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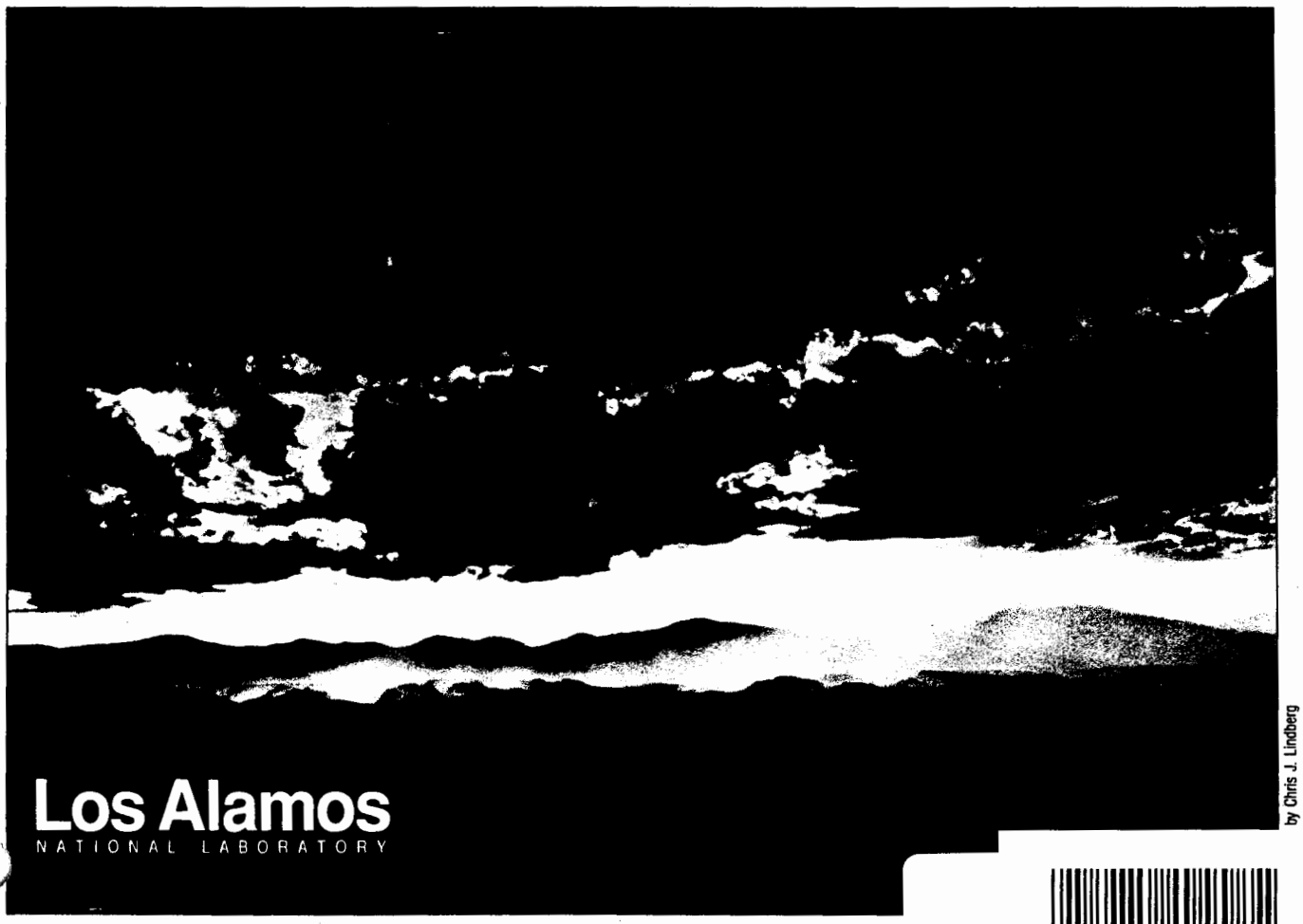
Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1100

Timothy Haarmann



by Chris J. Lindberg

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Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1100

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Abstract

The Environmental Restoration Program of Los Alamos National Laboratory (LANL) proposes to conduct site characterization studies in Operable Unit 1100 at LANL. These studies consist primarily of soil sampling to determine the nature and extent of hazardous waste releases from Solid Waste Management Units. Before proceeding, LANL's Biological Resources Evaluation Team (BRET) initiated ecological field surveys for OU 1100, Technical Areas 53 and 72, in 1993.

Survey data indicated that suitable habitat is present in Operable Unit 1100 for several protected species, including the Jemez Mountains salamander, the peregrine falcon, the northern goshawk, the spotted bat, the meadow jumping mouse, and several raptors. The initial surveys did not confirm the presence of these species; however, BRET requires mitigation measures to ensure that sampling will not affect these species. Also, this report discusses management practices for the Cooper's hawk, which is sensitive to disturbance.

BRET noted wetlands and floodplains in OU 1100 by consulting the National Wetland Inventory Maps and field checks. We will complete wetland boundary delineation before site characterization to ensure that no sampling will occur within a wetland or floodplain area.

This report also includes information on revegetation programs for areas affected by site characterization activities, i.e., off-road vehicular travel and sampling disturbances.

1. INTRODUCTION

1.1 Project Description

Since the inception of Los Alamos National Laboratory (LANL), research activities throughout the facility have generated a variety of hazardous and radioactive wastes. LANL defines a Solid Waste Management Unit (SWMU) as "any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste" (IT 1990). The Laboratory's Environmental Restoration (ER) Group develops and implements cleanup or containment of SWMUs at LANL, following a four-phase corrective action process: (1) site assessment, (2) site characterization, (3) development of proposed corrective actions, and (4) selection and performance of corrective actions (IT 1990).

This report documents a biological assessment for the site characterization (sampling phase) of the ER Program for Operable Unit (OU) 1100 in Technical Areas (TAs) 53 and 72. The ER Program proposes to sample numerous sites within OU 1100 to characterize hazardous waste releases from SWMUs. Personnel would remove soil samples with hand-held auger drills or with auger-mounted heavy machinery.

1.2 Purpose and Scope

The Biological Resources Evaluation Team (BRET) prepared this assessment to evaluate the impacts of site characterization activities at OU 1100 in accordance with the following regulations and orders:

- the 1973 Endangered Species Act (ESA) (USFWS 1988)
- New Mexico's Wildlife Conservation Act (WCA) (NM 1974)
- New Mexico's Endangered Plant Species Act (EPSA) (NM 1985)
- Floodplain/Wetland Executive Orders (EOs) 11990 and 11988 (USFWS 1977a, b)
- Department of Energy (DOE) Order 5400.1 (Environmental Compliance) (USDOE 1988)
- the National Environmental Policy Act (USDOE 1992)
- Code of Federal Regulation 10 CFR 1022 (DOE compliance with floodplain/wetlands Environmental Review Requirements) (USDOE 1979)

This assessment identifies threatened, endangered, and sensitive (TES) species, floodplains, and wetlands in the project area and assesses the impacts of site characterization. In addition, this assessment provides

baseline information that can be used for long-term monitoring of plant and animal communities. This report also recommends management practices that would minimize impacts to non-TES species.

1.2.1 Endangered Species

Section 7 of the ESA requires federal agencies to ensure that their activities and programs do not jeopardize the continued existence of a federally listed threatened or endangered species or its designated critical habitat (USFWS 1988). New Mexico's WCA and EPSA also require federal agencies to avoid impacts to state-protected species. Section 7 of the ESA and New Mexico's WCA and EPSA are implemented within the framework of NEPA.

Three possible TES species assessment outcomes are

1) TES species do not use the proposed project area habitat
2) TES species use the proposed project area habitat, but we foresee no potential adverse impacts on the species
3) TES species use the proposed project area habitat and we foresee adverse impacts on the species

If no adverse impacts from the proposed project are expected, the biological evaluation is reviewed by the appropriate state or federal agency for concurrence. If a proposed project is expected to jeopardize a listed species, BRET initiates consultation with the appropriate state or federal agency. This could result in project modifications, alternatives, or complete abandonment of the proposed project.

1.2.2 Floodplains and Wetlands

Two Executive Orders provide protection for floodplains and wetlands. Executive Order 11988, "Floodplain Management," ensures the protection of floodplains and mandates that potential effects of any federally funded action in a floodplain be evaluated (USFWS 1977a). Executive Order 11990, "Protection of Wetlands," requires all federally funded agencies to protect wetlands from loss and/or degradation (USFWS 1977b).

10 CFR 1022 outlines the procedures for DOE compliance with the floodplain/wetland executive orders and provides a means for public review (USDOE 1979). These regulations require that all DOE actions be assessed for impacts to floodplains and wetlands, regardless of size. The potential impacts are addressed in NEPA documentation and Federal Register Notifications. If it is determined that floodplains or wetlands would be affected by the proposed project, the agency must determine if the impacts would be adverse.

Additionally, under Section 404 of the Clean Water Act, the degradation of wetlands and floodplains must be controlled by limiting the discharge of fill into them (USFWS 1993). Depending on the size of the floodplain or wetland, two types of discharge permits may be issued by the Army Corps of Engineers: Nationwide permits (if the impact is confined to less than 4 ha. [10 ac], and Individual permits (if the impact will affect an area larger than 4 ha. [10 ac]).

1.2.3 DOE Orders

DOE Order 5400.1 requires DOE facilities to conduct a pre-operational environmental survey prior to the development of any new site, facility, or process that may adversely affect the environment (USDOE 1988). To evaluate the biotic communities under varied seasonal changes, the survey should begin a minimum of one year, and preferably two years, before startup of the proposed project.

2 ENVIRONMENTAL SETTING

2.1 General Setting

The project area is located within the boundaries of DOE property in Los Alamos County, New Mexico, approximately 105 km (65 mi) north of Albuquerque and 48 km (30 mi) northwest of Santa Fe (Fig. 1). The dominant physical feature in the LANL area is the Pajarito Plateau, a broad, dissected plateau comprised of numerous alternating narrow mesas and canyons at the base of the Jemez Mountains. These volcanic mountains lie along the northwest margin of the Rio Grande Rift (Burton 1982).

The plateau is approximately 32-40 km (20-25 mi) long and 8-16 km (5-10 mi) wide. Elevations on the Plateau vary from approximately 2380 m (7800 ft) above sea level near the mountains to 1890 m (6200 ft) at the plateau's lower edge on the rim of White Rock Canyon. Plateau canyons are 46-91 m (150-300 ft) deep and 91-183 m (300-600 ft) wide.

The bedrock of the plateau is composed of Bandelier Tuff, a welded ash formation deposited during volcanic eruptions in the Jemez Mountains roughly 1.1-1.4 million years ago. The tuff overlays other volcanic layers, which in turn overlay the conglomerate of the Puye Formation. This conglomerate intermixes with Chino Mesa basalts along the Rio Grande River (Environmental Surveillance Group 1988).

2.1.1 Regional Climate

The climate in the LANL region is a semi-arid, temperate mountain type (Bowen 1990). Climate characteristics in this type are highly variable season to season as well as year to year. For example,

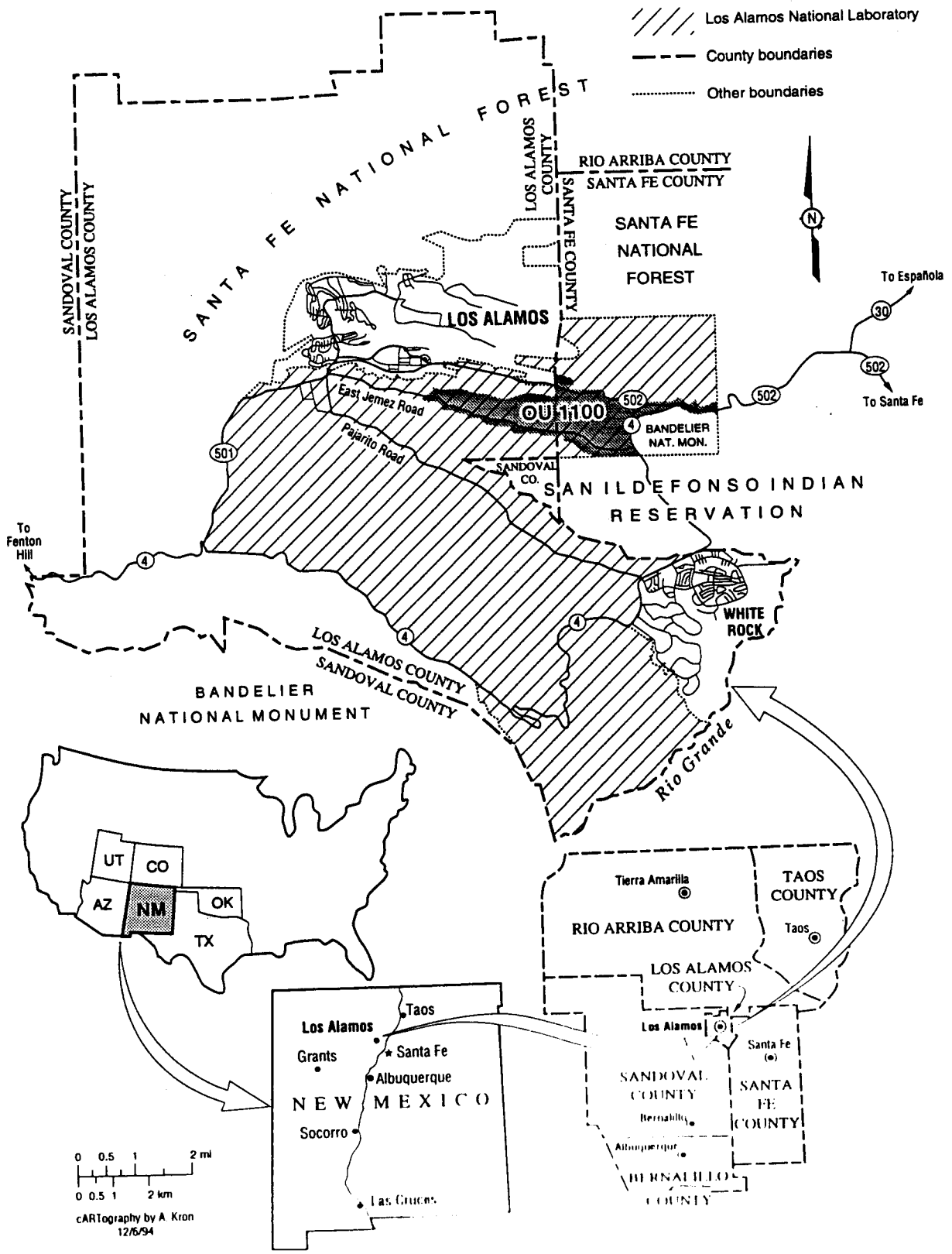


Figure 1. Location of Los Alamos National Laboratory

precipitation at the Laboratory, including rainfall and water-equivalent snowfall, averages about 46 cm (18 in.) per year, but year-to-year accumulations have varied by nearly 60 cm (24 in.) over the past 69years. Precipitation increases with elevation on the Pajarito Plateau, causing western portions of LANL to receive considerably more rainfall and water-equivalent snowfall than the lower elevations along the Rio Grande. Precipitation is not evenly distributed throughout the year, but occurs in two distinct periods. During the summer months (predominantly July and August), air masses from the Gulfs of Mexico and California bring the heaviest precipitation of the year, with rainfall locally concentrated as thunder showers. Winter storms derive from Pacific frontal systems and deliver lesser amounts of precipitation from November through March, much of it in the form of snow.

Even though Los Alamos is situated at a relatively low latitude (35°32' North), air temperatures are typically cool because of the area's 2255 m (7400 ft) average elevation. Thin, dry air and clear skies encourage both strong daytime heating and nighttime cooling, resulting in differences in extremes of daily temperatures of as much as 14 °C (25 °F). Winter temperatures typically range from -9 to -4 °C (15 to 25 °F) during the night and from 1 to 10 °C (30 to 50 °F) during the day. Summers usually have relatively warm days and cool nights. Daily afternoon temperatures are typically in the 21 - 27 °C (70 - 80 °F) range, occasionally reaching 32 °C (90 °F). Even after the warmest days, the relatively thin air, light winds, clear skies, and dry atmosphere cause nighttime temperatures to drop into the 10 - 15 °C (50 - 60 °F) range.

2.1.2 Regional Vegetation

Northern New Mexico's semi-arid environments support a diversity of plants whose distribution is in large part determined by elevation. Generally, arid-climate vegetation dominates at low elevations and vegetation adapted to more consistent moisture grows at higher elevations in the mountains. The varied topography and vertical relief of the Jemez Mountains and the Pajarito Plateau support an especially rich and diverse subset of the regional vegetation. Plains and Great Basin Riparian-Deciduous Forest grows at the lowest elevations in Los Alamos County along the Rio Grande floodplain, about 1524 m (5000 ft) above sea level. The trees that characterize this vegetation type, such as cottonwood (*Populus* spp.), willow (*Salix* spp.), and non-native salt cedar (*Tamarix pentandra*) and Russian olive (*Eleagnus angustifolia*) are restricted to areas where water is available at or near the ground surface year-round. Above the Rio Grande Floodplain at elevations ranging from about 1700 to 1890 m (5600 to 6200 ft), one-seed juniper (*Juniperus monosperma*) becomes the most common overstory species, often intermixed with lesser amounts of piñon pine (*Pinus edulis*). Both of these tree species, typical of the Great Basin Conifer Woodland, are tolerant of a relatively dry climate and together they form an open piñon-juniper woodland at elevations of 1890 to 2100 m (6200 to 6900 ft) on the Plateau.

As the elevation increases towards the Jemez Mountains, the piñon-juniper woodland community gradually intergrades into Rocky Mountain Montane Conifer Forest, where increased precipitation allows ponderosa pine (*Pinus ponderosa*) to become a dominant species at about 2100 to 2290 m (6900 to 7500 ft). White fir (*Abies concolor*) and Douglas fir (*Pseudotsuga menziesii*) grow along the north-facing slopes at intermediate elevations. These species are often intermixed with ponderosa pine and form a mixed-conifer community. Species of the Rocky Mountain Subalpine Conifer Forest and Woodland along the extreme western edge of the county and are more prevalent at the higher elevations of the Jemez Mountains.

Most of the streams in Los Alamos County are ephemeral and do not support wetland vegetation, but permanent flows from springs and laboratory facilities create a small number of permanent or near-permanent streams in some canyons.

2.2 Setting of the Operable Unit

Operable Unit 1100 lies along the northern boundary of the Laboratory. The OU includes two technical areas, TAs 53 and 72, both located on Mesita de Los Alamos, and consists of Sandia and Los Alamos Canyons (Fig. 2). The Los Alamos townsite bounds the OU on the north; on the south, the East Jemez Road bounds this unit, which is located within the Township T19N, Range R6E, Section 15.

The elevation of TA-53 is between 2012 and 2176 m (6600 and 7140 ft). The topography includes steep canyon cliffs, densely forested slopes, and a narrow central riparian area (Fig. 3).

Bandelier Tuff underlies portions of this OU, and alluvium underlies the Los Alamos Canyon bottom (Nyhan et al. 1978). The potentiometric surface of the main aquifer lies between 1774 and 1823 m (5820 and 5980 ft) under TA-53. Over 244 m (800 ft) of unsaturated tuff and volcanic rock separate the surface from the aquifer in this area. There is little potential for downward flow from the surface because of the low moisture conditions of the tuff (IT 1987).

2.3 Previous Studies

Prior to the 1992 surveys initiated for this study, other investigators completed several site-specific studies within or near OU 1100. In these investigations, researchers obtained information on TES species and baseline ecological data.

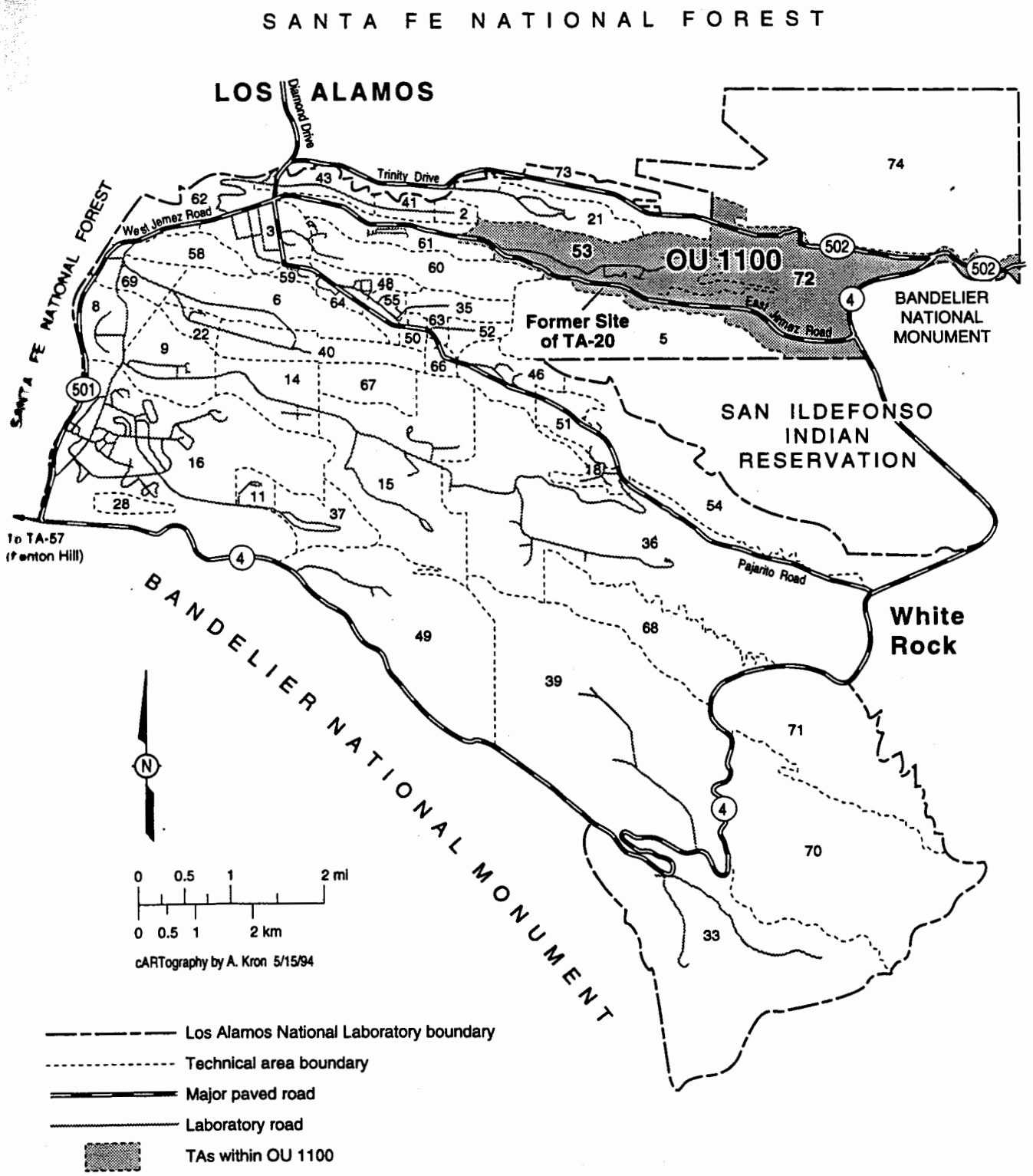
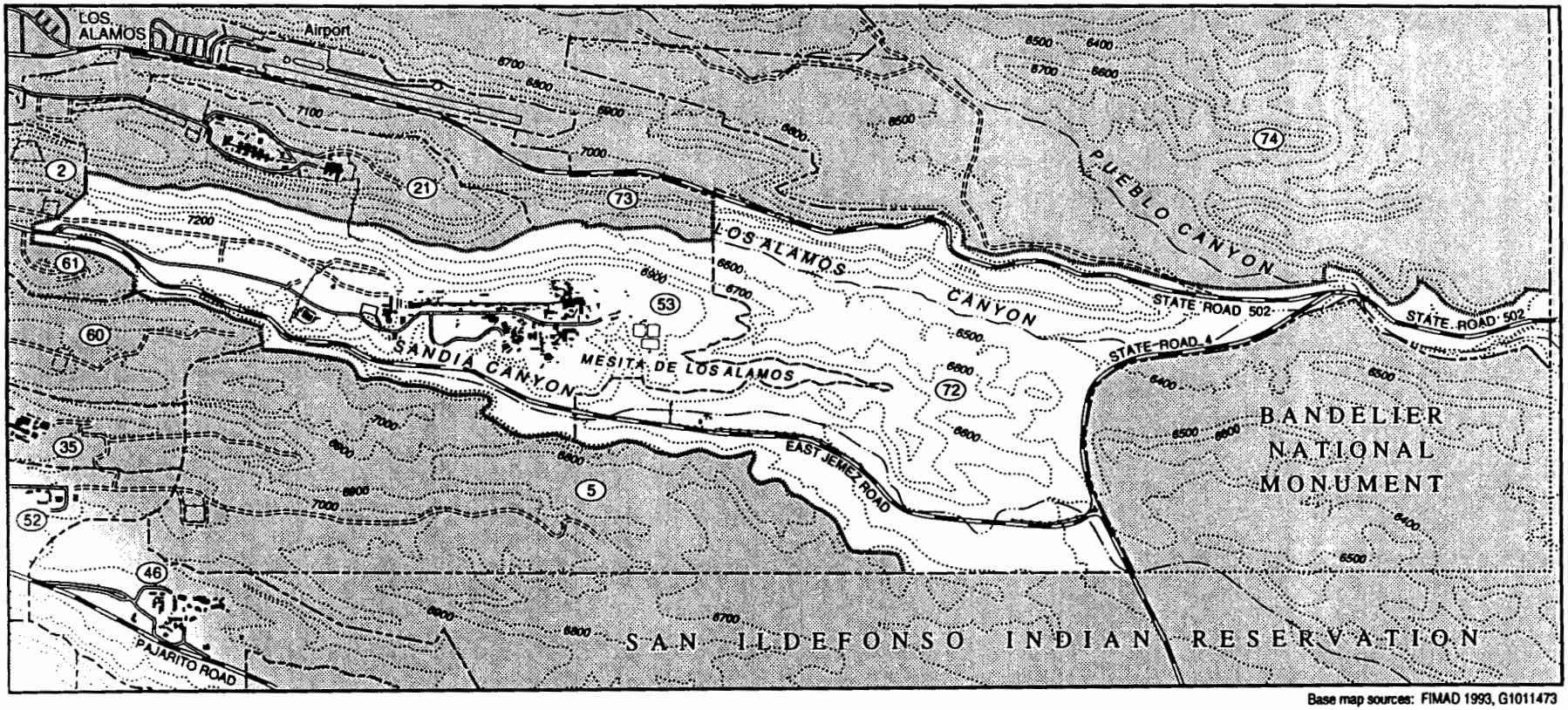


Figure 2. Location of OU 1100 with respect to Laboratory technical areas and surrounding lands.



Base map sources: FIMAD 1993, G1011473
U.S.G.S. 1984, White Rock, N.M. 7.5' topo. quad.
Modified by: cARTography by A. Kron 12/7/94

Major paved road
Secondary road
Unimproved road
Fence
Ephemeral stream
Contour interval 100 ft
Technical area boundary
Operable unit boundary
Laboratory boundary
Other political boundary
(53) Technical area number
Building or structure

0 500 1000 ft

N

F' ·e 3. Topographic map showing general features of OU 1100.

2.3.1 Plants

Several vegetation researchers surveyed within the Operable Unit boundaries in portions of Los Alamos Canyon. Appendix A contains a checklist of plant species identified during these surveys and lists surveys used in the checklist preparation.

2.3.2 Wildlife

2.3.2.1 Invertebrates

Terrestrial Invertebrates

No invertebrate studies have been completed within the project area, but at least 164 families of terrestrial arthropods have been identified on DOE property. Most of these are very likely to inhabit the project area (see Appendix B).

Aquatic Invertebrates

Few studies on aquatic invertebrates have been conducted in Los Alamos County. Currently, BRET is collecting and identifying aquatic insects within and adjacent to DOE property. Eighty-one aquatic insect families have been collected to date. Five species of aquatic mollusks were found on DOE property and further surveys are expected to yield additional species. A number of these live in the wetland habitats of Pajarito Canyon.

2.3.2.2 Vertebrates

Fish

No fish have been found on DOE property, although some were observed in and downstream from Guaje Reservoir, Los Alamos Reservoir, and at the confluence of White Rock Canyon and the Rio Grande below Ancho Springs. There is no fish habitat in the vicinity of the project area.

Reptiles and Amphibians

Biologists identified seventeen lizard and snake species in the LANL region. In 1978, Bogart (1978) surveyed for reptiles and amphibians in Los Alamos County, including Los Alamos Canyon. He found one amphibian species, the Jemez Mountains salamander, in the upper reaches of the canyon near the reservoir, and eight reptile species (Appendix C).

Fi 3. Topographic map showing general features of OU 1100.

Birds

Over 200 bird species, including at least 112 species of breeding birds, have been identified in Los Alamos County (Travis 1992). Thirty-nine of the breeding bird species are residents and fifty-nine are migratory summer residents. Morrison (1988) set up bird transects in Los Alamos Canyon. Also, other surveys have gathered information on local bird activities (Kennedy 1988, 1989; Sinton and Kennedy 1993). Appendix D contains a checklist of the birds found in the above studies in Los Alamos Canyon.

Mammals

Twenty-nine small mammal species have been found in the LANL area. Mule deer and elk are the most visible large mammals of the region. These species generally winter in the lower elevations of the Pajarito Plateau, including many of the mesas and canyons along the central and eastern portions of the county. They generally spend the summer at higher elevations in the Jemez Mountains. However, recent surveys in the Los Alamos County area indicate that growing numbers of large mammals reside year-round at lower elevations.

2.3.3 Threatened, Endangered, and Sensitive Species

2.3.3.1 Plants

Foxx and Tierney (1980a, b, 1985) completed several threatened and endangered plant species and NEPA compliance surveys for proposed projects in Los Alamos Canyon. No threatened or endangered plant species were found.

2.3.3.2 Wildlife

Previous surveys in Los Alamos Canyon reported only one endangered species, the Jemez Mountains salamander. Ramotnik found the specimen in an area south of the OU 1078 boundary on the north-facing slope (Ramotnik 1986).

Kennedy (1988) reported two diurnal raptors (Cooper's hawk and red-tailed hawk), which are classified as state sensitive, nesting in Los Alamos Canyon east of Omega Site. Both species have nested in ponderosa pine in the canyon bottom since 1983. The Cooper's hawk nesting site is one of the most productive sites within Los Alamos County.

3 SURVEY METHODS

3.1 Level 1 (Reconnaissance) Surveys

In a Level 1 survey , the field crew walks through the project area and notes general habitat types, site features, presence or absence of water sources and floodplains, and evidence of previous disturbance, and determines placement of line transects. The vegetation types are used as search criteria in BRET's TES database after which biologists determine if any of the encountered habitat types are useful to a TES species; if so, a Level 2 survey is required.

3.2 Level 2 (Habitat Evaluation) Surveys

Level 2 surveys quantitatively define habitat. For this assessment, standard ecological techniques were used to analyze cover, density, and frequency of species in overstory and understory vegetation. Information obtained from the vegetation studies was categorized into a hierarchical system of vegetation types. BRET then compared the vegetation types with specific habitat requirements for threatened, endangered, and sensitive species. If the habitat requirements of a particular TES species were not met, BRET considered the site unsuitable habitat and no further studies for that species were conducted. Conversely, if any of the habitat could be used by listed species, BRET initiated Level 3 surveys.

The classification for both upland and wetland vegetation types for the Pajarito Plateau, including known and potential habitat types and phases, is based on descriptions by Brown (1982). No attempt was made to designate new habitat types in the OU 1100 project area. Vegetation associations in the project area that did not fit within designated habitat types were classified with the habitat types they most closely resembled.

Descriptions of the vegetation survey methods follow.

3.2.1 Overstory Evaluation

BRET used the line intercept technique (Lindsey 1955, Woodin and Lindsey 1954) to characterize the overstory in coniferous forests. Transects were established in the habitat and data were collected within a 6-m (20-ft) wide strip centered on a 213-m (700-ft) transect line. Within the strip, BRET measured the diameter at breast height (DBH) of all single-stemmed trees and counted all shrub stems greater than 0.9 m (3 ft) in diameter. To determine foliar cover, BRET measured the distance along the centerline of the transect that was covered by a vertical projection of overstory onto the transect. Plant frequency was measured along the transect within rectangular plots measuring 15 m (50 ft) long.

BRET used a circular plot technique to measure the overstory components in riparian zones and piñon-juniper woodlands. Circular plots were established every 30.5 m (100 ft) along a transect line within the habitat to be evaluated. From a center point on the transect line, basal diameter of all multi-stemmed trees within a 9.1-m (30-ft) radius was measured. For single-stemmed trees within a 9.1-m (30-ft) radius, DBH was measured. BRET also counted all shrub stems and estimated overstory cover within each quarter of the circular plot.

Analysis also included calculating an importance index for all tree and shrub species within the transects by averaging relative cover, relative density, and relative frequency for each species. The importance index is a measure of species dominance within a transect.

3.2.2 Shrub Layer Evaluation

Woody species were separated into two categories, trees and shrubs, for purposes of analysis. The DBH of trees was recorded and the number of stems were counted for shrubs. Data on all shrubs in the transects are listed in the accompanying tables. All woody species were classified as shrubs if their DBH was less than 7.6 cm (3 in.) and their height was less than 0.9 m (3 ft).

3.2.3 Understory Evaluation

BRET used the quadrat method with a 20 x 50 cm (7.9 x 19.7 in.) Daubenmire plot to measure percent cover of cryptogamic and herbaceous plants, bare soil, and litter, and of shrubs less than 0.9 m (3 ft) high (Daubenmire 1959). BRET placed quadrats on the same transect that was established for overstory evaluation. Percent cover was estimated based on visual observation of each quadrat. Species composition was also estimated by visual inspection of each plot. Quadrats were read along the transect at 3-m (10-ft) intervals for a minimum of 213 m (700 ft) or until the number of species within several successive plots had not increased.

All plants were identified using Martin and Hutchins (1980), Foxx and Hoard (1984), and Foxx and Tierney (1985). When necessary, voucher specimens were collected and archived in the herbarium at BRET's lab at LANL. Any questionable identifications were clarified by consultation with the University of New Mexico Herbarium in Albuquerque.

3.3 Threatened, Endangered, and Sensitive Species

3.3.1 Peregrine Falcon Survey Procedures

The breeding habitat of peregrine falcons consists of nesting and foraging areas and occupies steep cliffs in wooded or forested habitats. Topography is the primary determining factor in characterizing peregrine breeding habitat (Johnson 1985). BRET subcontracted to Terrell Johnson to develop a habitat mangagement plan for Peregrines. In Los Alamos County, Johnson (1992) identified one primary nesting area for peregrine falcons within the Pueblo-Bayo Canyon complex. Johnson (1985) included two potential secondary use areas in Los Alamos Canyon as suitable nesting sites while assessing potential impacts of a now existing firing range on peregrine falcons. Additionally, he identified Pueblo Canyon as providing high quality, suitable nesiting sites, and also discussed the fact that peregrine falcons had been observed nesting in Pueblo Canyon and foraging in Los Alamos Canyon. No other sites on Laboratory property have been identified as supporting peregrine falcons.

3.3.2 Spotted Bat Survey Procedures

To survey for spotted bats, BRET deployed mist nets in areas of highest spotted bat habitat suitability. Because of the high flight patterns of spotted bats, mist nets were placed on 6- to 9-m (20- to 30-ft) poles. Multiple mist nests were placed on each pole. Nets were deployed at dusk and inspected every fifteen minutes. If a bat was found in a net, it was removed and the species, sex, age, reproductive condition, location, net height, direction of entry to the net, and date and time of capture were recorded on data forms. Bats were released after the information was recorded.

3.4 Wetlands Survey Procedures

To identify all wetlands, BRET first consulted National Wetland Inventory maps produced by the US Fish and Wildlife Service (1985) and then conducted vetgetation surveys in potential wetland areas. BRET used the vegetation data to compile a plant checklist and then consulted *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) to determine which plants were wetland indicator species. If indicator species were present, the area was considered a wetland. BRET did not delineate wetland boundaries during these surveys, but will map them at a later date if they could be affected by construction activities.

4. SURVEY RESULTS

4.1 Level 1 (Reconnaissance) Surveys

During the Level 1 survey, BRET located sampling locations, established the best access routes for future work, and began general observations of wildlife, terrain, and the degree of disturbance at the site. In addition, the reconnaissance surveys identified four general plant zones to use as search criteria in the BRET TES database:

- Mixed conifer
- Ponderosa pine
- Wetlands
- Riparian areas

We established four vegetation transects within OU 1100, all within Sandia Canyon, to evaluate the understory and overstory components. Other transects were done in Los Alamos Canyon near the boundary of OU1100.

4.1.1 Species Identified in the BRET Database Search

The initial search of the BRET TES database revealed a number of species whose general habitat requirements matched the vegetation types identified in the project area. This list includes plants and animals from state and federal listings.

4.1.1.1 Threatened and Endangered Plants

Federally Listed Species: The database search did not identify habitat in the project area that would be suitable for any federally listed plant species.

State-Listed Species: Only the wood lily (*Lilium philadelphicum* var. *andium*), which is listed as state endangered, met the search criteria. Table 1 lists the wood lily's status, habitat, and potential for occurrence within OU 1100.

4.1.1.2 State Listed Sensitive Plants

Under the Endangered Species Act and New Mexico State statutes, only those plant species that are listed or are a candidate for listing are protected. New Mexico also lists those species occurring within the state that are considered rare because of restricted distribution or low density. Rare plants are sensitive to long-term or cumulative land-use impacts and are vulnerable to biological or climatic events. The State

monitors these species to determine if they should be evaluated for endangered status. Table 1 lists these sensitive plant species, their habitat, and the potential for occurrence.

4.1.1.3 Federal- and State-Listed Wildlife

Table 1 lists federal- and state-listed wildlife species, their status, habitat, and occurrence potential.

Federally listed species: Four endangered, threatened, or proposed candidate species met the search criteria: the northern goshawk, the peregrine falcon, the Mexican spotted owl, and the spotted bat.

State-Listed Species: Two species met the search criteria that were either state endangered (Group 1) or threatened (Group 2) species: the spotted bat and the peregrine falcon.

TABLE 1: Threatened, Endangered, and Sensitive (TES) Species That May Inhabit OU 1100

SCIENTIFIC NAME	COMMON NAME	STATUS *	HABITAT	POTENTIAL TO OCCUR⊗
Wildlife				
Accipiter gentilis	Northern goshawk	FCC2	Ponderosa pine/Gambel's oak, ponderosa pine/gray oak, mixed conifer	Moderate
Euderma maculatum	Spotted bat	FCC2 SPG2	Ponderosa, piñon-juniper; cliffs and rock crevices	Moderate
Falco peregrinus	Peregrine falcon	FE SPG1	Ponderosa-piñon; cliffs and rock outcrops on cliffs	Moderate
Strix occidentalis	Mexican spotted owl	FT	Forested mountains and canyons. Generally uneven-aged, multi-storied forest with closed canopy.	Low
Plants				
Aletes sessiliflorus, Theobald & Tseng	Sessile-flowered false carrot	SS	Piñon-juniper; rocky canyons or slopes, usually basaltic or sandstone areas; 6500-8100 ft	Low
Astragalus cyaneus, Gray	Cyanic milk vetch	SS	Piñon-juniper; sandy or gravelly hillsides; 5500-6000 ft	Low
Astragalus feensis, M.E. Jones	Santa Fe milk vetch	SS	Piñon-juniper; dry slopes; 5000-6500 ft	Low
Astragalus mollissimus, Torr. var. mathewsii (Wats)	Mathew's woolly milk vetch	SS	Open slopes and ridges in piñon pine forests; sometimes in canyons; 5000-6000 ft	Low
Astragalus puniceus, Osterh. var. gertudis (Green)	Taos milk vetch	SS	Open, loose soil in piñon and juniper areas; 7000 ft	Low
Lilium philadelphicum var. *andium*	Wood lily	SE3	Ponderosa to mixed conifer; 6000-10,000 ft	Low
Mammillaria wrightii, Engelm.	Wright fishhook cactus	SE2	Desert grassland to piñon-juniper; gravely or sandy hills or plains; 3000-7000 ft	Low
Opunita viridiflora, Britt. and Rose.	Santa Fe cholla	FCC2	Piñon-juniper; 7200-8000 ft	Low
Silene plankii	Plank's catchfly	SS	Mountains along Rio Grande in piñon-juniper	Low
Silene plankii, Hitchc. and Maguire	Plank's catchfly	C3	Piñon-juniper; crevices and pockets in protected cliff faces of igneous rock; 5000-6000 ft	Low
Tetradymia filifolia, Greene	Threadleaf horsebrush	SS	Piñon-juniper; limestone or highly gypseous soils; 6000-7000 ft	Low
Toumeya papyracantha, (Engelm.) Britt., Rose.	Grama grass cactus	FCC2	Sandy soil in piñon-juniper; basalt outcrops; 5000-7300 ft	Low

•CODES FOR LEGAL STATUS

FE = federally endangered
FPT = federally proposed as threatened
FT = federally threatened
FCC2 = federal candidate as a C2
SE1 = state protected and listed as threatened or endangered under the Federal Endangered Species Act
SE2 = state protected, so rare across its entire range with limited distribution and population size that unregulated collection jeopardize its survival in New Mexico
SE3 = state protected, widespread in or adjacent to New Mexico, but its numbers are being significantly reduced to such a degree that its survival within New Mexico is jeopardized
SPG1 = state protected as a Group 1 species (endangered)
SPG2 = state protected as a Group 2 species (threatened)
SS = state sensitive

⊗POTENTIAL TO OCCUR

High= species is known to occur in the area
Moderate= the area has some species habitat components
Low = the area does not have species habitata components

4.2 Level 2 (Habitat Evaluation) Surveys

4.2.1 Overstory of Los Alamos Canyon

Los Alamos Canyon bottom is a forest dominated by ponderosa pine (*Pinus ponderosa*). Shrub layer dominance depends on topography and elevation.

The Los Alamos Canyon branch located near the western boundary of OU 1100 is dominated by Douglas fir (*Pseudotsuga menziesii*) and ponderosa pine. Gambel oak (*Quercus gambelii*) dominates the shrub layer. Appendix E summarize the percent canopy cover, frequency, average DBH, and trees per acre within the four overstory transects. An importance index was calculated using these data.

4.2.2 Understory of Los Alamos Canyon

The understory of Los Alamos Canyon is predominantly

- mountain muhly (*Muhlenbergia montana*)
- brome grass (*Bromus* spp.)
- bluegrass (*Poa* spp.)
- redtop (*Agrostis alba*)
- blue grama (*Bouteloua gracilis*)

Appendix F lists the percentage of each understory component (litter, bare soil, rock, graminoids, and forbs). We calculated importance values for each understory species and summed relative percent cover and frequency averages to obtain the importance values for each species.

4.3 Level 3 Surveys (Species Specific Surveys)

4.3.1 Species Dismissed from Further Consideration

Of the species identified in the database search, BRET eliminated ten plant and one animal species from further consideration in this study. These species are not expected to occur in the project area for the reasons given below.

- the Mexican spotted owl (*Strix occidentalis* var *lucida*) inhabits mixed-conifer and ponderosa-Gambel oak forest in mountains and canyons in the southwestern United States and northern Mexico with the following characteristics: (USFWS 1990)

  -high canopy closure
  -high stand diversity
  -multilayered canopy resulting from an uneven age stand
  -large, mature trees
  -downed logs
  -snags
  -stand decadence as indicated by the presence of mistletoe

  In addition, spotted owls favor narrow steep canyons where there is little light penetration and temperatures are cool. Therefore, spotted owls tend to prefer north-facing slopes (Ligon 1926; Erlich et al. 1988). Spotted owls nest in trees, crevices or small caves (Travis 1992).

  Terrell Johnson (1993) developed a topographic model of potential spotted owl habitat in New Mexico. In addition to this model, Johnson is developing a similar model to be used for Los Alamos National Laboratory. Results from initial modeling have indicated three areas within Laboratory boundaries that could have potential owl habitat. The areas are the junction of Two-Mile and Pajarito Canyon, a section of Los Alamos Canyon below TA-2, Omega Site, and an area near the junction of Water Canyon and Cañon del Valle. Because the model is based on topographic features, the nature of the forest stand is unaccounted for.

  The forest in Los Alamos Canyon within OU1100 is relatively open-canopied, with an average canopy cover of 36%, and spotted owls would thus most likely not inhabit the area.

- the Wright fishhook cactus *(Mammillaria wrightii* var. *wrightii)* grows on gravelly and sandy hills or plains, desert grasslands, and piñon pine-juniper zones (NMNPPAC 1984). Habitat evaluations indicated that mesa tops, canyon walls, and canyon bottoms have stands of piñon and juniper and contain sandy alluvial areas (Totavi gravelly, loamy sands) are found along the bottom of Ancho Canyon. However, the cactus was not found during field surveys.
- the Santa Fe cholla (*Opuntia viridiflora*) has been found only in an urban area in Santa Fe County. They appear to be strongly associated with south- and west-facing slopes in piñon-juniper woodlands at about 2195 m (7200 ft) (NMNPPAC 1984). Although the project area includes terrain at this elevation, BRET found no specimens of this cactus during Level 1 and Level 2 surveys.
- Grama grass cactus (*Toumeya papyracantha*) inhabits sandy soils within basalt outcrops in piñon-juniper woodlands. Although there are piñon-juniper woodlands in the OU, no specimens of this cactus were found during field surveys, and none were found in previous surveys.

However, the grama grass cactus is noticeable only between April and June; a Level 3 survey was not conducted during this period.

- the sessile-flowered false carrot (*Aletes sessiliflorus*) lives in rocky canyons and slopes, usually on substrates of basalt or sandstone. This species was not included in further analyses in this study because it is found primarily in south-central New Mexico and has not been found in Los Alamos County.
- the threadleaf horsebrush (*Tetradymia filifolia*) lives on limestone or gypsiferous soils. This species has not been recorded for Los Alamos County and was not encountered during the Level 2 surveys.
- Plank's catchfly (*Silene plankii*) grows in piñon-juniper habitats and is known to inhabit igneous rock crevices along the Rio Grande. It is restricted to mountains characterized by steep to sheer rocky canyons in protected areas that receive little direct sunlight. It has not been found in Los Alamos County and was not encountered during the Level 2 surveys.
- the Cyanic milkvetch (*Astragalus cyaneus*) inhabits sandy or gravelly slopes in piñon-juniper vegetation. The species usually grows adjacent to the Rio Grande and has not been found in Los Alamos County. Although there is habitat for this species in the project area, it was eliminated from further study because numerous surveys in similar habitat throughout LANL did not encounter it (Foxx and Tierney 1985, Banar 1993).
- the Santa Fe milkvetch (*Astragalus feensis*) is found on dry slopes in piñon-juniper woodlands. The species has not been recorded for Los Alamos County and was not found during the Level 2 surveys.
- Mathew's wooly milkvetch (*Astragalus mollissimus*) inhabits slopes, ridges, and canyons in open country. The species has not been recorded for Los Alamos County and was not found during the Level 2 surveys.
- Taos milkvetch (*Astragalus puniceus*) lives on dry slopes in open areas of piñon pine-ponderosa woodlands. This species was dismissed from further consideration because numerous surveys did not find it anywhere in Los Alamos County, nor was it found in any of the Level 2 surveys.

4.3.2 Species Selected for Level 3 Surveys

The Level 2 survey identified habitat in the project area suitable for the wildlife species listed below; BRET completed species-specific surveys, where possible, to confirm their presence or to infer their absence in OU 1100.

4.3.2.1 Northern Goshawk

The northern goshawk is currently a candidate species, listed with the USFWS as a "Category 2 species." In the Southwest, goshawks inhabit ponderosa pine, mixed species, and spruce-fir habitat (Kennedy 1988, Reynolds et al. 1992). Their nest site requirements include:

- dense, mature, or old growth coniferous forests containing trees with a diameter of at least 45.72 cm (18 in.) (Reynolds 1989)
- a location within a quarter mile of water (Kennedy 1988)

The home range of the goshawk usually includes a variety of forest conditions that include:

- foraging areas with open canopy cover
- snags, downed logs, woody debris, large trees, herbaceous and shrubby understories, and interspersion of forest age classes (Reynolds et al 1992)

Post fledgling family areas (PFAs) are characterized by:

- snags, downed logs, and woody debris
- forest interspersed with smaller canopy openings
- a majority of trees with a diameter of at least 30.5 cm (12 in.)

Because there is suitable habitat within OU1100, goshawk surveys were conducted within OU1100. In 1987 and 1988 Kennedy completed raptor surveys within Los Alamos Canyon and in surrounding areas (Kennedy 1989). These surveys revealed two raptor species (Cooper's hawk and red-tailed hawk) that currently nest in Los Alamos Canyon. Although some goshawk habitat components exist, neither she nor others report sightings within the canyon system (Sinton and Kennedy 1993).

4.3.2.2 Peregrine Falcon

Peregrine falcons nest where they can establish breeding territories with areas suitable for both nesting and foraging. Optimal habitat includes:

- breeding territories near cliffs that are within areas of ponderosa and piñon pines
- large nearby gulfs of air, which permit peregrines to attack their prey from above

Topography is the primary determining factor in characterizing peregrine breeding habitat (Johnson 1985). Peregrine foraging areas may extend to 32 km (20 mi) from a nest site, but an estimated 90% of foraging occurs within a radius of 16 km (10 mi).

Based on the fact that some components of suitable habitat occur within OU1100, surveys were conducted. Nesting peregrines have been observed in Pueblo Canyon north of LANL boundaries. During 1990, young male birds were found in upper Chaquehui Canyon, but there was no evidence of nesting in the area. No

sightings of this species nesting in OU 1100 have been recorded and none were observed during the surveys. The known foraging areas are near the Rio Grande outside OU 1100.

4.3.2.3 Spotted Bat

The spotted bat (*Euderma maculatum*) is a federal listed Candidate 2 (C2) and is listed by the New Mexico Department of Game and Fish (NMDGF) State Game Commission as Endangered, Group 2. Under this category, a specie's prospects of survival are likely to be at risk in the foreseeable future. Spotted bat distribution covers much of the western United States and northwestern Mexico (Watkins 1977), but capture of this bat is rare. It was first recorded in New Mexico in 1961, when two spotted bats were captured at Ghost Ranch in Rio Arriba County (Constantine 1961). Since then, the Museum of Southwestern Biology has captured a few specimens (Findly 1972). Spotted bats have been found at Lake Roberts, Mt. Taylor, and the Jemez Mountains. This species has not previously been found in Los Alamos County.

The spotted bat's habitat varies. It has been observed in grassland, desert shrub, pinon-juniper, ponderosa, mixed conifer, spruce-fir, and riparian habitats (NMDGF 1988). It has most often been seen in areas with sage brush, rabbitbrush, short grasses, and open ponderosa pine (Tyrell and Brack 1990). Key habitat for this species includes:

- a source of water with standing pools for foraging
- rock crevices on high cliff faces
- loose rocks or boulders under which to shelter during the day

The bat's diet seems to consist mainly of nocturnal moths (Leonard & Fenton 1983). Bats will return to the same roost sites night after night.

During 1991, limited bat mist netting on Laboratory lands did not capture any spotted bats. Attempts to mist net in the vicinity of OU 1100 were not successful, perhaps due to heavy rains. Also, a team of

independent contractors supported by BRET personnel again surveyed Los Alamos Canyon for bats in the summer of 1992. Two nights of mist netting captured no spotted bats (Tyrell and Brack 1992).

4.3.2.4 Meadow Jumping Mouse

The meadow jumping mouse (*Zapus hudsonius luteus*) prefers wetlands and other mesic habitats, such as permanent streams and wet meadows. Joan Morrison, state expert on the jumping mouse, evaluated habitat in Los Alamos Canyon where the flows are intermittent but dependable in late spring to early summer because of releases from Los Alamos Reservoir. She reported an area near the Reservoir that may have suitable habitat (Morrison 1990, 1992).

Meadow jumping mouse habitat includes:

- permanent free-flowing water, riparian zones along steam and ditches, or wet meadows near cattail marshes associated with major rivers (Morrison 1992)
- dry higher ground near waterways to provide locations for nesting and hibernation
- damp or moist soil with no standing water
- dense, tall vegetation (0.5 m or greater) dominated by grasses and forbs, providing thick cover and food sources

In the Jemez Mountains-Española area, the meadow jumping mouse is most active from June through September; breeding occurs between May and September (NMDFG 1988).

During the summer of 1992, BRET set up a trapping grid in Los Alamos Canyon, west of the Diamond Drive bridge and roughly 2.5 miles downstream from the reservoir. We trapped, without result, for four nights. We did not trap further down the stream where the flow was intermittent and less dependable during the summer.

4.3.2.5 Jemez Mountains Salamander

The Jemez Mountains salamander (*Plethodon neomexicanus*) is designated as a state threatened (Group II) species and is a candidate (C1) species for federal listing. The species is endemic to north-central New Mexico and is known only from the Jemez Mountains. This is a relict species that has a restricted range and narrow ecological requirements. All areas found to contain the salamander are considered key habitat.

Jemez Mountains salamanders occur in coniferous, wooded areas with cool, moist, and shaded sites ranging from 2190 to 3290 m (7183 to 10791 ft). They spend most of their lives under rocks and in well-decayed logs in mixed conifer communities. The greatest numbers of salamanders have been found in stabilized talus slopes. Their skins must remain moist at all times or they will quickly die. The major threat to salamanders is habitat alteration, especially changes resulting in drier conditions, from such activities as logging and other vegetation removal (NMDGF 1988).

During early August 1991 after heavy rains, BRET surveyed for salamanders approximately 1/4 mile west of the bridge in Los Alamos Canyon on the north-facing slope. The area was a mixed-conifer plant community with a downed log cover of less than 5%. Soil moisture was relatively low. The survey efforts did not reveal any salamanders. Because we found no salamanders on the north-facing slope, we performed no survey of the south-facing slope, which has a lower soil moisture content.

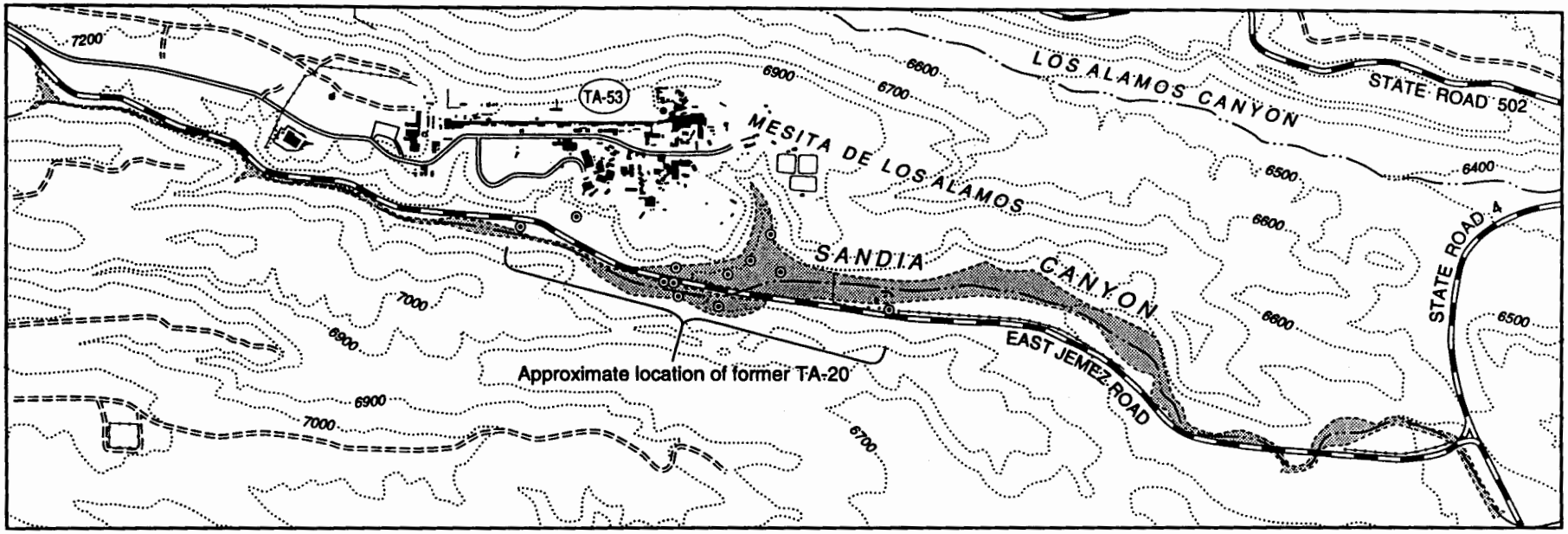
4.4 Floodplains and Wetlands

Within OU 1100, there is a 100-year floodplain in Sandia Canyon (see Fig. 4).

Using the maps drawn up by the USFWS on wetlands at LANL, BRET determined there is one palustrine, temporarily-flooded wetland and four intermittent riverine wetlands in OU 1100 (see Fig. 5). BRET did not delineate exactly where wetlands occur because the exact sampling locations for site characterization are uncertain. However, when the ER Program determines the sampling plan, we will delineate the applicable wetland boundaries.

5 IMPACTS

The following section addresses impacts caused by soil characterization procedures or carelessness. It concentrates on sensitive species and habitats and is not an inclusive listing of all possible impacts to the OU 1100 environment.



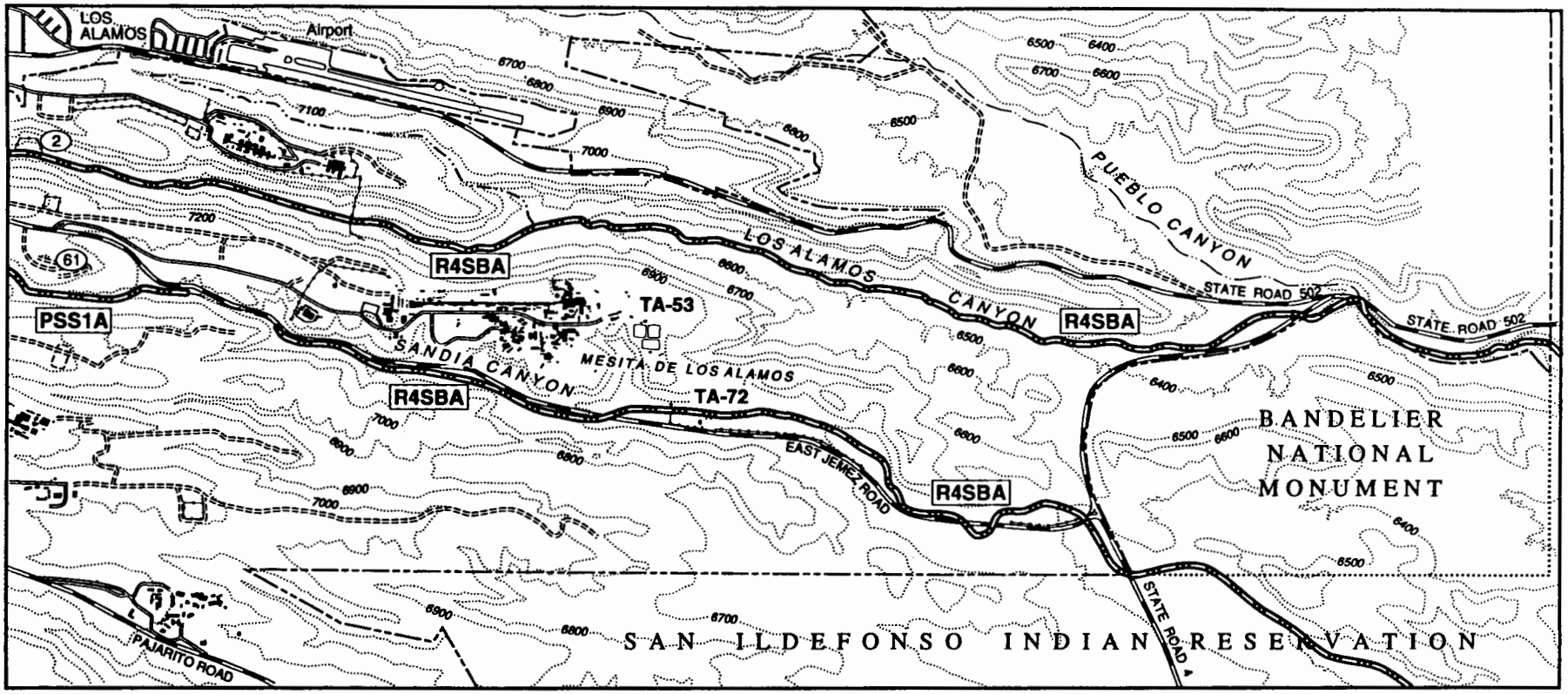
Base map sources: FIMAD 1993, G1011473
U.S.G.S. 1984, White Rock, N.M. 7.5' topo. quad.
McLin 1992, 0825
Modofied by: cARTography by A. Kron 5/15/94

0 500 1000 ft

Building or structure
Approximate PRS location within former TA-20
Major paved road
Secondary road
Unimproved road
Fence
Ephemeral stream
Approximate area of 100-year floodplain
100-ft contour line

N

Fig 4. Location of 100-year floodplain and PRSs in Sandia Cany nd former TA-20.



Base map sources: FIMAD 1993, G1011473
U.S.G.S. 1984, White Rock, N.M. 7.5' topo. quad.
Modified by: cARTography by A. Kron 5/15/94

Major paved road
Secondary road
Unimproved road
Fence
Ephemeral stream
Contour interval 100 ft
Laboratory boundary
Other political boundary
(53) Technical area number
Building or structure
Wetland area
(PSS1A = Palustrine, scrub-shrub, broad-leaved deciduous, and temporarily flooded wetland; R4SBA = Riverine, intermittent, streambed, temporarily flooded)

0 500 1000 ft

N

Figure 5. Wetlands map of OU 1100.

5.1 Floodplains and Wetlands

Sampling within the Operable Unit may include core drilling to a depth of 2.4 cm (6 in.) or more. We foresee no impact from such surface sampling. However, heavy equipment and coring within a wetland area could result in the discharge of fill into the wetland, which could destroy wetland vegetation.

5.2 Threatened, Endangered, and Sensitive Species

5.2.1 Northern Goshawk

The majority of sampling will be done by hand or with hand augers; these techniques will keep impacts low. If sampling will be conducted with any heavy equipment, impacts that could ocur are as follows:

- during the breeding and nesting season (March through August), human activity and mechanical disturbance such as vehicles, drill rigs, back hoes, generators, and machine sampling within a quarter mile of a nest site may cause the goshawk to abandon the nest or to not feed the young adequately
- canopy or tree removal can decrease nesting and perching habitat
- removing or disturbing large areas of vegetation can affect prey species availability, which may result in decreased use of the area by the goshawk

5.2.2 Peregrine Falcon

Although disturbances associated with soil sampling could affect peregrine falcons, Johnson (1985) stated that disturbances such as pedestrian and motor vehicle traffic in Los Alamos Canyon near suitable nesting sites would likely have no effect on nesting or foraging peregrine falcons if present in that area. In addition, Johnson suggests delineating sensitive core areas around suitable nest sites of up to 1950 m (6396 ft), depending on the type of disturbance and surrounding habitat (Johnson 1985). Based on this information, soil sampling with hand-held augers should have no effect on peregrine falcons if conducted more than 1950 m (6396 ft) from known or suspected nest sites.

The use of heavy machinery, such as drill rigs, could result in the following impacts to breeding peregrine falcons if present in the project area:

- peregrine falcons can be disturbed by disturbances up to 3.2 km (9.8 mi) away (Johnson 1992)
- sampling disturbances occurring during a sensitive time (i.e., the breeding period, March through September) could affect breeding pairs (i.e., nest abandonment)
- excessive damage to potential foraging habitat could affect densities of associated prey species
- habitat modifications such as vegetation clearing could result in loss of potential prey species; however, Johnson (1985) suggests that even projects such as machine sampling, which could cause more impacts than hand sampling to vegetation, were expected to have only slight effects on prey species

5.2.3 Spotted Bat

The spotted bat is affected by the following:

- destruction of caves and rock crevices in high cliffs will reduce the available roosting sites for the spotted bat, and use of any heavy equipment larger than hand augers on canyon slopes may adversely affect these areas
- nearby streams or water sources may be damaged if heavy equipment such as drill rigs and other vehicles are driven through these features. Dumping of soil and sediment into streams can also alter water sources

5.2.4 Meadow Jumping Mouse

The following impacts could occur to the potential meadow jumping mouse habitat:

- heavy equipment sampling or backfilling of stream channels could damage riparian or wetland areas, which could destroy breeding and foraging habitat
- mowing of riparian areas or other dense, tall, streamside vegetation would destroy potential habitat

5.2.5 Jemez Mountains Salamander

Impacts to the salamander include:

- habitat destruction due to tree removal
- soil disturbance and erosion
- removal of downed logs
- any activity that increases surface drying

Sampling for the site characterization should not require extensive tree removal, but some soil disturbance may occur.

5.3 Sensitive Species

In Los Alamos Canyon there is a Cooper's hawk nest site that has been productive throughout the years. This species does not have a threatened or endangered species status, but the Migratory Bird Treaty Act protects it from harassment and collection. Impacts to this species include excessive activity or noise during the mating and nesting periods (May-September), which could lead to nest abandonment.

5.4 Erosion

The Environmental Management Group should plan sampling so as to minimize erosion, which could affect wetland and riparian areas. Sampling teams should avoid driving large equipment indiscriminently throughout the area; such activity could harm ground cover and soil crust, thereby increasing chances of causing erosion.

6 MITIGATION

6.1 Floodplains and Wetlands

Teams should complete all sampling outside designated wetlands, which BRET will delineate within two years of the sampling in order to maintain the validity of the results. Presently in Los Alamos Canyon, wetlands occur adjacent to the stream channel.

If sampling teams use heavy equipment during site characterization, they should follow these steps to prevent unnecessary impacts:

- avoid disturbances that could produce or initiate erosion along the drainages and steeper slopes
- minimize excessive off-road travel that may disturb vegetation and cause erosion
- avoid excessive disturbance to vegetation and soil surfaces that could alter the water flow, widen the stream channel, or both
- avoid hazardous fuel spills or leaks from vehicles or sampling machinery

Sampling and corrective actions may require revegetating the disturbed area. The Environmental Management Program should contact BRET for assistance if this is necessary.

6.2 Protected Species

6.2.1 Northern Goshawk

To preserve potential goshawk habitat, soil samples that require the use of heavy equipment or other intrusive sampling methods into canyons in this OU must be scheduled between October 1 and February 28. If scheduling requirements mandate that sampling be conducted outside of this time, the following mitigation measures must occur:

- schedule use of heavy equipment for sampling activities for October 1 through February 28, when goshawks are not breeding or nesting;
- BRET will conduct broadcast surveys prior to sampling to determine whether there are nest site locations and occupancey. Surveys must be conducted between May 15 and June 30. If nest sites are found or the survey is not conducted, sampling for that area cannot begin until October 1. If nest sites are not occupied or gashawks are not found, sampling can be initiated in a canyon;
- if any sampling activity would disturb or destroy over one-tenth acre of understory, BRET must be contacted to evaluate the removal. BRET will have a species expert (e.g., Patricia Kennedy) to aid in evaluating forage area loss. If an adverse impact is expected, BRET will not approve the vegetation removal;
- tree removal in all canyons should be minimized. BRET must approve any tree (live or snag) removal in canyons. BRET will determine if the tree(s) could be used for goshawk perching or nesting and if tree removal would change canopy characteristics. BRET will not approve tree removal if it would adversely affect goshawk habitat.

6.2.2 Peregrine Falcon

There have been no known peregrine nests within Los Alamos Canyon. Although there are no expected impacts to peregrine falcons in OU 1100, disturbance in the middle to lower section of Los Alamos Canyon (starting at the western boundary of OU 1100 and extending to New Mexico State Road 4) must be kept to a minimum. (Note: this area is not within the boundary of OU 1100.)

A field survey will be conducted by a species specialist (Terrell Johnson) prior to sampling to determine the presence/absence of the peregrine falcon. If absent, sampling can proceed. If present or if presence is suspected, a determination of whether sampling can proceed will be made based on location of the falcon and the type and location of the sampling. This could result in a restriction on sampling from March 1 to August 30 and avoiding the area after dark from February 1 to August 30 (Johnson 1992).

6.2.3 Spotted Bat

No studies have found spotted bats in Los Alamos County; however, viable habitat is present in OU 1100. In order to avoid impacts to spotted bats, the following mitigation measures must be followed:

- if sampling requires equipment larger than hand augers on the slopes of Los Alamos Canyon, a biologist from BRET must be present before sampling to conduct a survey of all rock cervices in the sampling area; if the biologist finds any evidence of bats in the sampling area, all sampling with heavy equipment on that slope will be cease until further investigations of species presence are made;
- prior to sampling, BRET must approve any disturbance, including vehicle, drill rig, and backhoe travel through water sources and any backfilling of streams, that may alter existing water sources. If the disturbance would alter the source so that it is no longer suitable for spotted bats, the disturbance will not be allowed. BRET will have a species expert (e.g., 3D/Environmental, Inc.) to aid in evaluating forage area loss.

6.2.4 Meadow Jumping Mouse

To protect a meadow jumping mouse population that may inhabit the project area, the following mitigation measures must be followed:

- 60 days prior to sampling within riparian areas, BRET must evaluate the need for a site-specific survey. If a meadow jumping mouse is necessary, sampling cannot proceed until the survey is complete. Surveys will be conducted only during periods when mice are active, the optimal time being in July during the rainy season. If the mouse is present or if tits presence is suspected, BRET will assess the type of sampling and its location in relation to the specie's site, and from this information make a determination of whether sampling can proceed;
- all site sampling should be conducted in a manner that leaves streamside habitat and vegetation undisturbed;
- the sampling teams should preserve nearby, intact, dry areas that the mice could use as hibernacula;
- limit foot traffic and avoid mowing grassy areas near stream channels and marshy areas;
- limit off-road driving by using existing roads;
- do not drive through streams or dump sediments into streams

6.2.5 Jemez Mountains Salamander

The following mitigation measures must be followed for sampling on north-facing slopes within OU 1100:

- a biologist from BRET must be present during sampling; if salamanders are found, all ground-disturbing activities at that site must cease immediately
- any trees that are cut must be left in place to enhance habitat
- activity will not be permitted when the soil surface has a high moisture content
- all disturbed areas must be revegetated with native plants
- downed logs and talus slopes must not be needlessly disturbed

The Environmental Restoration Program proposes Phase II sampling from the Los Alamos Reservoir to New Mexico State Road 4. Many more surveys will be necessary to ensure that such sampling will not threaten TES species and to delineate wetland and floodplain boundaries. Once ER defines phase II sampling procedures, the project leader should immediately notify BRET. We must complete the necessary biological fieldwork at specific times of the year or over an extended period; this could result in a considerable delay for sampling approval unless we receive sufficient advance notice. Sampling teams should follow these suggested management practices:

- avoid unnecessary disturbance to stream-side areas and their surrounding vegetation during sampling and travel to sampling sites; such disturbances include parking areas, equipment storage areas, and off-road travel
- avoid removal of vegetation and unnecessary soil disturbance along riparian and wetland areas as well as drainage and stream channels
- avoid disturbance to vegetation along canyon slopes and especially along existing drainages on these slope

6.2.6 Grama Grass

The following mitigation measures must be followed for sampling that will take place in the pinon-juniper woodlands of TA-53:

> BRET must conduct a Level 3 survey for grama grass cactus. Adequate advance notice must be given to enable BRET to survey during the April to June flowering period

6.3 Sensitive Species

Cooper's Hawk: In Los Alamos Canyon, within the boundary of OU 1100, there is a Cooper's hawk nest that has been productive over the years. Sampling teams should follow these mitigation measures to prevent impacts to hawks and other raptors in the canyon system:

- sample outside the Cooper's hawk nesting area during the mating, nesting, and fledgling times (September - March)
- sample in Los Alamos Canyon outside of a 1/2 mile radius of the municipal well because the nest is located near the well

6.4 Erosion

Sampling and corrective actions may require revegetating the disturbed area to prevent erosion. The Environmental Restoration Program should contact BRET for assistance in planning any revegetation projects and should also follow the recommended mitigation measures suggested for the wetlands (Section 6.1).

7 ACKNOWLEDGMENTS

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8 REFERENCES

Banar, A., "Biological and Floodplain/Wetland Assessment for Environmental Restoration Program Operable Unit 1157, TAs 8 and 9," Los Alamos National Laboratory report LA-UR-93-4184 (1993).

Bogart, C., "The Amphibians and Reptiles of the Los Alamos National Research Park," Los Alamos National Laboratory unpublished report (1978).

Bowen, B. M., "Los Alamos Climatology," Los Alamos National Laboratory report LA-11735-MS UC-902 (May 1990).

Brown, D.E., "Biotic Communities of the American Southwest-United States and Mexico," in *Desert Plants* (Boyce Thompson SW Arboretum; Superior, Arizona, 1982).

Burton, B. W, "Geological Evolution of the Jemez Mountains and Their Potential for Future Volcanic Activity," Los Alamos National Laboratory report LA-8795-Geol (January 1982).

Constantine, D.G., "Spotted Bat and Big Free-Tailed Bat in Northern New Mexico," *Southwestern Naturalist* **6**, 92-97 (1961).

Daubenmire, R., "A Canopy-Coverage Method of Vegetation Analysis," *Northwest Science* **33**, 43-64 (1959).

Environmental Laboratory, "Corps of Engineers Wetlands Delineation Manual," US Department of the Army Research Program report 4-87-1 (January 1987).

Environmental Surveillance Group, "Environmental Surveillance at Los Alamos During 1987," Los Alamos National Laboratory report LA-11306-ENV (May 1988).

Erlich, P.R., D.S. Dobkin, and D.Wheye, *The Breeder's Handbook* (Simon and Schuster, Inc., New York, New ork, 1988), p. 294.

Findly, J.S., "Status of the Southwest Bat Population," Symposium on Rare and Endangered Wildlife of the Southwest, New Mexico Department of Game and Fish (1972).

Foxx, T. S. and G.D. Tierney, "Status of the Flora of the Los Alamos National Environmental Research Park," Vol.I, Los Alamos National Laboratory report LA-8050-NERP (May 1980a).

Foxx, T.S. and G.D. Tierney, *Status of the Flora of the Los Alamos National Environmental Research Park, A Historical Perspective*; Vol. II, Los Alamos National Laboratory report LA-8050-NERP (May 1980b).

Foxx, T. S., and D. Hoard, *Flowers of Southwestern Forests and Woodlands* (Los Alamos Historical Society; Los Alamos, New Mexico, 1984).

Foxx, T.S. and Tierney, G.D.; *Status of the Flora of the Los Alamos National Environmental Research Park. Checklist of Vascular Plants of the Pajarito Plateau and Jemez Mountains*; Vol. III, Los Alamos National Laboratory report LA-8050-NERP (June 1985).

IT, "Hydrogeologic Assessment of Technical Areas 54, Areas G and L, Los Alamos National Laboratory," International Technology Corporation report 3400 (1987).

IT; "Solid Waste Management Units Report, Los Alamos National Laboratory," International Technology Corporation report LA-UR-90-3400 (November 1990).

Johnson, T.H., "Biological Assessment of the Effects of the Proposed Firing Range in Los Alamos Canyon on the Peregrine Falcon," unpublished report (October 1985).

Johnson, T.H., "R-30 Peregrine Falcon Habitat Management Plan," unpublished report (February 1992).

Johnson, T.H., "Topographic Model of Potential Spotted Owl Habitat in New Mexico," for the New Mexico Department of Game and Fish unpublished report for contract 80-516.6-56 (1993).

Kennedy, P., "Habitat Characteristics of Cooper's Hawks and Northern Goshawks Nesting in New Mexico," in *Proceedings of the Southwest Raptor Symposium*, R.L. Glinski, et al., Eds., National Wildlife Federation Science and Technology Series No. 12 (1988), pp. 218-227.

Kennedy, P., "The Nesting Ecology of Cooper's Hawks and Northern Goshawks in North Central New Mexico; Summary of 1984-1988 Data Collection Efforts," report to NM Department of Game and Fish and US Department of Agriculture (1989).

Leonard, M.L., and M.B. Fenton, "Habitat Use by Spotted Bat (*Euderma maculatum*, Chiroptera:Vespertilionidae) Roosting and Foraging Behavior," *Canadian Journal of Zoology* **61**, 1478-1491 (1983).

Ligon, J.S., "Habitats of the Spotted Owl," *Auk* **43**, 421-429 (1926).

Lindsey, A.A., "Testing Line Strip Method Against Full Tallies in Diverse Forest Types," *Ecology* **36**, 485-495 (1955).

Martin, W. C., and C.R. Hutchins, *A Flora of New Mexico* (J. Cramer, Germany, 1980).

Morrison, J.L., "Bird Database of Los Alamos National Laboratory," Los Alamos National Laboratory unpublished report (1988).

Morrison, J.L., "The Meadow Jumping Mouse in New Mexico: Habitat Preferences and Management Recommendations;" in *Managing Wildlife in the Southwest* (P. Krausman and N. Smith, Eds; The Wildlife Society; Phoenix, Arizona, 1990), pp. 136-143.

Morrison, J.L., "Persistence of the Meadow Jumping Mouse, Zapus Hudsonius Luteus, in New Mexico," *The Southwestern Naturalist*; **37**, 308-311 (1992).

NMDGF, *Handbook of Species Endangered in New Mexico*, State of New Mexico (1988).

NMNPPAC, *A Handbook for Rare and Endemic Plants of New Mexico* (University of New Mexico Press, Albuquerque, New Mexico, 1984).

NM, "Wildlife Conservation Act of New Mexico," New Mexico State Act 1978, Sections 17-2-37 through 17-2-46 (July 1, 1974).

NM, "Endangered Plant Species Act," New Mexico State Act 1978, Section 9-10-10 (April 3, 1985).

Nyhan, J.W., L.W. Hacker, T E. Calhoun, and D.L. Young, "Soil Survey of Los Alamos County, New Mexico," Los Alamos National Laboratory report LA-6779-MS (1978).

Ramotnik, C.A., "Status Report, *Plethodon neomexicanus*, Stebbins and Riemer, Jemez Mountains Salamander, US Fish and Wildlife Report (July 1986).

Reynolds, R.T., "Accipiters," in *Proceedings of the Western Raptor Management Symposium and Workshop*, National Wildlife Federation Scientific and Technical Series Report Number 12 (1989), pp. 92-101.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Basset, P.L. Kennedy, D.A. Boyce Jr., G.Goodwin, R.Smith, and E.L. Fisher, "Management Recommendations for the Northern Goshawk in the Southwestern United States," USDA Forest Service Rocky Mountain Forest Range Experiment Station General Technical report RM-217 (1992).

Sinton, D.T., and P.L. Kennedy, "1993 Northern Goshawk Inventory on Portions of Los Alamos National Laboratory, Los Alamos, NM," Colorado State University report 9-XG2-Z7115 (1993).

Travis, J., "Atlas of the Breeding Birds of Los Alamos County, New Mexico," Los Alamos National Laboratory report LA-12206 (October 1992).

Tyrell, K. and V. Brack, "Survey for Bats in the Los Alamos National Environmental Research Park, with Special Emphasis on the Spotted Bat, *Euderma Maculatum*," 3D/Environmental Services, Inc., report (1992).

USDOE, "General Environmental Protection Program Regulations," US Department of Energy Order 5400.1 (November 9, 1988).

USDOE, "National Environmental Policy Act of 1969," US Department of Energy Code of Federal Regulation 10 CFR 1021 (April 24, 1992).

USFWS, "Executive Order 11988 Floodplain Management," US Fish and Wildlife Service Federal Register 42 FR 26951 (May 24, 1977a).

USFWS, "Executive Order 11990 Protection of Wetlands," US Fish and Wildlife Service Federal Register 42 FR 26961 (May 24, 1977b).

USFWS, "Compliance with Floodplain/Wetlands Environmental Review Requirements," US Fish and Wildlife Service Code of Federal Regulation 10 CFR 1022 (May 7, 1979).

USFWS, "User's Guide, National Wetlands Inventory Maps, Information and Legend for Map Products," US Fish and Wildlife Service (1985).

USFWS, "Endangered Species Act of 1973, as Amended Through the 100th Congress," US Fish and Wildlife Service (1988).

USFWS, "Clean Water Act," US Fish and Wildlife Service Code of Federal Regulation 40 CFR Parts 100-136, 230-233, and 400-471 (July 1, 1993).

USFWS, "Endangered and Threatened Wildlife and Plants: Rule to List the Mexican Spotted Owl as a Threatened Species," US Fish and Wildlife Service Federal Register 58 FR 14248 (1993).

Watkins, L.C., "*Euderma maculatum*," American Society of Mammologists, Number 77, pages 1-4 (June 15, 1977).

Woodin, E.H.D., and A.A. Lindsey, "Juniper-Pinyon East of the Continental Divide, as Analyzed by the Line Strip Method," *Ecology* **35**, 473-489 (1954).

Appendix A

Plant Checklist for OU1100

Plant Checklist for OU 1100 (TAs-53, -72)

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
ANACARDIACEAE	**Rhus radicans*	Rhra	Poison Ivy
	Rhus trilobata	Rhtr	Skunk Bush
ASCLEPIADACEAE	*Asclepias subverticillata*	Axsu	
	**Asclepias tuberosa*	Astu	Butterflyweed
BERBERIDACEAE	**Berberis fendleri*	Befe	Fendler Barberry
BETULACEAE	**Alnus tenuifolia*	Alte	Thin Leaf Alder
BORAGINACEAE	*Cryptantha jamesii*	Crja	James Hiddenflower
	**Lappula spp.*	Lapx	Stickseed
	**Lithospermum spp.*	Litx	Puccoon
CACTACEAE	*Echinocereus triglochidiatus*	Ectr	Hedgehog cactus
	Opuntia imbricata	Opim	Walkingstick Cholla
	Opuntia spp.	Opux	Prickly Pear Cactus
CAMPANULACEAE	**Campanula rotundifolia*	Caro	Hare Bell
CAPPARIDACEAE	**Cleome serrulata*	Clse	Rocky Mountain Beeweed
CHENOPODIACEAE	*Atriplex canescens*	Atca	Fourwing saltbush
	Chenopodium desiccatum	Chde	
	Chenopodium fenderli	Chfe	Lamb's quarters
COMPOSITAE	**Achillea lanulosa*	Acla	Yarrow
	Ambrosia artemisifolia	Amar	Common ragweed
	**Antennaria parvifolia*	Anpa	Pussytoes
	Artemisia carruthii	Arca	Wormwood
	Artemisia dracunculus	Ardr	False Tarragon
	Artemisia frigida	Arfr	Estafiata
	Artemisia ludoviciana	Arlu	Wormwood
	Artemisia tridentata	Artr	Big sagebrush
	**Bahia dissecta*	Badi	Wild Chrysanthemum
	Bidens cernua	Bice	Nodding beggartick
	Brickella spp.	Brix	Bricklebush
	Chrysopsis foliosa	Chfo	Golden Aster
	Chrysothamnus nauseosus	Chna	Chamisa, Rabbitbrush
	Circium spp.	Cirx	Thistle
	Conyza canadensis	Coca	Horseweed
	**Cosmos parviflorus*	Copa	Cosmos
	Erigeron divergens	Erdi	Fleabane Daisy
	Erigeron flagellaris	Erfl	Spreading Fleabane
	Grindelia aphanactis	Grap	Gummweed
	Gutierrezia sarothrae	Gusa	Snakeweed
	Helianthus annus	Hean	Annual Sunflower
	Helianthus petiolaris	Hepe	Sunflower
	Hymenopappus filifolius	Hyfi	Wild chrysanthemum
	Hymenoxys argentea	Hyar	Perky sue
	Hymenoxys richardsonii	Hyri	Bitterweed
	Lactuca spp.	Lacx	Prickly lettuce
	Liatris punctata	Lipu	Dotted gayfeather
	Macaeranthera spp.	Macx	Bllue aster
	**Rudbeckia lacinata*	Rula	Cutleaf Coneflower
	**Senecio fendleri*	Sefe	Fendler's Senecio
	Senecio multicapitatus	Semu	Groundsel, butterweed

Plant Checklist for OU 1100 (TAs-53, -72)

	**Senecio spp.*	Senx	Groundsel
	Solidago spp.	Senx	Goldenrod
	Taraxacum spp.	Tarx	Dandelion
	**Taraxacum officinale*	Taof	Dandelion
	**Thelesperma megapotimicum*	Thme	Indian Tea, Cota
	Thelesperma trifidum	Thtr	Greenthread
	Townsendia exscapa	Toex	Easter daisy
	**Townsendia incana*	Toin	Townsend's Aster
	Tragopogon dubius	Trdu	Salisfy, Goatsbeard
	**Verbesina enceliodes*	Veen	Crownbeard
	Vigueria multiflora	Vimu	Goldeneye
CRUCIFERAE	**Capsella bursa-pastoris*	Cabu	Shepherd's Purse
	Descurainia spp.	Desx	Tansy mustard
	**Erysium capitatum*	Erca	Western Wallflower
	**Thelypodium wrightii*	Thwr	Thelypody
CUPRESSACEAE	*Juniperus monosperma*	Jumo	One-Seeded Juniper
	**Juniperus scopulorum*	Jusc	Rocky Mountain Juniper
CYPERACEAE	**Carex spp.*	Carx	Sedge
ELAEAGNACEAE	*Elaeagnus angustifolia*	Elan	Russian Olive
EQUISETACEAE	**Equisetum spp.*	Equx	Horsetail
ERICACEAE	**Plerospora andromedea*	Plan	Pinedrops
EUPHORBIACEAE	**Croton texensis*	Crte	Doveweed
	Euphorbia dentata	Eude	Poinsettia spurge
	Euphorbia seripyfolia	Euse	Spurge
FAGACEAE	*Quercus gambelii*	Quga	Gambel Oak
	Quercus grisea	Qugr	Gray oak
	Quercus undulata	Quun	Wavyleaf
GERANIACEAE	**Geranium caespitosum*	Geca	James Geranium
	Geranium circutarium	Geci	Storksbill, afilaria
	Geranium richardsonii	Geri	Richards geranium
GRAMINEAE	*Agropyron smithii*	Agsm	Western Wheatgrass
	**Agropyron spp.*	Agrx	Wheatgrass
	**Agropyron trachycaulum*	Agtr	Slender wheatgrass
	Agrostis alba	Agal	Red top
	Andropogon gerardii	Ange	Big bluestem
	Andropogon scoparius	Ansc	Little bluestem
	Aristida divaricata	Ardi	Poverty three-awn
	**Aristida longiseta*	Arlo	Red three-awn
	Aristida spp.	Arix	Three-awn
	Blepharoneuron tricholepsis	Bltr	Pine dropseed
	Bouteloua gracilis	Bogr	Blue grama
	Bouteloua hirsuta	Bohi	Black grama
	**Bromus inermis*	Brin	Smooth Brome
	**Bromus marginatus*	Brma	Mountain Bromegrass
	Bromus spp.	Brox	Bromegrass
	**Bromus tectorum*	Brte	Downy Chess
	**Elymus canadensis*	Elca	Canadian Wildrye
	**Festuca octiflora*	Feoc	Six-Weeks Fescue
	Hordeum spp.	Horx	Wild barley

Plant Checklist for OU 1100 (TAs-53, -72)

	Lycurus phleoides	Lyph	Wolftail
	**Koeleria cristata*	Kocr	Junegrass
	Muhlenbergia montana	Mumo	Mountain muhly
	Muhlenbergia torreyi	Muto	Ring muhly
	**Muhlenbergia wrightii*	Muwr	Spike Muhly
	Oryzopis hymenoides	Orhy	Indian ricegrass
	Panicum capillare	Paca	Witchgrass
	Panicum obtusum	Paob	Vine mesquite
	**Phleum pratense*	Phpr	Common Timothy
	Poa fendleriana	Pofe	Bluegrass
	**Poa spp.*	Poax	Bluegrass
	Sitanion hystrix	Sihy	Bottlebrush Squirreltail
	Sporobolus cryptandrus	Spcr	Sand Dropseed
	**Stipa comata*	Stco	Needle-Grass
HYDROPHYLLACEAE	*Phacelia spp.*	Phax	Scorpionweed
JUNCAEAE	**Juncus spp.*	Junx	Rush
LABIATAE	**Monarda menthaefolia*	Mome	Horesmint
	Monarda pectinata	Mope	Ponymint
	**Salvia retroflexa*	Sare	Rocky Mountain Sage
LEGUMINOSAE	**Astragalus spp.*	Astx	Milkvetch
	**Lotus wrightii*	Lowr	Deer Vetch
	Lupinus caudatus	Luca	Lupine
	**Medicago lupulina*	Melu	Black Medic
	Melilotus alba	Meal	Sweetclover
	Melilotus officinalis	Meof	Yellow sweetclover
	**Petalostemum candidum*	Peca	White Prairie Clover
	Robinia neomexicana	Rone	New Mexico Locust
	**Thermopsis divosicarpa*	Thdi	Golden Banner
	**Thermopsis pinetorum*	Thpi	Big Golden-Pea
	**icia americana*	Viam	American vetch
LILIACEAE	*Alium cernuum*	Alce	Nodding onion
	Asparagus officinalis	Asof	Asparagus
	Yucca angustissima	Yuan	Narrowleaf yucca
	Yucca baccata	Yuba	Banana Yucca
LOASACEAE	*Mentzelia pumila*	Mepu	Blazing star
LORANTHACEAE	*Arceuthobium vaginatum*	Arva	Dwarf mistletoe
NYCTAGINACEAE	*Oxybaphus linearis*	Oxli	Desert Four O'Clock
OLEACEAE	*Forestiera neomexicana*	Fone	New Mexico Olive
ONAGRACEAE	*Oenothera coronopifolia*	Oeco	Cutleaf Evening Primrose
	**Oenothera hookeri*	Oeho	Hooker's Evening-Primrose
OROBANCHACEAE	*Orobanche fasciculata*	Orfa	Cancer root
OXALIDACEAE	**Oxalis metcalfei*	Oxme	Woodsorrel
PINACEAE	**Abies concolor*	Abco	White Fir
	Pinus edulis	Pied	Pinyon Pine
	Pinus flexilis	Pifl	Limber Pine
	Pinus ponderosa	Pipo	Ponderosa Pine
	**Pseudotsuga menziesii*	Psme	Douglas Fir
PLANTAGINACEAE	**Plantago purshii*	Plpu	Wooly Indian Wheat
POLEMONIACEAE	*Ipomopsis aggregata*	Ipag	Scarlet Trumpet

Plant Checklist for OU 1100 (TAs-53, -72)

POLYGONACEAE	*Eriogonum jamesii*	Erja	Antelope Sage
	Eriogonum polycladon	Erpo	Sorrel wild buckwheat
	**Polygonum convolvulus*	Poco	Black Binweed, Cornbind
	**Rumex mexicanus*	Rume	Dock
RANUNCULACEAE	**Clematis pseudoalpina*	Clps	Rocky Mountain Clematis
	**Thalictrum fendleri*	Thfe	Fendler Meadowrue
ROSACEAE	*Cercocarpus montanus*	Cemo	Mountain Mahogany
	Fallugia paradoxa	Fapa	Apache plume
	**Fragaria bracteata*	Frbr	Wild Strawberry
	Potentilla spp.	Ponx	Cinquefoil
	Prunus persica	Prpe	Peach, cultivated
	**Prunus virginiana var. melanocarpa*	Prvi	Western Black Chokecherry
	**Rosa arizonica*	Roar	Arizonia Rose
	**Rosa spp.*	Rosx	Wild Rose
	**Rosa woodsii var. fendleri*	Rowo	Fendler's Rose
	**Rubus strigosus var. arizonicus*	Rust	Red Raspberry
RUBIACEAE	**Galium spp.*	Galx	Bedstraw
RUTACEAE	**Ptelea trifoliata*	Pttr	Narrowleaf Hoptree
SALICACEAE	**Populus angustifolia*	Poan	Narrowleaf Cottonwood
	Populus fremontii	Pofr	Cottonwood
	**Populus tremuloides*	Potr	Aspen
	**Salix spp.*	Salx	Willow
SAXIFRAGACEAE	**Jamesia americana*	Jaam	Cliffbush
	Philadelphicus microphyllus	Phmi	Mockorange
	Ribes cereum	Rice	Wax Current
SCROPHULARIACEAE	*Castilleja integra*	Cain	Indian Paintbrush
	**Penstemon barbatus*	Peba	Bearded penstemon
	Penstemon secundiflorus	Pese	Beardtongue
	Penstemon spp.	Penx	Penstemon, beardtongue
	Verbascum thapsus	Veth	Mullein
SOLANACEAE	**Physalis foetens*	Phfo	Groundcherry
TAMARACACEAE	*Tamarix spp.*	Tamx	Tamarisk, salt cedar
TYPHACEAE	**Tylpha latifolia*	Tyla	Cattails
ULMACEAE	*Ulmus pumila*	Ulpu	Siberian elm
VALERIANACEAE	**Valeriana spp.*	Valx	Valerian, tobacco root
VERBRNACEA	*Verbena prostrata*	Vepr	Prostate verbena
VITACEAE	**Parthenocissus inserta*	Pain	Virginia Creeper

* This plant list was complied from the present data and the previous surveys listed below:

1=Foxx (1987)
2=Foxx (1988)
3=Miller (1988)
4=Tierney and Foxx (1989)

**** Bennett and Edeskuty (1991),***

Appendix B

Terrestrial Arthropods of OU1100

Terrestrial insects found on LANL property as of November, 1994. T. Haarmann		
ORDER	**FAMILY**	**COMMON NAME**
Thysanura (Bristletails)	Lepismatidae	Silverfish
	Machilidae	Jumping bristetail
Collembola (Springtails)	Sminthuridae	Globular springtail
	Entomobryiidae	Elongate-bodied springtail
	Isotomidae	Smooth springtail
	Hypogastruridae	Elongate-bodied springtail
Odonata (Dragon and damselflies)	Aeshnidae	Darner
	Libellulidae	Common skimmer
	Coenagrionidae	Narrow-winged damselfly
	Gomphidae	Clubtail
Phasmida (Walkingsticks)	Heteronemiidae	Common walkingstick
Orthoptera (Grasshoppers and crickets)	Acrididae	Short-horned grasshopper
	Gryllacrididae	Camel cricket
	Gryllidae	True cricket
Plecoptera (Stoneflies)	Perlidae	Common stonefly
Dermaptera (Earwigs)	Forficulidae	Common earwig
Thysanoptera (Thrips)	Thripidae	Common thrip
	Phlaeothripidae	Tube-tailed thrips
Hemiptera (True bugs)	Belostomatidae	Giant water bug
	Miridae	Plant bug
	Reduviidae	Assassin bug
	Phymatidae	Ambush bug
	Lygaeidae	Seed bug
	Cydnidae	Burrower bug
	Scutelleridae	Shield-backed bug
	Pentatomidae	Stink bug
	Anthocoridae	Minute pirate bug
	Piesmatidae	Ash-gray leaf bug
	Rhopalidae	Scentless plant bug
	Coreidae	Squash bug
	Gerridae	Water strider bug
	Nabidae	Damsel bug
Homoptera (Cicadas and kin)	Cicadidae	Cicada
	Aphididae	Aphid
	Cercopidae	Spittlebug
	Cicadellidae	Leafhopper
	Coccidae	Soft scale insect
	Delphacidae	Delphacid planthopper
	Psyllidae	Jumping plantlice
Neuroptera (Net-veined insects)	Myrmeleontidae	Antlion
	Hemerobiidae	Brown lacewing
	Raphidiidae	Snakefly
Coleoptera (Beetles)	Cicindelidae	Tiger beetle
	Carabidae	Ground beetle
	Silphidae	Carrion beetle
	Lampyridae	Firefly

	Cantharidae	Soldier beetle
	Lycidae	Net-winged beetle
	Buprestidae	Metallic wood-boring beetle
	Staphylinidae	Rove beetle
	Erotylidae	Pleasing fungus beetle
	Nitidulidae	Sap beetle
	Coccinellidae	Ladybird beetle
	Tenebrionidae	Darkling beetle
	Meloidae	Blister beetle
	Cerambycidae	Long-horned beetle
	Lucanidae	Stag beetle
	Scarabaeidae	Scarab beetle
	Chrysomelidae	Leaf beetle
	Curculionidae	True weevil
	Dermestidae	Dermestid beetle
	Bruchidae	Pea weevil
	Cleridae	Checkered beetle
	Cucujidae	Flat bark beetle
	Melyridae	Soft-winged flower beetle
	Mordellidae	Tumbling flower beetle
	Scolytidae	Bark beetle
Lepidoptera (Butterflies, moths)	Papilionidae	Swallowtail
	Lycaenidae	Copper
	Hesperiidae	Skipper
	Pieridae	White, sulphur, and orange
	Nymphalidae	Brush-footed butterfly
	Satyridae	Satyr, nymph, and artic
	Noctuidae	Noctuid moth
	Sphingidae	Sphinx moth
	Saturniidae	Giant silkworm moth
	Gelechiidae	Gelechiid moth
	Geometridae	Measuringworms
	Pterophoridae	Plume moth
Diptera (Flies)	Tabanidae	Horse and deer flies
	Therevidae	Stiletto fly
	Asilidae	Robber fly
	Bombyliidae	Bee fly
	Syrphidae	Hover fly
	Tachinidae	Tachinid fly
	Calliphoridae	Blow fly
	Cecidomyiidae	Gall midge
	Chironomidae	Midge
	Dolichopodidae	Long-legged fly
	Drosophilidae	Pomace fly
	Empididae	Dance fly
	Heleomyzidae	Heleomyzid fly
	Muscidae	House fly
	Mycetophilidae	Fungus gnat
	Phoridae	Humpbacked fly
	Pipunculidae	Big-headed fly

	Sarcophagidae	Flesh fly
	Simuliidae	Black fly
	Trichoceridae	Winter crane fly
	Tephritidae	Fruit fly
Siphonaptera (Fleas)	Pulicidae	Common fly
Hymenoptera (Bees, ants, wasps)	Ichneumonidae	Ichneumonid wasp
	Cynipidae	Gall wasp
	Mutillidae	Velvet ant
	Scoliidae	Scoliid wasp
	Formicidae	Ant
	Pompilidae	Spider wasp
	Eumenidae	Euminid wasp
	Vespidae	Vespid wasp
	Sphecidae	Sphecid wasp
	Halictidae	Metallic wasp
	Megachilidae	Leafcutting bee
	Apidae	Honey and bumble bees
	Chalcidiidea	Chalcidid wasp
	Mymaridae	Fairfly
	Tiphiidae	Tiphiid wasp
	Chrysididae	Cuckoo wasp
	Braconidae	Braconid wasp

Non-insect terrestrial arthropods found on LANL property as of October 1993.	
CLASS/ORDER	**FAMILY**
Chilopoda	Geophilidae
	Lithobiidae
Diplopoda	Julidae
Arachnida/Acarina	Anystis
	Bdellidae
	Ascidae
	Bryobiidae
	Calligonellidae
	Cryptognathidae
	Cunaxidae
	Erythraeidae
	Eupodidae
	Gymnodamaeidae
	Laelapidae
	Nanorchestidae
	Paratydaeidae
	Phytoseiidae
	Rhagidiidae
	Rhaphignathidae
	Scutacaridae
	Stigmaeidae
	Tenuipalpidae
	Terpnacaridae
	Trombidiidae
	Tydeidae
	Tarsonemidae
	Zerconidae
Archnida/Araneida	Agelenidae
	Amaurobiidae
	Anyphaenidae
	Araneidae
	Clubionidae
	Dictynidae
	Gnaphosidae
	Hahniidae
	Linyphiidae
	Lycosidae
	Micryphantidae
	Miryphantidae
	Oonopidae
	Pholcidae
	Tetragnathidae
	Salticidae
	Theridiidae
	Thomisidae
Arachnida/Opiliones	Phalangiidae

Appendix C

Reptiles and Amphibians of OU1100

Reptiles and Amphibians of OU 1100 and Surrounding Canyons
Found by Charles Bogart (1978-1979)

FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCATION
AMBYSTOMATIDAE	*Ambystoma tigrinum*	Tiger salamander	Pajarito Canyon
BUFONIDAE	*Bufo punctatus*	Red-spotted toad	Pajarito Canyon
	Bufo woodhousei	Woodhouse toad	Pajarito Canyon
COLUBRIDAE	*Elphae guttata*	Corn snake	Pajarito Canyon
	Thamnophis elegans	Western terrestrial garter snake	Pajarito Canyon
HYLIDAE	*Hyla arenicolor*	Canyon treefrog	Pajarito Canyon
	Pseudocris triseriata	Striped chorus frog	Pajarito Canyon
IGUANIDAE	*Crotophytus collaris*	Collared lizard	Water Canyon
	Phrynosoma douglassi	Short-horned lizard	Ancho Canyon
	Sceloporus undulatus	Eastern fence lizard	Throughout LA county from 1640 m to 2500m
	Urosaurus ornatus	Tree lizard	Ancho Canyon
PELOBATIDAE	*Scaphiopus multiplicatus*	Southern spadefoot	Pajarito Canyon
SCINCIDAE	*Eumeces obsoletus*	Great Plains skink	Ancho Canyon
TEIIDAE	*Cnemidophorus exsanguis*	Chihuahuan spotted whiptail	Ancho Canyon
	Cnemidophorus velox	Plateau striped whiptail	Pajarito Canyon
VIPERIDAE	*Crotalus atrox*	Western diamondback rattlesnake	Ancho Canyon

Appendix D

Birds of OU1100

Birds OU 1100 (TAs-53, -72)

FAMILY	SCIENTIFIC NAME	COMMON NAME
ACCIPITRIDAE	*Accipiter cooperii*	Cooper's hawk
AEGITHALIDAE	*Psaltriparus minimus*	Bushtit
APODIDAE	*Aeronautes saxatalis*	White-throated swift
CAPRIMULGIDAE	*Chordeiles minor*	Common nighthawk
	Phalaenoptilus nuttallii	Common poorwill
CARTHARTIDAE	*Cathartes aura*	Turkey vulture
CERTHIIDAE	*Certhia americana*	Brown creeper
COLUMBIDAE	*Zenaida macroura*	Morning dove
CORVIDAE	*Amphelocoma coerulescens*	Scrub jay
	Corvus corax	Common raven
	Cyanocitta stelleri	Steller's jay
EMBERIZIDAE	*Agelaius phoeniceus*	Red-winged blackbird
	Chodestes grammacus	Lark sparrow
	Dendroica coronata	Yellow-rumped warbler
	D. gracial	Grace's warbler
	D. nigrescens	Black-throated gray warbler
	Euphagus cyanocephalus	Brewer's blackbird
	Icterus galbula bullockii	Northern oriole
	Junco hyemalis	Dark-eyed junco
	Melospiza melodia	Song sparrow
	Molothrus aster	Brown-headed cowbird
	Oporonis tolmei	Macgillivray's warbler
	Passerina amoena	Lazuli bunting
	Pheucticus melanocephalus	Black-headed grosbeak
	Pipilo chlorurus	Green-tailed towhee
	P. erythrophthalmus	Rufous-sided towhee
	P. fuscus	Canyon towhee
	P. ludoviciana	Western tanager
EMBERIZIDAE	*Spizella passerina*	Chipping sparrow
	Vermivora celata	Orange-crowned warbler
	Vermivora virginiae	Virginia's warbler
FALCONIDAE	*Falco sparverius*	American kestrel
FRINGILLIDAE	*Carduelis pinus*	Pine siskin
	Carpodacus cassinii	Cassin's finch
	C. mexicanus	House finch
	C. psaltria	Lesser goldfinch
	Cocothraustes vespertinus	Evening grosbeak
	Loxia curvirostra	Red crossbill
HIRUNDINIDAE	*Tachycineta thalassina*	Violet-green swallow
MUSCICAPIDAE	*Catharus guttatus*	Hermit thrush
	Myadestes townsendii	Townsend's solitaire
	Polioptila caerulea	Blue-grey gnatcatcher
	S. mexicana	Western bluebird
	Turdus migratorius	American robin
PARIDAE	*Parus gambeli*	Mountain chickadee

	P. inornatus	Plain titmouse
PASSERIDAE	*Passer domesticus*	House sparrow
PICIDAE	*Colaptes auratus*	Northern flicker
	Melanerpes formicivorus	Acorn woodpecker
	Picoides villosus	Hairy woodpecker
SITTIDAE	*Sitta carolinensis*	White-breasted nuthatch
	S. pygmaea	Pygmy nuthatch
TROCHILIDAE	*Selasphorus platycercus*	Broad-tailed hummingbird
TROGLODYTIDAE	*Catherpes mexicanus*	Canyon wren
	Salpinctes obsoleuts	Rock wren
	Thromanes bewickii	Bewick's wren
	E. wrightii	Gray flycatcher
TYRANNIDAE	*Myiarchus cinerascens*	Ash-throated flycatcher
	Sayornis nigricans	Black phoebe
	S. saya	Say's Phoebe
	Tyrannus vociferans	Cassin's kingbird
TYTONIDAE	*Buto virginianus*	Great horned owl
VIREONIDAE	*Vireo gilvus*	Warbling vireo
	V. solitarius	Solitary vireo

Appendix E

Vegetation Overstory Data for OU1100

TA-53

Overstory 1

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
JUMO	120	263.74	73.17	3.46	18.20	47.64	1.00	46.67	55.83
PIED	43	94.51	26.22	5.11	20.00	52.36	1.00	46.67	41.75
PIPO	1	2.20	0.61	2.40	0.00	0.00	0.14	6.67	2.43
TOTAL:	164	360.44	100.00	10.97	38.20	100.00	2.14	100.00	100.00

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Shrubs								
RHTR	43	94.51	94.66	3.00	100.00	0.57	100.00	98.22
Total =	43	94.51	94.66	3.00	100.00	0.57	100.00	98.22

LOCATIOI Sandia Canyon 2 Overstory
DATE: 6/1/92

Species	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees								
JUMO	56.01	18.37	3.05	4.73	9.55	0.50	25.00	17.64
PIED	6.22	2.04	0.80	0.00	0.00	0.07	3.57	1.87
PIPO	155.57	51.03	6.86	34.14	68.98	0.79	39.29	53.10
PSME	68.45	22.45	5.45	10.63	21.47	0.43	21.43	21.78
ABCO	3.10	1.02	0.10	0.00	0.00	0.07	3.57	1.53
QUGAt	15.52	5.09	4.34	0.00	0.00	0.14	7.14	4.08
TOTAL:	304.88	100.00	NA	49.50	100.00	2.00	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
QUGA	230.00	715.63	25.16	30.47	84.95	0.86	29.27	46.46
QUEX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AMAL	3.00	9.33	0.33	0.00	0.00	0.07	2.44	0.92
RHTR	39.00	121.35	4.27	0.89	2.47	0.21	7.32	4.68
RICE	13.00	40.45	1.42	0.06	0.16	0.14	4.88	2.15
CEMO	583.00	1813.96	63.79	4.46	12.43	0.71	24.39	33.53
BEFE	46.00	143.13	5.03	0.00	0.00	0.93	31.71	12.25
Total =	914.00	2843.85	100.00	35.87	100.00	2.93	100.00	100.00

LINE TRANSECT Overstory 3
LOCATION: TA-53
DATE: 6/1/93

Species	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees								
JUMO	28.00	18.00	0.77	0.10	0.23	0.21	17.65	11.96
PIPO	124.46	80.00	8.79	42.23	98.50	0.93	76.47	84.99
PIFL	3.11	2.00	3.30	0.54	1.27	0.07	5.88	3.05
TOTAL:	155.57	100.00	NA	42.87	100.00	1.21	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
QUGA	10.00	31.11	2.38	1.14	26.85	0.29	22.22	17.15
RICE	8.00	24.89	1.90	0.00	0.00	0.14	11.11	4.34
CEMO	402.00	1250.79	95.71	3.11	73.15	0.86	66.67	78.51
Total =	420.00	1306.80	100.00	4.26	100.00	1.29	100.00	100.00

LINE TRANSECT Overstory 4
LOCATION: TA-53
DATE:

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
JUMO	67.00	147.25	72.83	5.18	27.51	55.94	1.00	50.00	59.59
PIED	25.00	54.95	27.17	6.23	21.67	44.06	1.00	50.00	40.41
TOTAL:	92.00	202.20	100.00	NA	49.17	100.00	2.00	100.00	100.00

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Shrubs								
CHNA	15.00	32.97	3.94	5.00	23.20	0.14	3.13	10.09
RHTR	298.00	654.95	78.22	8.14	37.78	0.71	15.63	43.87
RICE	15.00	32.97	3.94	2.03	9.44	3.29	71.88	28.42
CHAX	1.00	2.20	0.26	0.10	0.46	0.14	3.13	1.28
FONE	52.00	114.29	13.65	6.28	29.12	0.29	6.25	16.34
Total =	381.00	837.36	100.00	21.55	100.00	4.57	100.00	100.00

Appendix F

Vegetation Understory Data for OU1100

LINE TRANSECT LINE TRANSECT 1 Understory
LOCATION: LOCATI TA-53 DATE: 6/1/93
FILE NAME:
READER/RECORDI
Number of feet

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
Bare Soil	45.11					
Rock	0.64					
Litter	38.87					
BOGR		4.99	32.43	0.47	35.48	33.96
QUSA		0.07	0.46	0.01	1.08	0.77
HYRI		0.16	1.02	0.06	4.30	2.66
ARLO		0.14	0.93	0.01	1.08	1.00
LUCA		0.43	2.79	0.03	2.15	2.47
soil crust		5.61	36.52	0.34	25.81	31.17
OPOX		0.50	3.25	0.04	3.23	3.24
bladder pod		0.07	0.46	0.01	1.08	0.77
IPAG		0.00	0.00	0.03	2.15	1.08
ARX		0.14	0.93	0.03	2.15	1.54
ARDR		0.16	1.02	0.03	2.15	1.59
unk1		0.06	0.37	0.06	4.30	2.34
JUMO		0.14	0.93	0.03	2.15	1.54
RHTR		0.07	0.46	0.01	1.08	0.77
POAX		0.14	0.93	0.03	2.15	1.54
ANSC		2.64	17.19	0.09	6.45	11.82
MEAL		0.01	0.09	0.01	1.08	0.58
PIAD		0.03	0.19	0.03	2.15	1.17
Total =	84.63	15.37	100.00	1.33	100.00	100.00

Understory

LINE TRANSECT 2
LOCATION: TA-53
FILE NAME:
READER/RECORDI
Number of feei

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importanc Index
Bare Soil	10.03					
Rock	3.98					
Litter	75.05					
ARLU		0.10	0.91	0.04	3.09	2.00
VIAM		0.00	0.00	0.00	0.00	0.00
MUMO		3.03	27.70	0.30	21.65	24.67
KOCR		0.70	6.40	0.11	8.25	7.32
CAREX		0.79	7.19	0.07	5.15	6.17
soil crust		1.01	9.28	0.13	9.28	9.28
ALCE		0.03	0.26	0.03	2.06	1.16
PSME		0.04	0.41	0.06	4.12	2.26
FAAM		0.00	0.01	0.01	1.03	0.52
ANPA		0.80	7.32	0.11	8.25	7.78
thellapodium		0.00	0.00	0.00	0.00	0.00
moss/lichen		0.50	4.57	0.03	2.06	3.32
trace grass		0.00	0.01	0.01	1.03	0.52
POAX		0.01	0.13	0.01	1.03	0.58
QUGA		1.43	13.07	0.11	8.25	10.66
YUAN		0.00	0.00	0.00	0.00	0.00
HYRI		0.07	0.65	0.03	2.06	1.36
HYAR		0.34	3.15	0.10	7.22	5.18
POTX		0.07	0.65	0.01	1.03	0.84
AGGE		0.00	0.00	0.00	0.00	0.00
PULU		0.14	1.31	0.01	1.03	1.17
CEMO		0.07	0.65	0.01	1.03	0.84
SOLX		0.43	3.92	0.06	4.12	4.02
THPI		0.71	6.53	0.06	4.12	5.33
ANSC		0.50	4.57	0.04	3.09	3.83
THPI		0.00	0.00	0.00	0.00	0.00
bromus		0.14	1.31	0.01	1.03	1.17
Total =	89.07	10.93	100.00	1.39	######	100.00

LINE TRANSECT Understory 3
LOCATION: Sandia Canyon
FILE NAME:
READER/RECORDI
Number of feei

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importanc Index
Bare Soil	8.70					
Rock	4.64					
Litter	80.41					
soil crust		0.37	5.97	0.09	10.71	8.34
MUMO		4.00	64.06	0.47	58.93	61.49
ANPA		0.30	4.80	0.07	8.93	6.87
HYAR		0.07	1.14	0.01	1.79	1.46
HYRI		0.29	4.58	0.01	1.79	3.18
AGGE		0.29	4.58	0.03	3.57	4.07
YUAN		0.00	0.00	0.00	0.00	0.00
SOLX		0.07	1.14	0.01	1.79	1.46
CAREX		0.29	4.58	0.04	5.36	4.97
puccoon		0.00	0.00	0.00	0.00	0.00
ANSC		0.43	6.86	0.03	3.57	5.22
SEFE		0.07	1.14	0.01	1.79	1.46
ARLU		0.07	1.14	0.01	1.79	1.46
YUBA		0.00	0.00	0.00	0.00	0.00
Total =	93.76	6.24	100.00	0.80	######	100.00

TA 21 AREA A?

LINE TRANSECT LINE TRANSECT 4 TA-53
LOCATION: LOCATION: lower sandia
FILE NAME:

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
Bare Soil	47.31					
Rock	26.43					
Litter	19.69					
BOGR		4.13	62.80	0.47	66.00	64.40
GUSA		0.09	1.30	0.03	4.00	2.65
HYRI		0.00	0.00	0.00	0.00	0.00
ARLO		0.00	0.00	0.00	0.00	0.00
ARDR		0.17	2.61	0.06	8.00	5.30
ANSC		0.00	0.00	0.00	0.00	0.00
HYFL		0.14	2.17	0.01	2.00	2.09
PESE		0.00	0.00	0.00	0.00	0.00
CHNH		0.00	0.00	0.00	0.00	0.00
STCO		0.14	2.17	0.01	2.00	2.09
OPUX		0.00	0.00	0.00	0.00	0.00
CRJA		0.03	0.43	0.03	4.00	2.22
ERJA		0.00	0.00	0.00	0.00	0.00
unk1		0.00	0.02	0.01	2.00	1.01
EUSE		0.01	0.22	0.01	2.00	1.11
POA		0.00	0.00	0.00	0.00	0.00
ORHY		0.36	5.43	0.01	2.00	3.72
SIHY		0.00	0.02	0.01	2.00	1.01
crust		0.07	1.09	0.01	2.00	1.54
CHNA		0.36	5.43	0.01	2.00	3.72
BOER		1.07	16.30	0.01	2.00	9.15
Total =	93.43	6.57	100.00	0.71	######	100.00

United States Government

memorandum

Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

DATE: JUN 20 1995

REPLY TO ATTN OF: LAAMEP:1EW-009

SUBJECT: U. S. Fish and Wildlife Service (USFWS) Response to LANL Biological Assessments

TO: Teralene Foxx, Acting Group Leader, ESH-20, LANL, MS-M887

Attached for your information and use are copies of the USFWS replies to the two following projects: (1) Mixed Waste Disposal Facility, and (2) Environmental Restoration Program Operable Unit 1100. Each of these responses were provided informally to your office at an earlier date. In both cases, the USFWS has agreed with our assessment that the proposed actions, with existing or planned mitigation measures, are not likely to adversely affect any endangered or threatened species or their critical habitat.

If you have any questions, please call me at 667-8690.

Elizabeth R. Withers
Acting NEPA Compliance Officer
Office of Environment and Projects

Attachments

cc w/o attachments:
A. Ladino, Scientech, LAAO

RECEIVED ESH-20 JUN 22 1995
ROUTE: ESH-MGMT: TLs
COPY: GRPMGMT: TLs
RETURN TO: GRPOPC
ORIGINAL:
NOTE:

Withers

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services State Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 761-4525 Fax: (505) 761-4542

March 17, 1995

Cons. #2-22-93-I-251

Mr. Larry Kirkman
Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico 87544

Dear Mr. Kirkman:

This responds to your letter dated February 17, 1995, requesting our review of the "Biological and Floodplain/Wetland Assessment (BA) for Environmental Restoration Program Operable Unit 1100 (Technical Areas 53 and 72). This draft copy was prepared by the Los Alamos National Laboratory (LANL) Biological Resources Evaluations Team (BRET). Research activities at LANL have resulted in a large number of Solid Waste Management Units (SWMUs). The proposed action involves the Site Characterization Phase (sampling activities) of the Environmental Restoration Program underway at LANL. Soil sampling will be conducted with hand-held auger drills or with auger-mounted heavy machinery. The soil samples will be used to determine the nature and extent of hazardous waste releases from SWMUs. Your geographic area of interest is in Los Alamos County, New Mexico.

The U.S. Fish and Wildlife Service (Service) recommends that all project BAs that contain information regarding known or potential Jemez Mountain salamander habitat impacts be submitted to the New Mexico Endemic Salamander Team (c/o Jerry Burton, Team Leader, at the letterhead address) for review. Additionally, all salamander surveys should be conducted according to the survey protocol procedures delineated in the Draft Management Plan for the Jemez Mountains Salamander on the Santa Fe National Forest, New Mexico (10 May 1994).

The Service concurs with the BRET determination that the proposed action, with existing mitigation measures, is not likely to adversely affect any endangered or threatened species or their critical habitat. If we can be of further assistance, please call Ms. Elizabeth Cervantes at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
State Supervisor

30003596