilities. Most LANL facilities are situated atop mesas, primarily in the northern and western portion of the DOE property. LANL is bounded by developed residential, industrial, and retail areas along its northern boundary (the town of Los Alamos) and by residential and retail development along a portion of its eastern boundary (the town of White Rock). Three major paved roads traverse LANL from northeast to southwest. Sandia, Pajarito, and Los Alamos canyons have paved roads within AEIs, and several AEIs have dirt roads along at least a portion of the canyon bottom. AEIs that contain paved or dirt roads in the canyon bottoms have not been occupied at LANL (Hathcock et al. 2010).

2.2.2.2 Ecological Risk

No specific information exists on the impact of chemicals on the Mexican Spotted Owl, although experience with other raptor species suggests that exposure to polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethane (DDT) and its derivatives, and other organophosphate or organochlorine pesticides would probably be harmful. Exposure to other chemicals could also be harmful (Cain 1988).

Between 1997 and 2009, LANL subject matter experts completed three ecological risk assessments that included the Mexican Spotted Owl. The ecological risk assessment process involves using computer modeling to assess potential effects to animals from chemicals of potential concern that have been detected in the environment. All of the following ecological risk assessments concluded that, on average, no appreciable impact to Mexican Spotted Owls is expected from chemicals of potential concern (Gallegos et al. 1997; Gonzales et al. 2004; Gonzales et al. 2009).

2.2.2.3 Disturbance

Pedestrians and Vehicles

Based on work with other raptors, LANL biologists assume that Mexican Spotted Owls would likely be disturbed by the approach of either pedestrians or vehicles. At an equal distance, pedestrians are frequently more disturbing to raptors than vehicles (Grubb and King 1991). Brown and Stevens (1997) reported that, during surveys in Grand Canyon National Park, 22 times more Bald Eagles were found in

canyon reaches with low human recreational use compared with reaches with moderate-to-high human recreational use. Human activity 100 m (328 ft) from Bald Eagle nests in Alaska caused clear and consistent changes in behavior of breeding eagles (Steidl and Anthony 2000).

Swarthout and Steidl (2001) found that both juvenile and adult roosting Mexican Spotted Owls were unlikely to alter their behavior in the presence of a single hiker at distances greater than 55 m (180 ft). Swarthout and Steidl (2003) concluded that cumulative effects of high levels of short-duration recreational hiking near Mexican Spotted Owl nests could be detrimental.

Many canyon bottoms and mesa tops at LANL have dirt roads traversing them. Most of these roads are gated; however, these roads are accessible to LANL employees, and some of them are accessible to the public on foot or by bike. LANL biologists found that AEIs are occupied less often if there is recreational access into a canyon (Hathcock et al. 2010).

Aircraft

Ground-based disturbances appear to impact raptor reproductive success more than aerial disturbances (Grubb and King 1991). Grubb and Bowerman (1997) concluded that an exclusion of aircraft within 600 m (1,968 ft) of Bald Eagle nest sites would limit Bald Eagle response frequency to 19 percent.

Delaney et al. (1999) found that, for Mexican Spotted Owls, chainsaws consistently elicited higher response rates than helicopters at similar distances. Owl flush rates did not differ between nesting and non-nesting seasons. No owls flushed when noise stimuli (helicopter or chainsaws) were at distances greater than 105 m (344 ft). Distance was generally a better predictor of owl response to helicopter overflights than sound level.

LANL is restricted airspace, and planes infrequently fly less than 609 m (2,000 ft) above ground level. The County of Los Alamos operates an airport along the northern edge of LANL. The airport is located on the southern rim of Pueblo Canyon. Most flights approach and depart to the east of the airport, over the Rio Grande.

Explosives

No specific information is currently available on the reaction of Mexican Spotted Owls to explosives detonation. Explosive blasts set off 120 to 140 m (393 to 459 ft) from active Prairie Falcon (*Falco mexicanus*) nests caused perched Prairie Falcons to flush from perches 79 percent of the time and, in 26 percent of the cases, caused incubating Prairie Falcons to flush from nests. Measured sound levels at aerie entrances during blasts ranged from 129 to 141 decibels (dB) (Holthuijzen et al. 1990). Explosives blasting for dam construction 560 to 1,000 m (1,837 to 3,280 ft) from active Prairie Falcon nests caused a change in behavior 26 percent of the time, and birds flushed in 17 percent of all cases. No incubating birds flushed (Holthuijzen et al. 1990). Brown et al. (1999) found little activity change in roosting or nesting Bald Eagles and no population-level impacts from weapons detonations at the Aberdeen Proving Ground. Holthuijzen et al. (1990) found that a 167-gram (g; 5.89-ounce [oz]) charge of Kinestik produced noise levels between 138 and 141 dB at 100 m (328 ft) and that a 500-g (17.6-oz) charge of trinitrotoluene(2,4,6-) (TNT) produced noise levels between 144 and 146 dB at 100 m (328 ft). A 20-kilogram (kg; 44-pound [lb]) charge of TNT produced noise levels that measured 163 dB at 100 m (328 ft) (Paakkonen 1991).

Measurements of noise levels during explosives testing were conducted at three locations at LANL using quantities of high explosives ranging from 4.5 to 67.5 kg (10 to 148 lb) of TNT during six shots. Noise levels increased during the test from a background level of 31 A-weighted decibels [dB(A)] to a range between 64 and 71 dB(A) during shots at a distance of 1.8 kilometers (km; 1.1 miles [mi]). At a distance

of 4.3 km (2.67 mi), noise levels rose from a background range of 35 to 64 dB(A) to a range of 60 to 63 dB(A) (Vigil 1995). At a distance of 6.7 km (4.16 mi), noise levels rose from a background range of 38 to 51 dB(A) to a range of 60 to 71 dB(A) (Burns 1995). LANL biologists estimated that the noise from a shot at the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility would be 150 dB(A) at the source and 80 dB(A) at 400 m (1,312 ft) (Keller and Risberg 1995). LANL biologists found that Mexican Spotted Owl AEIs located within the explosives-testing buffer area were occupied more frequently than AEIs in other locations (Hathcock et al. 2010)—likely due to the strict access control in explosives areas that limits human activity and development in the canyon bottoms.

Other Sources of Noise

Major noise-producing activities at LANL include automobile and truck traffic and noise associated with office buildings, construction activities, a live-fire range, and explosives testing. Noise is also associated with aircraft traffic at the Los Alamos County Airport. Construction and maintenance activities involved with operations at LANL are fairly common. In addition, implementation of the 2016 Compliance Order on Consent issued by the New Mexico Environmental Department has resulted in an increased frequency of drilling groundwater-monitoring wells in protected habitat at LANL. Also, forest fuels management operations use chainsaws, chippers, and other noise-generating equipment. The 2010 National Pollutant Discharge Elimination System Individual Permit (EPA 2010) issued by the Environmental Protection Agency requires LANL to comply with minimizing pollutants in storm water discharges from associated historical industrial activities. To do so, site-specific stormwater and sediment control features such as berms, rock check dams, and other best management practices (BMPs) are installed at various sites around LANL. These BMPs—and the associated monitoring required—often occur in canyon bottoms in protected habitat. LANL biologists conducted a study of noise levels in canyons and found that the primary sources of noise that exceed 55 dB(A) were cars and trucks. Readings taken near flowing water were up to 11 dB(A) higher than readings taken elsewhere. The average dB(A) in canyons near paved roads ranged from 41 to 62, with maximum values ranging from 62 to 74. Away from paved roads 1.6 km (1 mi) or more, average dB(A) in canyons ranged from 37 to 50, with all but one average below 45. Maximum dB(A) away from paved roads ranged from 38 to 76; 76 dB(A) was measured during a thunder clap (Huchton et al. 1997).

In December 1997, LANL biologists conducted noise measurements at the Los Alamos County Airport and in Bayo and Pueblo canyons, including the Los Alamos County Sewage Treatment Facility. Sound levels near the airport runway during the maximum use time (6:30 to 7:30 a.m.) had background values averaging 54 dB(A). Noise during plane arrivals ranged from 47 to 63 dB(A). No measurements were collected during plane take-off. Sound measurements conducted in the bottoms of Pueblo and Bayo canyons ranged from 37 to 40 dB(A) in most areas of the canyon. At the sewage treatment facility parking lot during a working day, the average dB(A) during a 3-minute period was 46 (range 45 to 49). At the intersection of the road going into Pueblo Canyon with State Road 502, the average dB(A) during a 3-minute period was 60 (range 41 to 70).

LANL biologists conducted sound measurements at successive distances from an industrial area near a canyon rim, into the canyon, and to the opposite rim using a C-weighted decibel (dB(C)) scale (Keller and Foxx 1997). Measurements of noise levels using the dB(C) scale are greater than if measured using the dB(A) scale. The average background noise on the mesa was 65.8 dB(C) [with a range of 43 to 81 dB(C)]. The average background noise in the canyon bottom was 62.3 dB(C) [with a range of 54 to 78 dB(C)]. The average background noise at the bottom of the north-facing slope was 53.8 dB(C) [with a range of 48 to 64 dB(C)]. Measurements were taken mid-day.

LANL biologists measured sound levels from various pieces of construction equipment used at LANL project sites over 5-minute intervals at distances of 6 to 31 m (20 to 100 ft) (Knight and Vrooman 1999). Average values ranged from 58.5 to 80.9 dB(A). Peak values ranged from 75.7 to 155.4 dB(A). Additional data were collected by other LANL operators on specific pieces of construction equipment and on the Security Computer Complex construction site fence perimeter at Technical Area 3 before and during construction (Knight and Vrooman 1999). The average noise level before construction began was 56.6 dB(A), and the average during construction was 82.1 dB(A).

LANL biologists conducted a series of sound measurements at LANL to investigate background noise levels around AEIs (Vrooman et al. 2000). Background noise levels were significantly higher in daytime than in nighttime. AEIs with greater than a 10 percent developed area in their buffers had significantly higher levels of background noise than undeveloped AEIs. The mean background sound level was 51.3 dB(A) in developed AEIs and 39.6 dB(A) in undeveloped AEIs. The LANL biological resources project review process uses the individual AEI background measurements from Vrooman et al. (2000) to screen project activities for increases more than 6 dB(A) above background.

LANL biologists took sound-level measurements of heavy equipment use associated with concrete recycling on Sigma Mesa at LANL in 2004 (Hansen 2004). At this location, background noise levels at two different locations were 55.2 and 58.8 dB(A). Operation of a dump truck hauling and dumping concrete increased noise levels above background by a mean of 22.7 dB(A) at 30 m (98 ft) and 2.4 dB(A) at 80 m (262 ft). Additional sound-level measurements were taken in the same general area on Sigma Mesa in 2005 as part of a biological assessment for the operation of an asphalt batch plant (Hansen 2005). Measurements were taken on the north rim of Mortandad Canyon (south of the asphalt batch plant at distances of approximately 30 to 122 m (100 to 400 ft), at the bottom of Mortandad Canyon approximately 183 to 244 m (600 to 800 ft) from the asphalt batch plant, and on the south rim of Mortandad Canyon approximately 305 m (1,000 ft) from the asphalt batch plant. Background noise levels at the various locations ranged from 41.1 to 48.7 dB(A). The only locations with increases greater than 3 dB(A) during operation of the asphalt batch plant were the locations on the north rim of Mortandad Canyon, within 122 m (400 ft) of the asphalt batch plant. Noise from the operation of the asphalt batch plant was not detected in the bottom of Mortandad Canyon or on the south rim.

LANL biologists took sound-level measurements around the LANL TA-3, Building 1076 with the heating, ventilation, and air conditioning (HVAC) system on and with it off (Hansen 2009). The area to the north of the TA-3, Building 1076 is developed; the area to the south is not. Background noise levels north of the facility ranged from 53.6 to 57.6 dB(A). Background noise levels south of the facility ranged from 41.6 to 49.7 dB(A). Noise from the HVAC system was detected at 25 m (82 ft) from the facility on both sides but was not detected at 81 m (266 ft) on the north side or at 107 m (351 ft) on the south side.

In 2020, LANL biologists conducted noise-level assessments around TA-35 to support a biological assessment (LANL 2020). Noise levels were measured along core habitat for the Mexican Spotted Owl in the Sandia-Mortandad AEI in TA-35. The average across all locations and sampling time intervals in this study was 47.47 dB(A), which was 5.27 dB(A) lower than the Vrooman et al. (2000) average.

Overall, these studies appear to show that areas adjacent to or within developed areas or paved roads are likely to have daytime average background noise levels between 45 and 63 dB(A). Less-disturbed areas are likely to have average background noise levels between 37 and 50 dB(A).

Artificially Produced Light

No information is available on the effects of artificially produced light on Mexican Spotted Owls. Under the Los Alamos County Code, commercial site development plans are reviewed to ensure that lighting

serves the intended use of the site while minimizing adverse impacts to adjacent residential property (Section 16-276). Section 16-276 of the County Code includes light-source measurement limitations by zoning district. The code allows offsite light to be 0.5 foot-candles (fc) in residential areas. By comparison, full moonlight measures 0.1 fc, and a crescent moon was measured at 0.01 fc. Table A-2 in the appendix presents preliminary light measurements in foot-candles.

Preliminary surveys were conducted for light levels within Los Alamos Canyon at the Omega Reactor (Keller and Foxx 1997). The Omega Reactor was brightly lit for purposes of security; therefore, total light intensity was greater than the average street lighting. Measurements were conducted at a light pole in an open parking lot at the reactor as the source. Trees did not obscure the area. Using the relationship of light intensity reducing as a square of the distance, calculations using the field data indicated that at 30 m (98 ft) from the source, the light levels would be equivalent or nearly equivalent to full moonlight.

2.3 AEI General Description for Mexican Spotted Owl

An AEI consists of two areas: a core and a buffer. The core of the habitat is defined as suitable canyon habitat from rim to rim and 100 m (328 ft) out from the top of the canyon rim. The buffer area is 400 m (1,312 ft) wide, extending outward from the edge of the core area. Although adult Mexican Spotted Owls might be found within their home range anytime throughout the year, the primary threat from disturbance to the owls is during the breeding season when owl pairs are tied to their nest sites; therefore, management of disturbance in Mexican Spotted Owl AEIs is concentrated on the breeding season.

2.3.1 Method for Identifying a Mexican Spotted Owl AEI

The original location of each Mexican Spotted Owl AEI was identified using a habitat model developed by Johnson (1998) that classified nesting and roosting habitat for Mexican Spotted Owls using topographic characteristics and vegetative diversity. LANL biologists compared the results from the Johnson (1998) model with a different model that identified slopes >40 percent in mixed conifer and ponderosa pine cover types at LANL. Areas identified from the Johnson (1998) model application to LANL that were greater than five contiguous 30 × 30 m (98 × 98 ft) pixels in size, were above 1,980 m (6,496 ft) in elevation, and that had mixed conifer or ponderosa pine forest cover were considered suitable Mexican Spotted Owl habitat. Where suitable habitat was identified, AEI core area boundaries were established to include the canyons and 100 m (328 ft) outward from the canyon rims.

Following the Cerro Grande wildfire, an updated Mexican Spotted Owl habitat model was developed and refined for application on LANL property (Hathcock and Haarmann 2008). This model incorporated finer-scale vegetation characteristics into the Mexican Spotted Owl habitat quality assessment and was used to redelineate the boundaries of the Mexican Spotted Owl AEIs at LANL in 2005 following wildfire, drought, and a regional bark beetle outbreak (USFWS consultation number 22420-2006-I-0010).

The new core boundaries were delineated with an area approximately 0.4 km (0.25 mi) from the edge of the nearest suitable habitat, up and down canyon. Core boundaries were established along readily recognizable geologic features or anthropogenic features in the terrain wherever possible to facilitate the ease of identification of core boundaries when in the field.

2.3.2 Location and Number of Mexican Spotted Owl AEIs

There are currently five Mexican Spotted Owl AEIs on LANL property, each encompassing one or more canyons. In general, the AEI cores are centered in canyons on the western side of LANL. The canyons with AEIs are Cañon de Valle, Water, Pajarito, Los Alamos, Sandia, Mortandad, and Three-mile.

2.4 AEI Management

2.4.1 Overview

This AEI management section provides guidelines for LANL operations to reduce or eliminate the threats to Mexican Spotted Owls from (1) habitat alterations that reduce habitat quality and (2) disturbance of breeding or potentially breeding owls. Habitat alterations are considered for all AEIs and for both core and buffer areas. Disturbance activities to owls are considered only for occupied AEIs and only for impacts on core areas. Developed areas (see Section 1.3.1) that have ongoing baseline levels of activities and are not suitable habitat for Mexican Spotted Owls have different restrictions than undeveloped core or buffer areas; therefore, the location of the disturbance activity within the AEI, the occupancy status of the AEI, and the type of activity all affect whether the activity is allowable. AEIs for different species may overlap, and an activity must meet the guidelines of all applicable site plans to be allowable.

2.4.2 Definition and Role of Occupancy in AEI Management

Occupancy simply refers to whether an AEI is occupied during a species' period of sensitivity. For Mexican Spotted Owls, the primary concern is to protect the owls from disturbance during the breeding season. Because individuals can colonize suitable habitat, all Mexican Spotted Owl AEIs are treated as though they are occupied from March 1 through August 31 or until surveys show an AEI to be unoccupied. Mexican Spotted Owl surveys are conducted from late March through June. In general, surveys in areas with ongoing or proposed projects are completed by May 15. If a nest is located during surveys, then the AEI can be treated as unoccupied except for the area within a 400 m (1,312 ft) radius of the nest site. Because owls are not as sensitive to disturbance during the non-breeding season, Mexican Spotted Owl AEIs are treated as unoccupied from September 1 to February 28.

The occupancy status of an AEI affects what activities are allowable in the AEI. Although activities that cause habitat alterations are restricted in all AEIs, disturbance activities are restricted only in occupied AEIs. The Activity Table (Table 2-1, Section 2.4.5.2) provides dates and levels of allowable disturbance activities within occupied Mexican Spotted Owl AEIs under the guidelines of this site plan. Contact a LANL biologist to find out the current occupancy status of an AEI (<https://int.lanl.gov/environment/bio/index.shtml>).

2.4.3 Introduction to AEI Management Guidelines

Sections 2.4.4 and 2.4.5 provide the guidelines for habitat alterations and allowable activities in AEI core and buffer areas. Section 2.4.4 describes what and where habitat alterations are allowed under the guidelines of this site plan. Section 2.4.5 describes what, when, and where disturbance activities are allowed in occupied AEIs under the guidelines of this site plan. If an activity does not meet the restrictions given in the guidelines, the activity must be individually reviewed for ESA compliance. This site plan provides only guidelines for Mexican Spotted Owl AEIs. If an activity is desired in an area with overlapping AEIs, all applicable site plans must be consulted. AEI maps show the location of all AEIs in an area. Section 2.4.6 describes management practices that should be applied when working or considering work in an AEI. LANL biologists are available to answer questions and provide advice (<https://int.lanl.gov/environment/bio/index.shtml>).

2.4.4 Definition of and Restrictions on Habitat Alterations

2.4.4.1 Definition of Habitat Alterations

Habitat alteration includes any action that alters the soil structure, vegetative components necessary to the species, prey quality and quantity, water quality, hydrology, or noise or light levels in undeveloped areas of an AEI. Long term means the alteration lasts for more than 1 year. For physical disturbances, in general, any activity that can be accomplished by one person with a hand tool generally is not considered habitat alteration; any activity that requires mechanized equipment on a landscape is habitat alteration. An actual activity may take place outside of the AEI and will be considered habitat alteration if consequences of the activity have effects inside the AEI core.

The habitat components most important to Mexican Spotted Owls include vegetative structure, food quality and quantity, and disturbance levels, including noise and light. The forest structure within a canyon designated as a Mexican Spotted Owl AEI is important because it provides roost sites and suitable habitat for nesting and foraging. Trees along the canyon rim are used for foraging and territorial calling, and they shelter the canyon interior from light and noise disturbances.

A long-term change in light or noise levels within the undeveloped core of an AEI is considered to be a habitat alteration if it increases average noise levels by >6 dB(A) during any portion of the 24-hour day or if it increases average light levels by >0.05 fc at night. Changes in noise and light levels are measured at the core area boundary if the source is outside the core area or at 10 m (33 ft) from the source if the source is inside the undeveloped core area. Impacts of changes in developed areas on undeveloped cores are measured at the developed area boundary if it is within the core or at the core area boundary if the developed area is outside of the core.

2.4.4.2 Fuels Management Practices to Reduce Wildfire Risk

The recovery plan for the Mexican Spotted Owl lists stand-replacing wildfires as a primary threat to their habitat and encourages land managers to reduce fuel levels and abate fire risks in ways compatible with owl presence on the landscape (USFWS 1995). Within undeveloped core areas, on slopes >40 percent, in the bottoms of steep canyons, and within 30 m (100 ft) of a canyon rim, thinning of trees <22 centimeters (cm; 9 inches [in.]) diameter at breast height, treatment of fuels, and prescribed and natural prescribed fires are allowed. Exceptions that allow trees >22 cm (9 in.) to be thinned within 30 m (100 ft) of buildings are granted to protect facilities. Large logs (>30 cm [11.8 in.] midpoint diameter) and snags should be retained. Thinning within core areas that do not meet the characteristics listed above and in buffer areas may include trees of any size to achieve 8 m (25 ft) spacing between tree crowns; however, clear cutting is not allowed in undeveloped core areas.

For health and safety reasons, any trees within 30 m (100 ft) of buildings but outside a developed area may be thinned to achieve 8 m (25 ft) spacing between crowns. Habitat alterations, including thinning, are not restricted in developed areas; however, LANL biologists encourage the retention of trees and snags along canyon rims if the rim is in a developed area. Because of the extreme fire danger associated with firing sites and the potential impact of a fire on Mexican Spotted Owl habitat, firing sites and burn areas are treated separately for the purposes of fuels management. Trees within 380 m (1,246 ft) of firing sites and burn areas in both core and buffer areas may be thinned to a 15-m (49-ft) spacing between trees everywhere except on slopes >40 percent or in the bottoms of steep canyons. Any tree in excess of 22 cm (9 in.) diameter at breast height within 380 m (1,246 ft) of a firing site may be delimited to a height of 2 m (6 ft) to help prevent crown fires.

In historically occupied core areas, fuels treatment may not exceed 10 percent of the undeveloped core area and is not allowed within 400 m (1,312 ft) of nesting areas. In occupied core areas, forest management activities must take place during the nonbreeding season (September 1 to February 28) (USFWS 1995).

2.4.4.3 Utility Corridors

Habitat alterations, such as cutting down trees that threaten power lines, are allowed within 8 m (26 ft) of either side of an existing utility line in all areas of an AEI (LANL 2020). New utility lines and utility lines that require clearance of a right-of-way greater than 16 m (52 ft) total must be individually reviewed for ESA compliance. Disturbance activities must follow the guidelines given in the Activities Table (Table 2-1, Section 2.4.5.2) for occupied AEIs.

2.4.4.4 Restrictions on Habitat Alterations

Habitat alterations other than the fuels management practices and utility corridor maintenance described above are not allowed in undeveloped core areas under the guidelines of this site plan. If a project or activity is planned that would alter habitat in an undeveloped core area, it must be individually evaluated for ESA compliance. Habitat alterations in undeveloped buffer areas other than the fuels management activities and utility corridor maintenance described above are restricted to 2 ha (5 ac) in area per project and are subject to other restrictions, including light and noise effects in the core (see Section 2.2.2.3). Projects in the buffer area larger than 2 ha (5 ac) in size will require individual ESA compliance review. A cumulative maximum area may be developed in each AEI's buffer. Once that cumulative area is reached, all habitat alterations in a buffer will require individual ESA reviews for compliance.

2.4.5 Definition of and Restrictions on Disturbance Activities

2.4.5.1 Definitions of Disturbance Activities

LANL biologists considered six categories of activities that might cause disturbance in an AEI. Most of the categories were first identified in the document "Peregrine Falcon Habitat Management in the National Forests of New Mexico," prepared for the United States Forest Service (Johnson 1994). LANL biologists added explosives detonation, other light production, and other noise production to provide the most comprehensive list of activities possible, thereby reducing the need for individual review of activities for ESA compliance. The categories of activities are people, vehicles, aircraft, other light production, other noise production, and explosives detonation. LANL biologists defined low, medium, and high levels of impact for these activities except for explosives detonation. Activity levels for explosives detonation have been designed to follow the guidelines agreed upon by LANL, DOE, and USFWS in the DARHT biological assessment (Keller and Risberg 1995). Restrictions on explosives detonation are described in the definition of the activity but are not included in the Activity Table (Table 2-1, Section 2.4.5.2). These six categories of activities are restricted only in AEIs that are classified as occupied.

People—includes any entry of people into an AEI on foot

- Low impact is the presence of three or fewer people per project and duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of people or the duration criteria.
- High impact is the exceedance of both the number of people and the duration criteria.

Vehicles—includes the entry of any two-axle highway vehicle, all-terrain vehicle, or motorized machinery into an AEI by any route other than a paved road or an improved gravel road

- Low impact is the presence of two or fewer vehicles per project and duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of vehicles or the duration criteria.
- High impact is the exceedance of both the number of vehicles and the duration criteria.

Aircraft—includes the operation of any aircraft below an elevation of 600 m (2,000 ft) above the highest ground level in the local vicinity

- Low impact is the presence of one single-engine airplane and the duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of aircraft or the duration criteria.
- High impact is the exceedance of both the number of aircraft and the duration criteria.

Any use of helicopters, jet airplanes, and propeller airplanes with two or more engines is classified as medium impact or above, depending on duration.

Other Light Production—includes any activity not previously listed that causes additional light to occur in an AEI core area. For example, plans for construction of a new building at the edge of a developed area may call for lighting at night to facilitate nighttime work that impacts an undeveloped core area.

- Low impact is the increase of light intensity by ≤ 0.05 fc and a duration of 1 night or less per project per breeding season.
- Medium impact is the exceedance of either the intensity or duration criteria.
- High impact is the exceedance of both the intensity and duration criteria.

Measurements for increases in light are taken at the AEI core area boundary closest to the light source if the source is outside the core and at 10 m (33 ft) from the source if the source is inside the core. Light measurements for developed areas are taken at the edge of the developed area if the developed area is within an AEI core or at the closest core boundary if the developed area is outside of an AEI core.

Other Noise Production—includes any activity not previously listed except for explosives detonation that causes additional noise to occur in an AEI. For example, operation of machinery creates noise.

- Low impact is increasing noise levels in an AEI core by 6 dB(A) or less for 1 day or less per project per breeding season.
- Medium impact is the exceedance of either the level or the duration criteria.
- High impact is the exceedance of both the level and the duration criteria.

Measurements for increases in noise are taken at the AEI core boundary closest to the noise source if the source is outside the core and at 10 m (33 ft) from the source if the source is inside the core. Noise measurements for developed areas are taken at the edge of the developed area if the developed area is within an AEI core or at the closest core boundary if the developed area is outside of an AEI core.

Explosives Detonation—includes the use of high explosives for any purpose. LANL biologists did not define low, medium, and high levels of this activity because of the difficulty of determining levels for a shot before actually doing the shot. For the purpose of explosives detonation near Mexican Spotted Owl AEIs, occupied habitat is defined as the area within 400 m (1,312 ft) of the current year's nest/roost sites

or the previous year's nest site if a current site has not been identified. No explosives detonation will take place within 400 m (1,312 ft) of nest/roost sites in occupied habitat between March 1 and August 31. Explosives detonation at night at sites within 400 to 800 m (1,312 to 2,624 ft) of a nest site in occupied habitat is restricted to once per month from March 1 and August 31. No restrictions exist on daytime explosives testing between 400 and 800 m (1,312 to 2,624 ft), and no restrictions exist between September 1 and February 28 or in unoccupied habitat. Explosives detonation adjacent to AEIs that have not previously been recorded by LANL biologists as occupied will have no restrictions unless surveys detect Mexican Spotted Owls. Explosives tests not allowed under the guidelines of this site plan must be individually reviewed for ESA compliance.

2.4.5.2 Activity Table

The dates shown in the Activity Table (Table 2-1) are the dates between which the activity in the row is restricted under the guidelines of this site plan. All AEIs are considered occupied from March 1 to August 31 or until surveys show an AEI to be unoccupied. If owls are detected, AEIs are considered occupied until August 31 within 400 m (1,312 ft) of the nest site. Consult with LANL biologists to find out occupancy status of AEIs and what locations are within 400 m (1,312 ft) of nest sites (<https://int.lanl.gov/environment/bio/index.shtml>).

Table 2-1. Restrictions on Activities in Undeveloped Occupied Mexican Spotted Owl AEIs

Levels of Impact	Core	Buffer
People		
Low	No Restrictions*	No Restrictions
Medium	March 1 to August 31	No Restrictions
High	March 1 to August 31	No Restrictions
Vehicles		
Low	No Restrictions	No Restrictions
Medium	March 1 to August 31	No Restrictions
High	March 1 to August 31	No Restrictions
Aircraft		
Low	March 1 to August 31	No Restrictions
Medium	March 1 to August 31	March 1 to May 15
High	March 1 to August 31	March 1 to August 31
Other Light Production		
Low	March 1 to August 31	No Restrictions**
Medium	March 1 to August 31	No Restrictions**
High	March 1 to August 31	No Restrictions**
Other Noise Production		
Low	March 1 to August 31	No Restrictions**
Medium	March 1 to August 31	No Restrictions**
High	March 1 to August 31	No Restrictions**
Explosives Detonation (see text in Section 2.4.5.1)		

* Entry is restricted in core areas that are occupied within 400 m (1,312 ft) of the nest site from March 1 to August 31. If the current nest has not been located, entry is restricted within 400 m (1,312 ft) of the previous year's nest site.

** Noise or light production in the buffer is restricted if the activity would violate core area restrictions on noise or light.

2.4.6 Protective Measures

This section provides a list of management practices to apply in Mexican Spotted Owl AEIs.

- Timing of projects must take into account that projects in core areas or projects that violate restrictions for occupied buffer areas must stop on February 28 of each year until occupancy status of the AEI is determined.
- Make every reasonable effort to reduce the noise from explosives testing within 800 m (2,624 ft) of occupied habitat. Methods to reduce noise could include contained shots, noise shields in the direction of AEI cores, etc. For night shots, every reasonable effort should be made to limit the amount of light directed into AEI core areas.
- Install signs on dirt roads and trails that lead into AEIs, posting them as restricted access areas and providing a contact number for access restrictions.
- Keep disturbance and noise to a minimum.
- Avoid unnecessary disturbance to vegetation (e.g., excessive parking areas or equipment storage areas, off-road travel, materials storage areas, crossing of streams or washes).
- Avoid removal of vegetation along drainage systems and stream channels.
- Avoid all vegetation removals not absolutely necessary.
- Employ appropriate erosion and runoff controls to reduce soil loss. The controls must be put in place and periodically checked throughout the life of projects.
- Revegetate all exposed soils as soon as feasible after construction to minimize erosion.
- Focus development away from undeveloped areas on the western end of the Los Alamos Canyon AEI.

2.5 Allowable Habitat Alteration in the Buffer Areas

The following quantifications of development and guidance for allowable habitat alteration in buffer areas were published and consulted on in the 1999 version of the HMP. Most AEIs changed in dimensions during the 2005 redelineation of the habitats, and many have experienced additional development under past consultations. Many projects were reviewed and received USFWS concurrence between 1999 and 2017.

The current development status for each of the AEIs is at the end of each AEI description. This section was updated in the 2022 revision. The original framework for the HMP included allowable levels of future development in buffer habitat for each AEI. The AEI boundaries have changed over time, so the percent of allowable development was used to compare 1999 values to 2022 levels.

Cañon de Valle

In 1999, 16.3 ha (40.3 ac) of the core was developed, and 52.2 ha (129 ac) of the buffer was developed. For this AEI, it was recommended that only an additional 25.30 ha (62.5 ac) of the AEI buffer be developed, which is 9.7 percent. The 1999 HMP stated that once this cap is reached or a large-scale project is proposed, additional consultation with USFWS would be required. By 2011, 28 ha (69.2 ac) of the core and 84 ha (207.5 ac) of the buffer was developed, with most of the changes due to consultations. The 2017 redelineation of the lower Water Canyon AEI resulted in another reduction of 69 ha (170 ac). The current size of this AEI is 277 ha (685 ac) of core and 524 ha (1,295 ac) of buffer habitat. Of that, 18.6 ha (46 ac) of the current core is developed, and 80.5 ha (199 ac) of the current buffer is developed.

As of this 2022 HMP revision, 15.47 percent of the buffer is developed. Any future development in buffer would require a consultation.

Pajarito

In 1999, 6.7 ha (16.5 ac) of the core was developed, and 75.1 ha (186.5 ac) of the buffer was developed. For this AEI, it was recommended that only an additional 35 ha (86.4 ac) of the buffer be developed, which is 21.8 percent. The 1999 HMP stated that once the cap is reached or a single large-scale project is proposed, additional consultation with the USFWS would be required. By 2011, 27 ha (66.7 ac) of the core and 89 ha (220 ac) of the buffer was developed, with most of the changes due to consultations. The current size of this AEI is 236 ha (585 ac) of core and 449 ha (1,111 ac) of buffer habitat. Of that, 29.5 ha (73 ac) of the current core is developed, and 101.5 ha (251 ac) of the current buffer is developed. As of this 2022 HMP revision, 22.6 percent of the buffer is developed. Any future development in buffer would require a consultation.

Los Alamos

In 1999, 77.16 ha (190 ac) of the core was developed, and 167.2 ha (413.1 ac) of the buffer was developed, which is 9.97 percent. Because this AEI is heavily developed, additional development was restricted to a few selected areas within the buffer. By 2011, 94 ha (232.2 ac) of the core and 181 ha (447.3 ac) of the buffer was developed, with most of the changes due to consultations. The current size of this AEI is 325 ha (805 ac) of core and 535 ha (1,323 ac) of buffer habitat. Of that, 125.4 ha (310 ac) of the current core is developed, and 347.2 ha (858 ac) of the current buffer is developed. These increases are largely due to large tracts of land that were transferred to Los Alamos County through the Land Conveyance and Transfer project (USFWS consultation number 2-22-01-F-634). As of this 2022 HMP revision, 64.8 percent of the buffer is developed. Any future development in buffer would require a consultation.

Sandia-Mortandad

In 1999, 29 ha (71.7 ac) of the core was developed, and 75.1 ha (185.6 ac) of the buffer was developed. For this AEI, it was recommended that only an additional 38.1 ha (94.1 ac) of the buffer be developed, which is 20.2 percent, before additional USFWS consultations take place. By 2011, 45 ha (111.2 ac) of the core and 83 ha (205.1 ac) of the buffer was developed, with most of the changes due to consultations. The current size of this AEI is 270 ha (669 ac) of core and 371 ha (918 ac) of buffer habitat. Of that, 48.5 ha (120 ac) of the current core is developed, and 101.2 ha (250 ac) of the current buffer is developed. As of this 2022 HMP revision, 27.2 percent of the buffer is developed. Any future development in buffer would require a consultation.

Three-mile

In 1999, 3.8 ha (9.4 ac) of the core was developed, and 21.5 ha (51.1 ac) of the buffer was developed. For this AEI, it was recommended that only 64.3 ha (158.8 ac) additional area of buffer be developed, which is 24.9 percent, before additional USFWS consultations take place. By 2011, 12 ha (29.6 ac) of the core and 37 ha (91.4 ac) of the buffer was developed, with most of the changes due to consultations. The current size of this AEI is 131 ha (325 ac) of core and 295 ha (730 ac) of buffer habitat. Of that, 7.2 ha (18 ac) of the current core is developed, and 32.3 ha (80 ac) of the current buffer is developed. As of this 2022 HMP revision, 10.9 percent of the buffer is developed. Additionally, this AEI has been occupied since 2007.



3.0 AREA OF ENVIRONMENTAL INTEREST SITE PLAN FOR THE SOUTHWESTERN WILLOW FLYCATCHER

3.1 Species Description—Southwestern Willow Flycatcher

3.1.1 Status

In 1995, the USFWS designated the Southwestern Willow Flycatcher as a federally endangered species (60 FR 10693). The USFWS most recently designated critical habitat for the Southwestern Willow Flycatcher in 2013 (78 FR 343). The most recent recovery plan for the Southwestern Willow Flycatcher was published in 2002 (USFWS 2002).

3.1.2 General Biology

The Southwestern Willow Flycatcher is one of four subspecies of the Willow Flycatcher. The historic range of the Southwestern Willow Flycatcher included Arizona, California, Colorado, New Mexico, Texas, Utah, and Mexico. Currently, this flycatcher breeds in riparian habitats from southern California to Arizona and New Mexico, plus southern Colorado, Utah, Nevada, and far western Texas. In winter, it is found in southern Mexico, Central America, and northern South America (USFWS 2002).

Southwestern Willow Flycatchers are present in New Mexico from early May through mid-September and breed from late May through late July (Finch and Kelly 1999; USFWS 2002; Yong and Finch 1997). The flycatcher's nesting cycle is approximately 28 days. Three or four eggs are laid at 1-day intervals, and incubation begins when the clutch is complete. The female incubates eggs for approximately 12 days, and the young fledge about 13 days after hatching. Southwestern Willow Flycatchers typically raise one brood per year (USFWS 2002). Because arrival dates vary, northbound migrant Willow Flycatchers (of all subspecies) pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants (of all subspecies) in late July and August might occur where Southwestern Willow Flycatchers are still breeding; therefore, it is only during a short period of the breeding season (approximately June 15 through July 20) that a Willow Flycatcher seen within Southwestern Willow Flycatcher range is probably of that subspecies (USFWS 2002).

The Southwestern Willow Flycatcher nests only along rivers, streams, and other wetlands. It is found in close association with dense stands of willows (*Salix spp.*), arrowweed (*Pluchea spp.*), buttonbush (*Cephalanthus spp.*), tamarisk (*Tamarix spp.*), Russian olive (*Eleagnus angustifolia L.*), and other riparian vegetation, often with a scattered overstory of cottonwood (*Populus spp.*) (USFWS 2002). The size of vegetation patches or habitat mosaics used by Southwestern Willow Flycatchers varies considerably and ranges from as small as 0.8 ha (1.9 ac) to several hundred hectares (Hatten and Paradzick 2003). The Southwestern Willow Flycatcher nests in thickets of trees and shrubs approximately 2 to 15 m (6 to 49 ft) tall, with a high percentage of canopy cover and dense foliage from 0 to 4 m (0 to 13 ft) above ground. Regardless of the plant species composition or height, occupied sites always have dense vegetation in the patch interior (Allison et al. 2003; USFWS 2002).

The Southwestern Willow Flycatcher is an insectivore. It forages within and occasionally above dense riparian vegetation, taking insects on the wing and gleaning them from foliage. The flycatcher's prey includes flies, bees, wasps, ants, beetles, moths, butterflies, grasshoppers, crickets, dragonflies, damselflies, and spiders (Durst et al. 2008; Wiesenborn and Heydon 2007).

3.1.3 Threats

The current population of Southwestern Willow Flycatchers in the United States occupies an estimated 1,214 territories (Durst et al. 2006). The distribution of breeding groups is highly fragmented, with groups often separated by considerable distances. This subspecies has suffered declines attributed to extensive loss of its cottonwood-willow habitat and to poor productivity resulting from brood parasitism by Brown-headed Cowbirds (*Molothrus ater*) (USFWS 2002).

3.2 Impact of Human Activities

3.2.1 Introduction

The primary threats to the Southwestern Willow Flycatcher on LANL property are (1) impacts on habitat quality from LANL operations and (2) disturbance of nesting flycatchers. This section includes a review and summary of the known effects of various types of human activities to the Southwestern Willow Flycatcher and an overview of the current levels of activities at LANL within species habitat.

3.2.2 Impacts on Habitat Quality

3.2.2.1 Development

Throughout the Southwest, riparian habitats are rare and tend to be small and separated by vast expanses of arid lands. The Southwestern Willow Flycatcher has experienced extensive habitat loss and modification resulting from urban and agricultural development, water diversion and impoundment, channelization of waterways, livestock grazing, off-road vehicle and other recreational uses, and hydrological changes that result from these and other land uses (USFWS 2002). River and stream impoundments, groundwater pumping, and overuse of riparian areas have altered as much as 90 percent of the Southwestern Willow Flycatcher's habitat (USFWS 2002). Loss of cottonwood-willow riparian forests has had widespread impact on the distribution and abundance of bird species associated with that forest. Development may be tolerated if the habitat is left intact.

Because watercourses at LANL tend to be intermittent to ephemeral, riparian habitat is uncommon. Extensive degradation of the riparian zone has occurred along the Rio Grande, caused by feral-cattle grazing and flood-control operations at Cochiti Lake. Other riparian/wetland areas on LANL property are associated with canyon bottoms, the most significant being the Pajarito wetlands in the lower end of Pajarito Canyon. A major paved road parallels the wetlands area in Pajarito Canyon.

3.2.2.2 Ecological Risk

There is no specific information on the impact of chemicals on the Southwestern Willow Flycatcher.

Ecorisk Assessment

LANL subject matter experts completed two ecological risk assessments between 1997 and 2009 that included the Southwestern Willow Flycatcher. The ecological risk assessment process involves using computer modeling to assess potential effects to animals from chemicals of potential concern that have been detected in the environment. The ecological risk assessments concluded that, in general, there is a small potential for effects to Southwestern Willow Flycatcher from chemicals of potential concern (Gonzales et al. 1998; Gonzales et al. 2009).

An ecotoxicological risk assessment for the Southwestern Willow Flycatcher, centered on the Pajarito wetlands, found that between 7 and 16 percent of 100 hypothetical nest sites examined had hazard indices

>1.0 and <10.0, depending on the foraging scenario (Gonzales et al. 1998). This result indicates a small potential for impacts from chemicals. The primary chemicals that drove the risk scenario were pentachlorophenol, aluminum, radium-226, calcium, and thorium-228. Aluminum, radium, and thorium are naturally occurring substances in northern New Mexico.

3.2.2.3 Disturbance

Pedestrians and Vehicles

No specific information is available on the reactions of Southwestern Willow Flycatchers to pedestrians and vehicles. The recovery plan for the Southwestern Willow Flycatcher recommends providing protected areas, reducing unpredictable activities, providing visual barriers, and reducing noise disturbance (USFWS 2002).

Aircraft

No specific information is available on the reaction of Southwestern Willow Flycatchers to aircraft.

LANL lies within restricted airspace, and planes infrequently fly less than 609 m (2,000 ft) above ground level. The County of Los Alamos operates an airport along the northern edge of LANL. The airport is located on the southern rim of Pueblo Canyon. Most flights approach and depart to the east of the airport, over the Rio Grande.

Explosives

No specific information is available on the reaction of Southwestern Willow Flycatchers to explosives detonation. The Southwestern Willow Flycatcher AEI is not located close to any explosives-testing sites at LANL.

Other Sources of Noise

LANL biologists do not have good information on the effects of noise, including machinery operation, on Southwestern Willow Flycatchers; however, Southwestern Willow Flycatchers are probably not as sensitive to disturbance as some other threatened or endangered species (USFWS 2002). For a description of noise levels at LANL, see Section 2.2.2.3.

Artificially Produced Light

No information is available on the effects of artificially produced light on Southwestern Willow Flycatchers. Under the Los Alamos County Code, commercial site development plans are reviewed to ensure that lighting serves the intended use of the site while minimizing adverse impacts to adjacent residential property (Section 16-276). Section 16-276 of the County Code includes light-source measurement limitations by zoning district. The code allows offsite light to be 0.5 fc in residential areas. By comparison, full moonlight measures 0.1 fc, and a crescent moon was measured at 0.01 fc.

3.3 AEI General Description for the Southwestern Willow Flycatcher

The AEI consists of two types of areas: core and buffer. Core areas represent wetland areas with suitable vegetation for nesting, primarily dense willows. The buffer area is the area within 100 m (328 ft) of core areas. The Southwestern Willow Flycatcher AEI on LANL property consists of two separate core areas. For purposes of this site plan, both core areas and associated buffers are considered one AEI unit.

3.3.1 Method for Identifying the Southwestern Willow Flycatcher AEI

The core areas were defined by the presence of riparian habitat and suitable wetland vegetation. These areas were identified in 1994 during a survey of wetlands at LANL and mapped using a global positioning system receiver. Wetlands without stands of dense willows at least 2 m (7 ft) tall and 30 m (98 ft) wide were not included in the AEI. The buffer area is the area within 100 m (328 ft) of the core areas.

3.3.2 Location of the Southwestern Willow Flycatcher AEI

There is one Southwestern Willow Flycatcher AEI on LANL property. It is composed of two core areas with associated buffers. The AEI core areas are located in the bottom of Pajarito Canyon, on the eastern side of LANL adjacent to Pajarito Road and State Road 4.

3.4 AEI Management

3.4.1 Overview

This AEI management section provides guidelines for LANL operations to reduce or eliminate the threats to the Southwestern Willow Flycatcher from (1) habitat alterations that reduce habitat quality and (2) disturbance of breeding or potentially breeding flycatchers. Habitat alterations are considered for all AEIs and for both core and buffer areas. Disturbance activities to flycatchers are considered only for occupied AEIs and only for impacts on core areas. Developed areas (see Section 1.3.1) that have ongoing baseline levels of activities and are not suitable habitat for Southwestern Willow Flycatchers have different restrictions than undeveloped core or buffer areas; therefore, the location of the disturbance activity within the AEI, the occupancy status of the AEI, and the type of activity all affect whether the activity is allowable. AEIs for different species may overlap, and an activity must meet the guidelines of all applicable site plans to be allowable. Protective measures are described as management practices that should be followed when working in AEIs.

3.4.2 Definition and Role of Occupancy in AEI Management

Occupancy simply refers to whether an AEI is occupied during a species' period of sensitivity. For Southwestern Willow Flycatchers, LANL biologists are primarily concerned with protecting the birds from disturbance during the breeding season. Because individuals can colonize suitable habitat, the Southwestern Willow Flycatcher AEI is treated as though it is occupied from May 15 through September 15 or until surveys show an AEI to be unoccupied. Southwestern Willow Flycatcher surveys are conducted during May, June, and July. Because Southwestern Willow Flycatchers migrate south for the winter, the AEI is treated as unoccupied from September 16 to May 14.

The occupancy status of an AEI affects what activities are allowable in the AEI. Although activities that cause habitat alterations are always restricted, disturbance activities are restricted only in occupied AEIs. The Activity Table (Table 2-1, Section 2.4.5.2) provides dates and levels of disturbance activities allowable in the occupied Southwestern Willow Flycatcher AEI under the guidelines of this site plan. The dates in Table 2-1 indicate the period during which the activity is restricted. Contact a LANL biologist to find out the current occupancy status of an AEI (<https://int.lanl.gov/environment/bio/index.shtml>).

3.4.3 Introduction to AEI Management Guidelines

Sections 2.4.4 and 2.4.5 provide the guidelines for habitat alterations and allowable activities in AEI core and buffer areas. The flowchart (see Figure 1-1) provides a quick reference that should be used to

determine if a project or activity will affect an AEI and what sections of the site plan need to be consulted. The section on habitat alterations (Section 2.4.4) describes what and where habitat alterations are allowed under the guidelines of this site plan. Section 2.4.5 and Table 2-1 describe what, when, and where disturbance activities are allowed in occupied AEIs under the guidelines of this site plan. If an activity does not meet the restrictions given in the guidelines, the activity must be individually reviewed for ESA compliance. This site plan provides only guidelines for the Southwestern Willow Flycatcher AEI. If an activity is desired in an area that has overlapping AEIs, all applicable site plans must be consulted. Section 2.4.6 describes management practices that should be applied when working or considering work in an AEI. LANL biologists are available to help interpret site plans and answer questions (<https://int.lanl.gov/environment/bio/index.shtml>).

3.4.4 Definition of and Restrictions on Habitat Alterations

3.4.4.1 Definition of Habitat Alterations

Habitat alteration includes any action that, over the long term, alters the soil structure, vegetative components necessary to the species, prey quality and quantity, water quality, hydrology, or noise or light levels in undeveloped areas of an AEI. Long term means that the alteration lasts for more than 1 year. Habitat alteration includes any activity that removes vegetative components important to the Southwestern Willow Flycatcher (primarily trees and shrubs). An actual activity may take place outside of the AEI and will be considered habitat alteration if consequences of the activity have effects inside the AEI core.

The habitat components most important to flycatchers include vegetative structure, food quality and quantity, and disturbance levels, including noise and light. The thickets of certain trees and shrubs along wetlands are important because they provide roost sites and a suitable habitat for nesting and foraging.

3.4.4.2 Fuels Management Practices to Reduce Wildfire Risk

Thinning within undeveloped buffer areas may include trees of any size to achieve 7.6 m (25 ft) spacing between tree crowns; however, clear cutting is not allowed in undeveloped buffer areas. No fuels management practices are allowed in core areas. Habitat alterations, including thinning, are not restricted in developed areas.

3.4.4.3 Utility Corridors

Habitat alterations, such as cutting down trees that threaten power lines, are allowed within 8 m (26 ft) of either side of an existing utility line in all areas of an AEI (LANL 2020). New utility lines and utility lines that require clearance of a right-of-way greater than 16 m (52 ft) total must be individually reviewed for ESA compliance. Disturbance activities must follow the guidelines given in the Activities Table (Table 2-1, Section 2.4.5.2) for occupied AEIs.

3.4.4.4 Restrictions on Habitat Alterations

Habitat alterations other than the utility corridor maintenance described above are not allowed in undeveloped core areas under the guidelines of this site plan. Habitat alteration in buffers is limited. If a project or activity is planned that would alter habitat in an undeveloped core area, it must be individually evaluated for ESA compliance.

3.4.5 *Definition of and Restrictions on Disturbance Activities*

3.4.5.1 Definition of Disturbance Activities

LANL biologists considered five categories of activities that might cause disturbance in an AEI. Most of the categories were first identified in the document “Peregrine Falcon Habitat Management in the National Forests of New Mexico,” prepared for the United States Forest Service (Johnson 1994). Other light production and other noise production were included to provide the most comprehensive list of activities possible, reducing the need for individual review of activities for ESA compliance. The categories of activities are people, vehicles, aircraft, other light production, and other noise production. The impact of explosives detonation on this species is not considered here because no explosives-testing sites are located within 2 km (1.25 mi) of potential nesting habitat. Low, medium, and high levels of impact for these activities are considered here. The following categories of activities are restricted only in AEIs that are classified as occupied.

People—includes any entry of people into an AEI on foot

- Low impact is the presence of three or fewer people per project and duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of people or the duration criteria.
- High impact is the exceedance of both the number of people and the duration criteria.

Vehicles—includes the entry of any two-axle highway vehicle, all-terrain vehicle, or motorized machinery into an AEI by any route other than a paved road or an improved gravel road

- Low impact is the presence of two or fewer vehicles per project and duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of vehicles or the duration criteria.
- High impact is the exceedance of both the number of vehicles and the duration criteria.

Aircraft—includes the operation of any aircraft below an elevation of 600 m (2,000 ft) above the highest ground level in the local vicinity

- Low impact is the presence of one single-engine airplane and duration of 1 day or less during a breeding season.
- Medium impact is the exceedance of either the number of aircraft or the duration criteria.
- High impact is the exceedance of both the number of aircraft and the duration criteria.

Any use of helicopters, jet airplanes, and propeller airplanes with two or more engines is classified as medium impact or above, depending on duration.

Other Light Production—includes any activity not previously listed that causes additional light to occur in an AEI core area (e.g., plans for construction of a new building at the edge of a developed area may call for lighting at night to facilitate nighttime work that impacts an undeveloped core area).

- Low impact is the increase of light intensity by up to 0.05 fc and a duration of 1 night or less per project per breeding season.
- Medium impact is the exceedance of either the intensity or duration criteria.
- High impact is the exceedance of both the intensity and duration criteria.

Measurements for increases in light are taken at the AEI core area boundary closest to the light source if the source is outside the core and at 10 m (33 ft) from the source if the source is inside the core. Light measurements for developed areas are taken at the edge of the developed area if the developed area is within an AEI core or at the closest core boundary if the developed area is outside of an AEI core.

Other Noise Production—includes any activity not previously listed except for explosives detonation that causes additional noise to occur in an AEI. For example, operation of machinery causes noise.

- Low impact is increasing noise levels in an AEI core by 6 dB(A) or less for 1 day or less per project per breeding season.
- Medium impact is the exceedance of either the level or the duration criteria.
- High impact is the exceedance of both the level and the duration criteria.

Measurements for increases in noise are taken at the AEI core boundary closest to the noise source if the source is outside the core and at 10 m (33 ft) from the source if the source is inside the core. Noise measurements for developed areas are taken at the edge of the developed area if the developed area is within an AEI core or at the closest core boundary if the developed area is outside of an AEI core.

3.4.5.2 Activity Table

The dates shown in the Activity Table (Table 3-1) are the dates between which the activity in the row is restricted under the guidelines of this site plan. Disturbance activities are of concern only when Southwestern Willow Flycatchers occupy an AEI. The AEI is always considered occupied between May 15 and September 15 or until surveys show the AEI to be unoccupied. The Southwestern Willow Flycatcher AEI is always considered unoccupied between September 16 and May 14, when flycatchers have migrated for the winter. For occupancy status of an AEI after completion of surveys, contact a LANL biologist (<https://int.lanl.gov/environment/bio/index.shtml>).

Table 3-1. Restrictions on Activities in Undeveloped Occupied

Levels of Impact	Core	Buffer
People		
Low	No Restrictions	No Restrictions
Medium	May 15 to August 15	No Restrictions
High	May 15 to September 15	No Restrictions
Vehicles		
Low	May 15 to September 15	No Restrictions
Medium	May 15 to September 15	No Restrictions
High	May 15 to September 15	No Restrictions
Aircraft		
Low	No Restrictions	No Restrictions
Medium	May 15 to August 15	May 15 to August 15
High	May 15 to September 15	May 15 to August 15
Other Light/Noise Production		
Low	May 15 to September 15	No Restrictions*
Medium	May 15 to September 15	No Restrictions*
High	May 15 to September 15	No Restrictions*

Noise or light production in the buffer is restricted if the activity would violate core area restriction on noise or light.

3.4.6 Protective Measures

This section provides a list of management practices to apply in the AEI.

- No wetland vegetation will be removed outside of developed areas.
- Employ appropriate erosion and runoff controls to reduce soil loss.
- Avoid unnecessary disturbance to vegetation (e.g., excessive parking areas or equipment storage areas, off-road travel, materials storage areas, crossing of streams or washes).
- Avoid removal of vegetation along drainage systems and stream channels.
- Avoid all vegetation removals not absolutely necessary.
- Appropriate erosion controls must be put in place and periodically checked throughout the life of any projects.
- Revegetate all exposed soils as soon as feasible after disturbance to minimize erosion.

3.5 Southwestern Willow Flycatcher AEI Description

3.5.1 Pajarito Canyon Southwestern Willow Flycatcher AEI

Allowable Habitat Alteration in the Buffer Area

Because the purpose of the buffer area is to help maintain the core area as suitable Southwestern Willow Flycatcher habitat, habitat alteration in the buffer area will be extremely limited. Restrictions on habitat alteration are relaxed in two areas:

- The mesa top of Mesita del Buey. This mesa top can be developed if restrictions on impacts to the core area are met.
- Pajarito Road within the AEI. Mowing of upland vegetation is allowed up to 5 m (15 ft) from Pajarito Road or to the fence if the fence is within 9 m (30 ft). Vegetation must cover the roadsides to prevent sediment runoff, so mowed plants should be at least 5 cm (2 in) high. LANL biologists encourage the growth of willow throughout the AEI—even the area along Pajarito Road—to enhance habitat. If it is absolutely necessary to remove new willow growth (i.e., to improve visibility for human safety) within this area, LANL biologists recommend that only willows at or above the level of the roadway surface be mowed.



4.0 AREA OF ENVIRONMENTAL INTEREST SITE PLAN FOR THE JEMEZ MOUNTAINS SALAMANDER

4.1 Species Description—Jemez Mountains Salamander

4.1.1 Status

In 2006, the Jemez Mountains Salamander was listed in New Mexico as endangered under the Wildlife Conservation Act of New Mexico (NMDGF 2006). In September 2012, the USFWS proposed the Jemez Mountains Salamander as endangered under the ESA (77 FR 56481), and the final listing as endangered occurred on September 10, 2013 (78 FR 55599).

4.1.2 General Biology

The Jemez Mountains Salamander is endemic to the Jemez Mountains of north-central New Mexico and is found in Los Alamos, Rio Arriba, and Sandoval counties (Stebbins and Riemer 1950). It is one of two endemic plethodontid salamanders that occurs in New Mexico, predominantly at elevations between 2,130 to 3,430 m (6,988 to 11,254 ft) in mixed-conifer forest with greater than 50 percent canopy cover that consists mainly of Douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco), blue spruce (*Picea pungens* Engelm.), Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), white fir (*Abies concolor* [Gord. & Glend.] Lindl. ex Hildebr.), limber pine (*Pinus flexilis* James), ponderosa pine, and quaking aspen (*Populus tremuloides* Michx.). The ground surface in forest areas has (a) moderate-to-high volumes of large fallen trees and other woody debris, especially coniferous logs at least 25 cm (10 in) in diameter, particularly Douglas fir, which are in contact with the soil in varying stages of decay from freshly fallen to nearly fully decomposed; or (b) structural features, such as rocks, bark, and moss mats, that provide the species with food and cover. Underground habitat in forest or meadow areas contains interstitial spaces provided by (a) igneous rock with fractures or loose rocky soils, (b) rotted tree root channels, or (c) burrows of rodents or large invertebrates (Degenhardt et al. 1996; 78 FR 9876).

Plethodontid salamanders, which lack both lungs and gills, breathe through the mucous membranes in their mouth and throat and through their moist skin. The Jemez Mountains Salamander is completely terrestrial and does not use standing surface water for any life stage (77 FR 56481). Present in its habitat year-round, the Jemez Mountains Salamander spends most of its life underground but can be found on the surface when conditions are warm and wet, approximately July through October. During this time, the Jemez Mountains Salamander can be found under rocks, bark, and moss mats, and inside and under logs (Ramotnik 1986, Everett 2003). The Jemez Mountains Salamander eats invertebrates, including ants, mites, and beetles, and is thought to lay its eggs underground (78 FR 9876).

4.1.3 Threats

Principal threats to habitat include historical fire exclusion and suppression and severe wildland fires; forest composition and structure conversions; post-fire rehabilitation; forest and fire management; roads, trails, and habitat fragmentation; recreation; and disease (77 FR 56482).

4.2 Impact of Human Activities

4.2.1 Introduction

Primary threats to the Jemez Mountains Salamander on LANL property are impacts to habitat quality or destruction of individual salamanders caused by LANL or Los Alamos County operations. Forested LANL property is also subject to impacts from severe wildland fire and wildfire suppression.

4.2.2 Impacts on Habitat Quality

4.2.2.1 Development

Property at LANL varies from remote, isolated land to heavily developed and/or industrialized. Most of the large developed areas at LANL are found on mesa tops, generally in the northern and western portion of LANL. The areas of Jemez Mountains Salamander habitat currently most impacted by development occur in Los Alamos Canyon. A secondary paved road (West Road) in the bottom of the canyon exits the canyon on the north-facing slope through Jemez Mountains Salamander habitat. The canyon bottom also contains a recreational ice rink operated by Los Alamos County on an inholding owned by Los Alamos County. Development that reduces the occurrence of primary constituent elements of Jemez Mountains Salamander in core habitat would likely have a negative impact on the species.

4.2.2.2 Pedestrians and Vehicles

Many canyon bottoms and mesa tops at LANL have dirt roads traversing them. Most of these roads are gated; however, many of these roads are accessible to LANL employees and the public on foot or by bicycle. Some areas, such as Los Alamos Canyon, are frequently used by hikers and dog owners on active and historic trails that traverse the canyon, through Jemez Mountains Salamander habitat in places. Maintenance of roads and trails in the habitat may have a negative impact on the species.

4.2.2.3 Severe Wildland Fire and Wildfire Suppression

Stand-replacing wildfires significantly change forest composition and structure and reduce canopy cover. Even ground wildfires could reduce the volume of fallen logs and large woody debris. Large areas of historic Jemez Mountains Salamander habitat have been impacted by stand-replacing wildfires associated with current forest stocking conditions, drought, and high temperatures (77 FR 56482). Forested habitats on LANL property are also subject to severe wildland fires. To mitigate wildfire risks, some areas of LANL have been treated for fuels reduction and creation of fuel breaks both pre-emptively and during active wildfire suppression. Both wildfires and wildfire suppression activities can negatively impact the primary constituent elements of Jemez Mountains Salamander core habitat.

4.2.3 Impacts on Individual Salamanders

4.2.3.1 Disease

The amphibian pathogenic fungus *Batrachochytrium dendrobatidis* (Bd) was found in a wild-caught Jemez Mountains Salamander in 2003 (Cummer et al. 2005) on the east side of the species' range and again in another Jemez Mountains Salamander in 2010 on the west side of the species' range (77 FR 56482). Bd causes the disease chytridiomycosis, whereby the Bd fungus attacks keratin in amphibians. In adult amphibians, keratin primarily occurs in the skin. The symptoms of chytridiomycosis can include sloughing of skin, lethargy, morbidity, and death. Chytridiomycosis has been linked with worldwide

amphibian declines, die-offs, and extinctions, possibly in association with climate change (Pounds et al. 2006). Chytridiomycosis could be a threat to the Jemez Mountains Salamander because this disease is a threat to many other species of amphibians, and the pathogen has been detected in the Jemez Mountains Salamander (77 FR 56482).

As part of a cooperative study with the New Mexico Department of Game and Fish between 2007 and 2013, various amphibian species, including the canyon tree frog (*Hyla arenicolor*), western chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Anaxyrus woodhousii*), tiger salamander (*Ambystoma tigrinum*), and Jemez Mountains Salamander were tested for Bd infection at LANL. To date, all sampling has been negative for Bd infection (Fresquez et al. 2013; B. Thompson, personal communication, January 2022).

4.2.3.2 [Destruction of Individual Salamanders](#)

During periods of the year when Jemez Mountains Salamanders are on the soil surface, when conditions are warm and wet (generally July to October), they are vulnerable to injury and mortality from soil-disturbing activities, including operation of heavy equipment in core habitat. They also are at risk to be found and collected by people.

4.3 **AEI General Description for the Jemez Mountains Salamander**

The AEI consists of two areas—a core area and a buffer area. The core habitat is defined as suitable habitat where the Jemez Mountains Salamander occurs or could occur at LANL. The core habitat consists of sections of north-facing slope that contain the required microhabitat to support the Jemez Mountains Salamander. The buffer area is 100 m (328 ft) wide, extending outward from the edge of the core area.

4.3.1 [Method for Identifying a Jemez Mountains Salamander AEI](#)

The first step in identifying potential Jemez Mountains Salamander AEIs at LANL was to use a GIS to model habitat. Early modeling efforts by Hathcock (2008) identified areas of potential habitat, and that model was further refined. The following parameters were modeled in the GIS:

- Elevation: 2,150 m (7,000 ft) and above
- Slope: Greater than 20 degrees
- Aspect: north-facing +/- 20 degrees
- Land cover: Mixed conifer
- Land use: Undeveloped
- Modeled habitat is selected only if it is greater than five contiguous 30 × 30 m (98 × 98 ft) pixels in size

Once this habitat layer was developed, a second layer was modeled that examined the level of shade in the habitat, also known as an illumination index. Because the Jemez Mountains Salamander needs cool moist conditions, an illumination index model would further highlight areas where this habitat type could occur or further reinforce the areas selected by the GIS modeling. The illumination index describes the amount and extent of solar radiation that reaches the Earth's surface at a given point, taking into account the topography that could cast shadows. The illumination model was developed using the 5 m (16 ft) resolution digital elevation model hillshade and using the Surface toolbox in ArcToolbox (Environmental Science Research Institute, Redlands, California) using the highest height of the sun on June 21 at 1:00

p.m., altitude of 74.4 and Azimuth of 178.4, when the sun would be at its maximum height. These procedures were based on work done by Reilly et al. (2009).

Once this modeling was complete, LANL biologists performed field validation to verify the suitability of the modeled habitat. The goal was to verify that mixed conifer was still the dominant cover class in the selected area. The GIS analysis used data from a landcover map created by McKown et al. (2003). Changes in habitat from fire and extreme drought effects have occurred since this landcover map was published. Because LANL is on the extreme edge of Jemez Mountains Salamander lower elevational range, a key component in this part of its range is soil moisture content. During field validation, evidence of a moist mixed conifer habitat versus a dry mixed conifer habitat was noted. One of the key indicators used to delimit areas of moist versus dry mixed conifer during the field validation was the presence of white fir (Evans et al. 2011) combined with a high canopy cover.

Field validation of the model occurred in May 2013, or decisions were based on earlier field visits to the sites from other projects. Each field validation consisted of LANL biologists walking down all of the modeled habitat polygons to look for the presence of indicator features. If a polygon of modeled habitat contained white fir, indicating a moist, wet conifer-type habitat, a high canopy closure, and other signs of high habitat quality such as dead logs, moss, or other areas that could be used as cover by the Jemez Mountains Salamander, then the polygon was marked for retention in the final core habitat. Polygons that did not contain the necessary habitat requirements were omitted.

After the field validation was complete, the final core habitat boundaries were hand-digitized using ArcGIS (Environmental Science Research Institute, Redlands, California) by LANL biologists in and around the validated modeled polygon and areas between polygons, if appropriate. The final identified core habitat at LANL occurs on the north-facing slopes of canyons. Toward the rim of the canyon, the core boundaries end where the mixed conifer ends. In the canyon bottoms, the core boundary extends to the edge of the stream channel. The upstream and downstream core boundaries end where the mixed conifer ends. A buffer habitat was extended around the core to a distance of 100 m (328 ft) outward. The LANL Fenton Hill satellite facility in the Jemez Mountains off New Mexico Highway 126 is on land leased to DOE by the Santa Fe National Forest. The entire footprint is considered to be developed core habitat for the Jemez Mountains Salamander because proposed critical habitat is adjacent to the facility.

4.3.2 Location and Number of Jemez Mountains Salamander AEIs

The identified Jemez Mountains Salamander core habitats were grouped by canyon system into AEIs, which contain contiguous and noncontiguous habitat areas. The largest contiguous section of habitat at LANL is in Los Alamos Canyon. Two noncontiguous areas of habitat are located in Two-mile Canyon, four in Pajarito Canyon, one contiguous area in Cañon de Valle, and the entire Fenton Hill footprint.

4.4 AEI Management

4.4.1 Overview

This AEI management section provides guidelines for LANL operations to reduce or eliminate the threats to the Jemez Mountains Salamander from habitat alterations that reduce habitat quality. Habitat alterations are considered for all AEIs and for both core and buffer areas. Developed areas that have ongoing baseline levels of activities and are not suitable habitat for Jemez Mountains Salamander have different restrictions than undeveloped core or buffer areas. AEIs for different species may overlap, and an activity must meet the guidelines of all applicable site plans to be allowable. Protective measures are described as management practices that should be followed when working in AEIs.

4.4.2 Definition and Role of Occupancy in AEI Management

Occupancy simply refers to whether an AEI is occupied by the Jemez Mountains Salamander. The Los Alamos Canyon AEI is known to be occupied based on past surveys. Surveys for the Jemez Mountains Salamander are known to have a very low detection rate for occupied areas, so at LANL, all AEIs are assumed to be occupied at all times. If needed, site-specific surveys will be conducted by federally permitted LANL biologists.

4.4.3 Definition and Role of Developed Areas in AEI Management

Developed areas include all building structures, paved roads, improved gravel roads, and paved and unpaved parking lots. The majority of Jemez Mountains Salamander core habitat is in undeveloped areas except for the satellite facility at Fenton Hill and a small amount of habitat in Los Alamos Canyon where West Road crosses the habitat. Generally, developed areas will not have restrictions; however, some of the undeveloped sections within the footprint of Fenton Hill may have restrictions because they could contain Jemez Mountains Salamanders when they move to the surface between July and October. Any project that occurs within developed core habitat will be evaluated by LANL biologists for ESA compliance.

4.4.4 General Description of Core and Buffer Areas and Allowable Area Development

The purpose of buffer areas is to protect core areas from habitat degradation. The current levels of development in buffer and core areas represent baseline conditions for this site plan. No further development is allowed in the core area under the guidelines of this site plan. Any development in a buffer area will be reviewed by LANL biologists to ensure that there are no impacts to the core habitat.

4.4.5 Emergency Actions

Managers may activate emergency actions if safety and/or property is immediately threatened by something occurring within an AEI (e.g., wildfire, water line breakage). Contact a LANL biologist (<https://int.lanl.gov/environment/bio/index.shtml>), the Environmental Stewardship Group (505-665-8855), or the DOE/NNSA Los Alamos Field Office (505-667-7014) as soon as possible. If the emergency occurs outside of regular business hours, contact the Emergency Operations Support Center (505-667-2400); this office will then communicate with the appropriate LANL and DOE/NNSA Field Office personnel.

4.4.6 Introduction to AEI Management Guidelines

Section 4.7 provides the guidelines for habitat alterations and allowable activities in AEI core and buffer areas. It describes what and where habitat alterations are allowed under the guidelines of this site plan. If an activity does not meet the restrictions given in the guidelines, the activity must be individually reviewed for ESA compliance. This site plan provides only guidelines for the Jemez Mountains Salamander AEIs. If an activity is desired in an area that has overlapping AEIs, all applicable site plans must be consulted. AEI maps show the location of all AEIs in an area. LANL biologists are available to help interpret site plans and answer questions (<https://int.lanl.gov/environment/bio/index.shtml>).

4.4.7 *Definition of and Restrictions on Habitat Alterations*

4.4.7.1 Definition of Habitat Alterations

Habitat alteration includes any action that alters the soil structure, vegetative components necessary to the species, water quality, or hydrology in undeveloped areas of an AEI. An actual activity may take place outside of the AEI and will be considered habitat alteration if consequences of the activity have effects inside the AEI core. Habitat alterations would also include soil pits for soil samples deeper than 15 cm (6 in.) using either hand or mechanized augers. Any activity that might disturb the soil will need to be reviewed by LANL biologists.

The habitat components most important to the Jemez Mountains Salamander include soil structure and vegetative structure. The forest structure within an area designated as a Jemez Mountains Salamander AEI is important because it provides the necessary moist, cool microclimate.

4.4.7.2 Fuels Management Practices to Reduce Wildfire Risk

One of the primary threats to the Jemez Mountains Salamander is wildfire (77 FR 56482), but they also require habitat with a high canopy cover, which makes fuels reduction challenging. Within undeveloped core areas, thinning trees to a level of 80 percent canopy cover or higher is approved. Trees may not be thinned below 80 percent canopy cover without further ESA review by LANL biologists. Large logs on the ground should be left in place and not chipped. Understory thinning that does not reduce total canopy cover below 80 percent is permitted. Large trees that are felled should be left as large logs on the ground. Smaller trees and understory shrubs that may be thinned should be dispersed and left onsite to aid in soil moisture retention. Thinning activities should not occur during the rainy season between July to October when the Jemez Mountains Salamander is found on the surface.

In buffer areas, thinning of trees may occur to the current LANL-approved prescription level (LAAO 2000). LANL biologists are available to provide guidance and mark trees for thinning (<https://int.lanl.gov/environment/bio/index.shtml>).

4.4.7.3 Utility Corridors

Habitat alterations, such as cutting down trees that threaten power lines, are allowed within 8 m (26 ft) of either side of an existing electrical utility line at LANL under existing guidelines and engineering controls (LANL 2019). This level is approved in all areas of an AEI. New utility lines and utility lines that require clearance of a right-of-way greater than 16 m (52 ft) total in core habitat must be individually reviewed for ESA compliance.

4.4.7.4 Restrictions on Habitat Alterations

Habitat alterations other than the fuels management practices and utility corridor maintenance described above are not allowed in undeveloped core areas under the guidelines of this site plan. If a project or activity is planned that would alter habitat in an undeveloped core area, it must be individually evaluated for ESA compliance. Habitat alterations in buffer areas must be reviewed by LANL biologists to ensure that there are no impacts to core habitat.



5.0 ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	acre
AEI	area of environmental interest
Bd	Batrachochytrium dendrobatidis (Chytrid Fungus)
BMP	Best management practices
cm	centimeter
DARHT	Dual-Axis Radiographic Hydrodynamic Test Facility
dB	decibel
dB(A)	A-weighted decibel
dB(C)	C-weighted decibel
DDT	(dichloro-diphenyl-trichloroethane)
DOE	U.S. Department of Energy
ESA	Endangered Species Act of 1973
fc	foot -candles
FR	Federal Register
ft	feet
g	gram
GIS	geographic information system
ha	hectare
HMP	Threatened and Endangered Species Habitat Management Plan
HVAC	heating, ventilation, and air conditioning
in.	inch
kg	kilogram
LANL	Los Alamos National Laboratory
m	meter
mi	mile
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
oz	ounce
PCBs	polychlorinated biphenyls
TNT	trinitrotoluene(2,4,6-)
USFWS	U.S. Fish and Wildlife Service



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Appendix A: SUPPLEMENTAL INFORMATION

Table A-1. Percentage of Each Food Type Found in Mexican Spotted Owl Food Remains at LANL

Species	Relative Abundance
<i>Neotoma</i> spp.	26.22
<i>Peromyscus</i> spp.	10.22
<i>Microtus</i> spp.	4.44
Gophers	4.89
Bats	5.78
Chipmunks	0.89
Rabbits	12.89
Shrews	1.33
Small Mammal	1.33
Medium Mammal	1.78
Medium Bird	8.00
Small Bird	4.89
Nocturnal Birds	0.89
Reptiles	4.89
Arthropods	11.56

Table A-2. Preliminary Light Measurements (in fc) for the Mexican Spotted Owl Site Plan

		Distance from Source			
	Source (street light)	5 m	10 m	15 m	20 m
fc	3.70	2.28	1.20	0.62	0.32

Appendix A: Supplemental Information

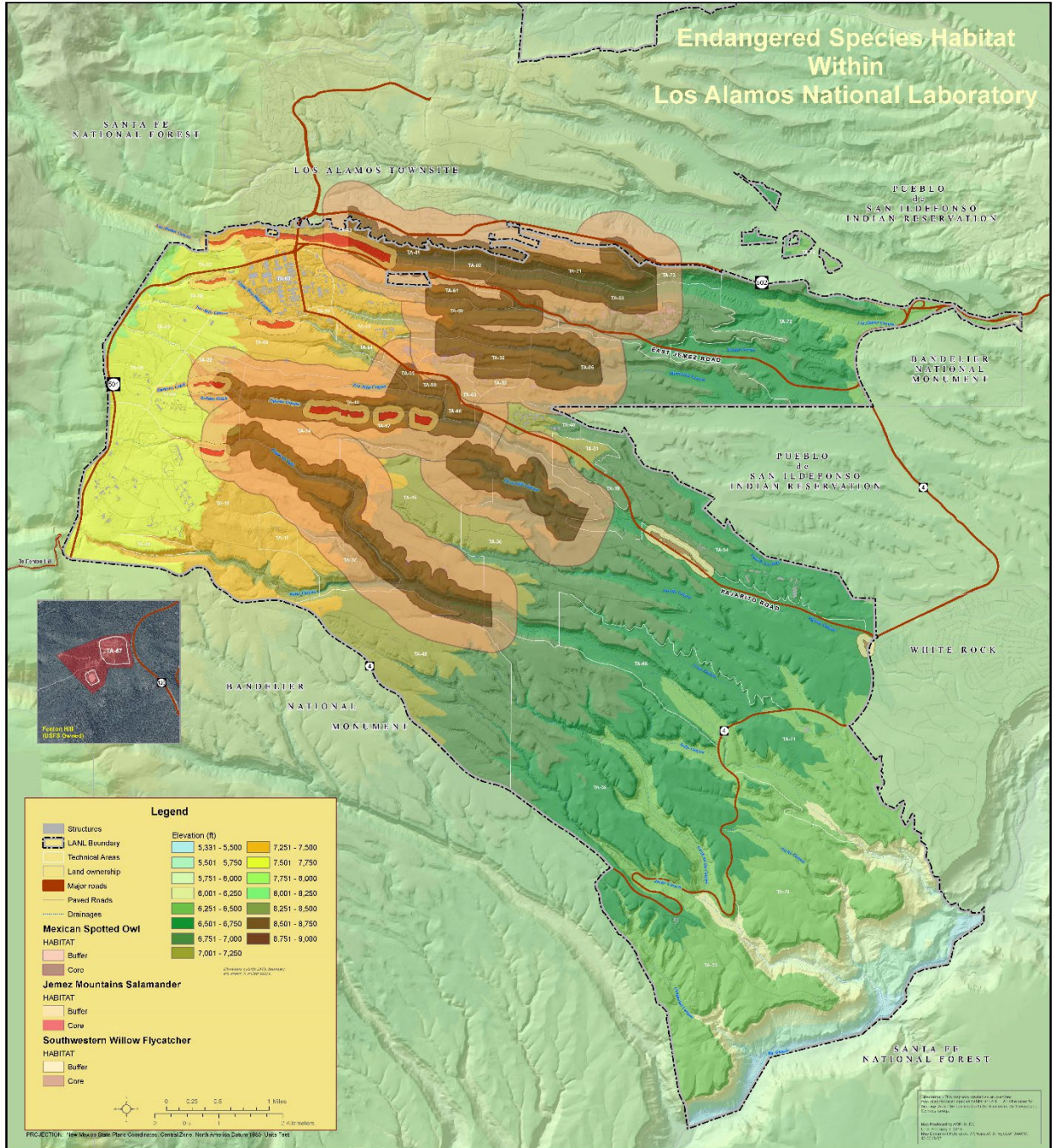


Figure A-1. Most recent map of all AEIs at LANL