

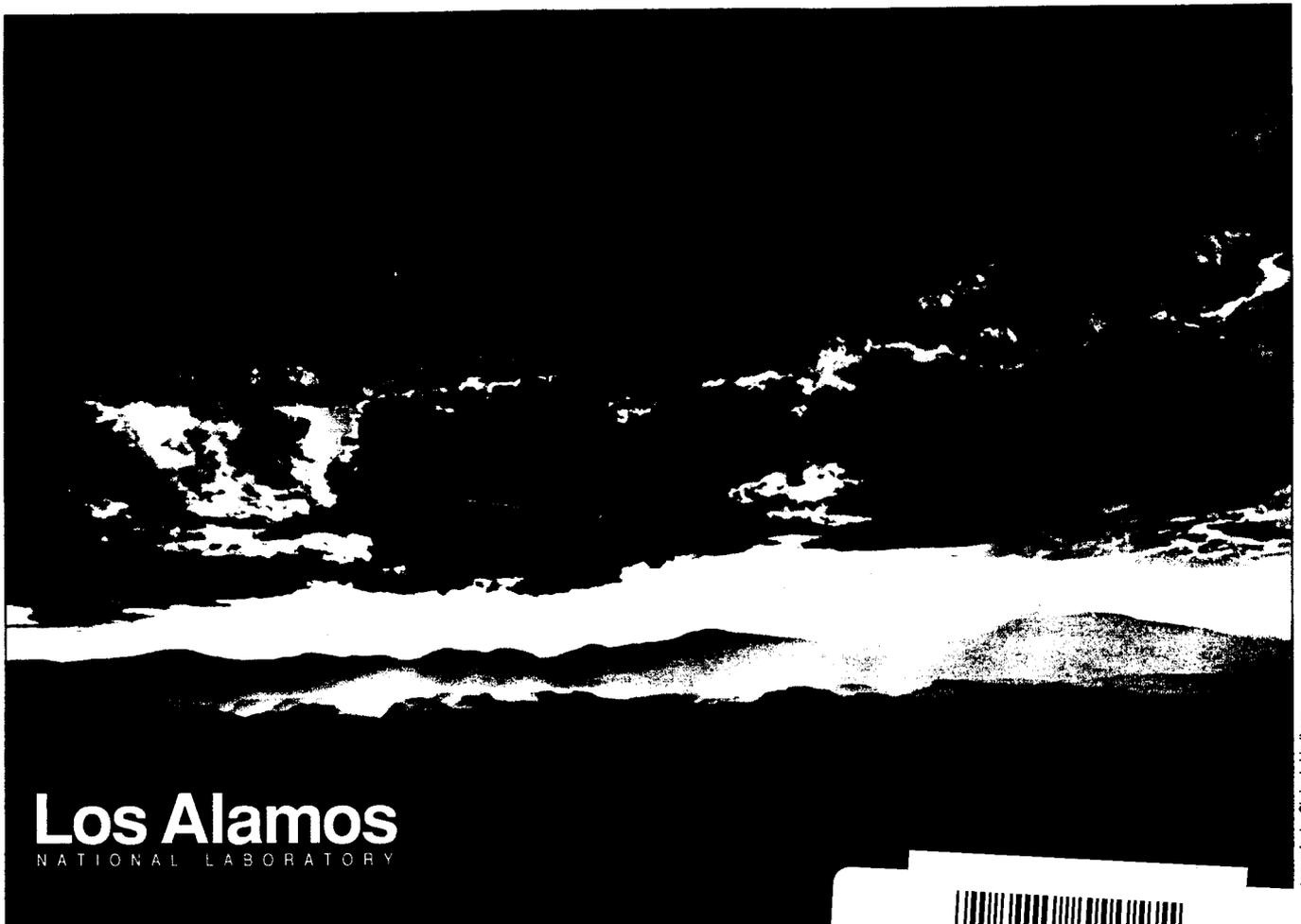
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ER ID # 26071

LA-UR-94-21

*Title: Biological Evaluation for
Environmental Restoration
Program; Operable Unit 1114;
Technical Areas 3, 30, 59, 60,
61, and 64*

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ER Record I.D.# 0026071



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LA-UR-94-21

January 1996

*Biological Evaluation for Environmental
Restoration Program; Operable Unit 1114;
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Los Alamos, New Mexico 87545

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**BIOLOGICAL EVALUATION
FOR
ENVIRONMENTAL RESTORATION PROGRAM
OPERABLE UNIT 1114;
Technical Areas 3, 30, 59, 60, 61, 64**

by
Saul Cross

ABSTRACT

The Biological Resource Evaluations Team (BRET) surveyed for threatened, endangered, and sensitive (TES) species, and for floodplains/wetlands within and near the boundaries of Operable Unit (OU) 1114, Technical Areas 3, 30, 59, 60, 61, and 64. These studies are instrumental in evaluating the proposed site characterization (sampling) phase of the Environmental Restoration Program, and were done in order to comply with the Federal Endangered Species Act, New Mexico's endangered species laws, and the Floodplain/Wetlands Executive Orders 11990 and 11988.

BRET read transects to quantify the vegetative communities of OU 1114, and analyzed all understory plant species for cover and frequency, and all overstory plants for density, cover, and frequency. In addition, the diameter at breast height of all trees was measured and shrub stems were counted. BRET calculated an importance index for all plant species surveyed.

Current survey data indicates that OU 1114 has habitat for the several protected species including the wood lily, checker lily, spotted bat, Jemez Mountains salamander, northern goshawk, Mexican spotted owl, willow flycatcher, meadow jumping mouse, and peregrine falcon. The initial surveys have not confirmed the presence of these species. However, mitigation measures are required to ensure that no adverse impacts affect these species.

Wetlands and floodplain areas were noted using the National Wetland Inventory Maps and field checks. Wetland boundary delineation will be conducted prior to site characterization to assure that no sampling is conducted within a wetlands area.

Potential impacts of the sampling program and corrective mitigation measures are discussed.

EXECUTIVE SUMMARY

During the summers of 1991 and 1992, the Biological Resource Evaluation Team (BRET) of the Environmental Protection Group (ESH-8) conducted field surveys within and near to Operable Unit (OU) 1114. BRET's surveys had three purposes. Firstly, we determined the presence or absence of any state or federally listed threatened, endangered, or sensitive (TES) species or their critical habitat within the boundaries of the OU. Secondly, surveys were conducted to identify the presence or absence of any sensitive areas, such as floodplains and wetlands. Thirdly, the surveys provide additional plant and wildlife species data to aid in defining the habitat types occurring within the OU. Data from these surveys will provide base line information about the biological components of the area and permit future comparisons.

BRET field surveys comply with requirements of the Federal Endangered Species Act of 1973, the New Mexico Wildlife Conservation Act, the New Mexico Endangered Plant Species Act,

Federal Executive Order 11990 ("Protection of Wetlands"), Federal Executive Order 11988 ("Floodplain Management"), Federal Regulation 10 CFR 1022, and Department of Energy Order 5400.1.

Data bases containing historical information and biological reports of previous surveys within or near OU 1114 were reviewed and summarized to provide background information. These summaries provide valuable inventory information for future ecological risk assessments and pathways analyses.

BRET conducted Level 1 (reconnaissance) surveys to determine potential habitats, identify survey locations, and identify access routes. The terrain of OU 1114 has moderately steep to steep canyons and adjacent mesas. The OU includes upper Mortandad and Sandia Canyons. It is bordered by Twomile Canyon on the south and Los Alamos Canyon on the north.

BRET conducted Level 2 (habitat evaluation) surveys on mesa tops, along north- and south-facing canyon slopes, and in riparian areas. Ten transects were established to identify both overstory and understory components of the area. The habitat evaluation surveys indicated three vegetation communities within the vicinity of OU 1114: Rocky Mountain Montane Conifer-Forest, Great Basin Conifer-Woodland, and Rocky Mountain Riparian-Deciduous Forest.

For every tree species encountered in the overstory surveys, we calculated average diameter at breast height (DBH), relative density, relative cover, relative frequency, and an importance index. The number of stems per acre, relative density, relative cover, relative frequency, and an importance index were determined for each shrub species. The relative cover, relative frequency, and importance index were determined for all understory species.

On north-facing slopes, Douglas-fir (*Pseudotsuga menziesii*), an indicator of the mixed conifer zone, and ponderosa pine (*Pinus ponderosa*) were co-dominants. Individual transects had lesser amounts of Rocky Mountain maple (*Acer glabrum*), limber pine (*Pinus flexillis*), and white fir (*Abies concolor*). North-facing slope shrubs were highly varied with Gambel's oak (*Quercus gambelii*), barberry (*Berberis fendleri*), cliffbush (*Jamesia americana*), and wax currant (*Ribes cereum*) present in all transects. Although many species of understory plants were noted, percent understory cover ranged from only 9.17 to 17.75.

South-facing slopes tend to be dryer and more exposed than north-facing. Ponderosa pine and Douglas-fir were the overstory dominants. The shrub layer on the south-facing slopes consisted of only three species and had the lowest cover value (1.07) of any transect. Understory cover was 4.14 with only four species having an importance index greater than five.

On Sigma Mesa (Technical Area -60), the dominant overstory species were ponderosa pine, piñon pine (*Pinus edulis*), and one-seed juniper (*Juniperus monosperma*). Percent overstory cover ranged from 13.06 to 48.73. Various oak (*Quercus*) species, mountain mahogany

(*Cercocarpus montanus*), and wax currant were the dominant shrubs. The dominant grasses were blue grama (*Bouteloua gracilis*) and mountain muhly (*Muhlenbergia montana*).

The mesa top surveyed near upper Mortandad Canyon was much moister than Sigma Mesa. Here the overstory species were ponderosa pine, Douglas-fir, and Gambel's oak. This composition indicates mixed conifer vegetation whereas Sigma Mesa had piñon-juniper and piñon-ponderosa communities. The Mortandad transect had willow (*Salix* sp.) as the dominant shrub and an understory dominated by sedge (*Carex* sp.) and redbud (*Agrostis alba*).

Riparian zones tend to have more species diversity than surrounding habitats. The greatest diversity of trees and shrubs in OU 1114 occurred in the riparian transects. The highest importance value for a tree was only 29.0, an indication that dominance was distributed among several species. A total of 19 shrub species were noted, and Gambel's oak was the only dominant shrub present in all riparian transects. Similarly, riparian understory was the most diverse with one transect containing 46 understory species.

All wetlands and floodplains within the survey area were noted using National Wetland Inventory Maps followed by field checks. Characteristics of wetlands, floodplains, and riparian areas were noted using criteria outlined in the "Federal Manual for Delineating Jurisdictional Wetlands". However, wetland boundaries (based on hydrophytic plants, hydric soils, and hydrology) were not delineated during these surveys since they are valid for only two years.

Our Level 2 surveys identified the following vegetation zones: mixed conifer, ponderosa pine, piñon-ponderosa, piñon-juniper, and riparian. We used these as search criteria in a threatened, endangered, and sensitive (TES) species data base. This search allowed comparison of the habitats within OU 1114 to the habitat requirements of all TES species previously reported from Los Alamos County and its adjacent counties.

If the habitat requirements of a TES species were not met, we conducted no further studies for that species and considered the site as unsuitable habitat for that species. Eleven species of plants and eight species of wildlife were thus dismissed from further consideration. If habitat requirements were met, BRET initiated Level 3 (species specific) surveys. Level 3 surveys are conducted in accordance with pre-established protocols and their completion often require particular meteorological or seasonal conditions.

Data base searches based on habitat and/or known occurrences indicated that potential species of concern for OU 1114 are the wood lily, checker lily, spotted bat, Jemez Mountain salamander, northern goshawk, meadow jumping mouse, and peregrine falcon. Habitat evaluations showed that all of these species have a medium potential for occurrence in the area.

The wood lily (*Lilium philadelphicum* var. *andium*) and checker lilies (*Fritillaria atropurpurea*) occur in moist shaded areas within the mixed conifer zone. Although these species have been found in Los Alamos County, they are very rare here. If extensive soil sampling is

planned within riparian areas, BRET must conduct a Level 3 survey prior to sampling. If heavy equipment or vehicles will be used off established roads, BRET personnel must be notified to conduct a walk-through to determine if any wood lilies or checker lilies are present. (See Section 9.2.1 for more information.)

Suitable habitat exists for the spotted bat (*Euderma maculatum*) in OU 1114 canyon bottoms. Spotted bats require open water for hunting. They roost in caves and rock crevices in piñon-juniper, ponderosa pine, mixed conifer, and riparian areas. Potential roost sites are present in OU 1114, but open water sources are limited to a cattail marsh and stream in Sandia Canyon. Soil sampling should not adversely impact spotted bats if small caves and rock crevices are not disturbed and areas of open water in Sandia Canyon are not altered. (See Section 9.2.2.1 for detailed information.)

The Jemez Mountains salamander (*Plethodon neomexicanus*) has been found near OU 1114, and Sandia Canyon appears to provide acceptable habitat. Impacts to salamanders would include habitat destruction due to tree removal, soil disturbance, and removal of downed logs. (See Section 9.2.2.2 for detailed information.) If sampling is scheduled on the north-facing slope of canyons:

- A biologist from ESH-8 must be present during sampling. If any salamanders are discovered, all ground disturbing activities will cease immediately.
- Any trees that are cut must be left 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.

The northern goshawk (*Accipiter gentilis*) occurs in mature ponderosa pine forests. This species has been recorded as nesting near the boundaries of OU 1114, and hunting within the north-west portions of the Laboratory. The following measures must be taken to avoid adverse impacts to goshawks (see Section 9.2.2.3 for detailed information):

- Machine sampling in undisturbed areas should be limited to October through February. Any machine sampling scheduled to occur from March through September, within ponderosa pine habitat and outside of the developed area of TA-3, must be cleared with BRET. BRET must be contacted at least 60 days prior to sampling to evaluate possible nest sites in and around the sampling area.
- If any disturbance will affect more than one-tenth acre, BRET must be conduct a presampling site-specific survey.
- Removal of any tree, live or snag, must first be approved by BRET.

Although no peregrine nests have been found within Los Alamos Canyon, and no impacts to the falcons are expected in OU 1114, disturbance in the middle to lower section of Los Alamos Canyon must be kept to a minimum (see Section 9.2.2.3 for detailed information). However, a

field survey must be conducted 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 prohibition on sampling from March 1 to August 30 and avoiding the area after dark from February 1 to August 30 (Johnson 1992). In addition, best management practices for the goshawk also apply to the peregrine falcon.

No spotted owls have been recorded within Laboratory lands. Furthermore, no heavy equipment sampling is scheduled to take place near the junction of Twomile and Pajarito Canyons. However, OU 1114 supports spotted owl habitat, and therefore the following measures must be taken to avoid adverse impacts to the owl (also see Section 9.2.2.6 for detailed information):

- Before any sampling takes place, BRET will conduct broadcast surveys and determine nest site locations and occupancy of spotted owls. Surveys will be conducted between May 15 and June 30 using USFS established methodology, which stipulates 2-year surveys. If spotted owls are found and nest sites are occupied, or if the survey is not conducted, sampling cannot begin until September 1. However, if nest sites are not occupied and spotted owls are not found, sampling can be initiated.
- Any tree removal (live or snag) must be approved by BRET. BRET will determine if the tree(s) could be used for owl perching or nesting and if the tree removal will change canopy characteristics. If BRET determines the tree is used for nesting or perching, or if the character of the canopy will be altered, the tree removal will not be approved and will not occur.
- If any sampling activity will damage or destroy any vegetation within spotted owl habitat, BRET must be contacted to evaluate the vegetation removal. BRET will use a species expert (Terrell Johnson) to aid in the evaluation of foraging area loss. If an adverse impact is expected, removal of vegetation will not be approved and will not occur. If no adverse impact to foraging is expected, BRET will approve the vegetation removal.

Meadow jumping mouse (*Zapus hudsonius luteus*) may be present within streamside areas of Twomile and Sandia Canyons. Mitigation includes avoiding excessive streamside vegetation removal. If sampling is to be conducted adjacent to the stream in Twomile or Sandia Canyons, BRET must be notified sixty days in advance to determine if site-specific surveys are required. If a Level 3 survey is necessary, it must be conducted during the rainy season (preferably in July), and soil sampling cannot proceed until the survey has been completed. (See Section 9.2.2.4 for detailed information.)

No willow flycatcher (*Empidonax traillii*) have been found in Los Alamos County, although they have been sighted in Bandelier National Monument. Some small amount of habitat (cottonwood-willow associations and structurally similar riparian vegetation associations along riparian areas) may exist for the willow flycatcher in riparian areas in the OU. For this reason the

following mitigation measures are required if sampling in riparian zones. (See Section 9.2.2.7 for detailed information).

- In willow flycatcher habitat, sampling must be scheduled outside of the breeding-nesting season (June 10 through July 20). If sampling is to be scheduled during this period, species-specific surveys must be conducted prior to sampling.
- BRET must approve all removal of riparian vegetation.
- BRET must approve all tree removal.
- BRET must approve any stream alteration.

Surface soil sampling of the OU should not cause any adverse impacts to any critical habitats or sensitive areas if conducted in accordance with this document. No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action level, workers must cease operations, shut down the site, and reassess the sampling.

1 INTRODUCTION

This biological assessment was conducted for the site characterization or "sampling phase" of the Environmental Restoration program, OU 1114, TAs 3, 30, 59, 60, 61, and 64. The sites will be sampled to characterize hazards, waste releases, and constituents from Solid Waste Management Units (SWMUs). This sampling will use hand-held augers or auger-mounted heavy machinery to remove soil samples.

This report documents the biological evaluation of TES species, and floodplain/wetlands for OU 1114. The proposed site sampling was evaluated for its impact on TES species and floodplain/wetlands in accordance with the 1973 Federal Endangered Species Act (ESA), New Mexico's Wildlife Conservation Act (WCA), New Mexico's Endangered Plant Species Act (EPSA), Floodplain/Wetland Executive Orders (EOs) 11990 and 11988, Department of Energy's (DOE's) Order 5400.1 (Environmental Compliance), 10 CFR 1022, and the National Environmental Policy Act (NEPA).

Section 7 of the Federal Endangered Species Act requires every federal agency to ensure that its activities and programs will not jeopardize the continued existence of a federally listed threatened or endangered species or its designated critical habitat. New Mexico's WCA and EPSA also require federal agencies to ensure their activities and programs will not jeopardize species that are under state protection. Implementation of Section 7 of the Federal ESA, as well as New Mexico's WCA and EPSA, is done within the framework of the NEPA.

A TES species assessment has three possible outcomes:

- (1) there are no TES species found utilizing the proposed project area habitat;
- (2) there are TES species utilizing the proposed project area habitat, but there are no adverse impacts to the species; or

- (3) there are TES species utilizing the proposed project area habitat, and there will be adverse impacts to the species.

When no adverse impacts are expected from the proposed project, the biological evaluation will be reviewed by appropriate state and or federal agency for concurrence. If the proposed project is expected to jeopardize a listed species, consultation with the appropriate state or federal agency is initiated. Formal consultation efforts could result in project modifications, alternative programs, or abandonment of the proposed project to avoid impacts to the protected species.

Two Executive Orders provide protection for floodplains and wetlands. Executive Order 11988, "Floodplain Management," ensures the protection of floodplains and stipulates that the potential effects any federally funded project in a floodplain must be evaluated before the action is initiated. Executive Order 11990, "Protection of Wetlands," requires all federally funded agencies to implement or amend proposed procedures to protect wetlands from loss or degradation.

The US DOE's Code of Federal Regulations 10 CFR 1022 outlines the procedures for DOE compliance with these EOs and requires that all DOE actions be assessed for impacts to floodplains or wetlands. This CFR does not specify a minimum area. If there is a potential impact to floodplains or wetlands, a floodplain/wetland assessment must be conducted to determine if the impact would be adverse. Public review of potential impacts is provided through NEPA documentation or Federal Register Notification.

In addition, under Section 404 of the Clean Water Act, the degradation of wetlands and floodplains is controlled by limiting the discharge of fill into these sensitive areas. Two types of permits are issued by the Corps of Engineers (COE), depending on the size of the floodplain or wetland to be affected. Nationwide Permits are most commonly issued and are applicable if the impact will affect less than ten acres. If the impact will affect an area larger than ten acres, Individual Permits must be issued before activities can be initiated.

DOE Order 5400.1 requires a environmental pre-operational survey prior to the start-up of a new site, facility, or process which has the potential for significant adverse environmental impact. This survey should begin a minimum of one year, and preferably two years, before the start-up to allow for the evaluation of biotic communities through seasonal change. These base line data support the "environmental setting" portion of the work plans for site investigation and are important in measuring the environmental impacts of corrective measures.

2 PROJECT DESCRIPTION

2.1 Background

Since LANL's inception, research activities have resulted in the formation of a large number of Solid Waste Management Units (SWMUs). SWMUs at LANL are defined as "any discernible 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). These SWMUs are located at various TAs throughout the 43 square mile facility and consist of various contaminants released from Laboratory facilities.

The US Environmental Protection Agency (EPA) is the regulatory authority in charge of SWMUs, deriving its authority from the Resource Conservation and Recovery Act (RCRA). In accordance with the requirements of RCRA, LANL must develop corrective actions for all releases of hazardous waste into the environment.

The Laboratory's Environmental Restoration (ER) group (EM-13) is responsible for developing and implementing corrective actions for SWMUs at LANL. The corrective action process is divided into four phases: (1) site assessment, (2) site characterization, (3) development of proposed corrective actions, and (4) selecting and performing corrective actions (IT 1990).

This document is the biological assessment that has been prepared for use with the site characterization phase, which focuses primarily on soil sampling, although additional disturbances associated with the sampling could occur. Biological assessments for other phases may also be required.

2.2 SWMUs and Proposed Sampling

Several types of outdoor SWMUs are located within OU 1114 and are associated with the following:

TA-3

- Container Storage Areas
- Electrical Equipment Storage
- Disposal Area
- Firing Chambers
- Surface Disposal of Rubble
- Oil Disposal
- Waste Water Treatment
- Drains and Sumps
- Drains and Outfall
- Septic System
- Surface Impoundments
- Landfill Storage Areas
- Underground Storage Tank
- Waste Line

TA-30

- Surface Disposal/Landfill

TA-59

- Septic Systems
- Drum Storage
- Sumps
- Outfalls

TA-60

Container Storage Areas
Landfill/Surface Disposal
Oil and Water Separators
Surface Impoundments
Septic Systems

TA-61

Container Storage Area
PCB Storage Area
Burn Site
Septic Systems
Landfill

TA-64

Waste Container Storage Area

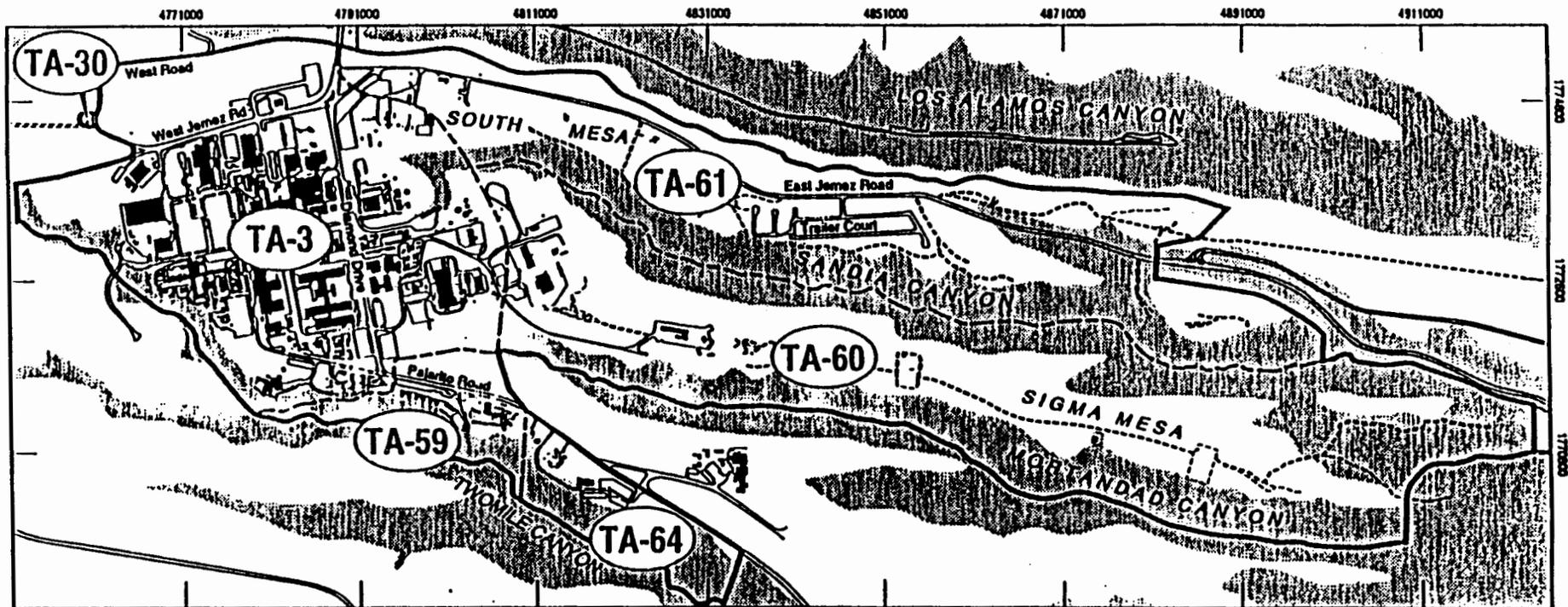
The type, quantity, and extent of any environmental contamination will be determined by sampling surface and subsurface soils at SWMUs (Fig. 1) and areas downgradient from SWMUs. Surface soils and near-surface soils will be collected with scoops and hand augers. The required drilling depth will determine the method of obtaining subsurface soils. A hollow stem auger will be used for samples less than 61 m (200 ft) below the surface. Holes surpassing 61 m in depth will be drilled with air or mud rotary coring or Odex drilling (Devaurs, 1991). All soil sampling is expected to occur in areas developed areas such as parking lots, around buildings and outfalls, in the disposal area, etc.

3 ENVIRONMENTAL SETTING

3.1 General Setting

OU 1114, TAs 3, 30, 59, 60, 61, 64, is located within the boundaries of Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico (Fig. 2). The Laboratory lies in north-central New Mexico approximately 10 km (62 mi) by air northwest of Albuquerque and 32 km (25 mi) northwest of Santa Fe.

LANL is located on the Pajarito Plateau on the east-central edge of the Jemez Mountains. These mountains are formed of a volcanic rock complex along the northwest margin of the Rio Grande Rift in north-central New Mexico (Burton, 1982). The plateau forms an apron of volcanic and sedimentary rocks along the eastern flank of the mountains. It is aligned approximately north-south and is approximately 32 to 40 km (20 to 25 mi) long and 8 to 16 km (5 to 10 mi) wide. From an elevation of approximately 2287 m (7500 ft) near the mountains, the plateau slopes gently eastward toward the Rio Grande River. The Pajarito Plateau terminates at an elevation of approximately 1891 m (6200 ft) at which point, the river (currently at 1647 m [5400 ft]) has cut steep slopes. The plateau has also been dissected into a number of narrow mesas by southeast-trending intermittent streams.



- Paved road
- Unimproved road or trail
- Building or structure
- OU 1114 boundary
- Technical area boundary
- Canyon areas

TA number	Total number of SWMUs
3	211
30	1
59	6
60	19
61	9
64	1

0 1000 2000 ft

 CARTography by A. Kron 9/22/93



Figure 1. Locations of Solid Waste Management Units (SWMUs) within OU 1114.

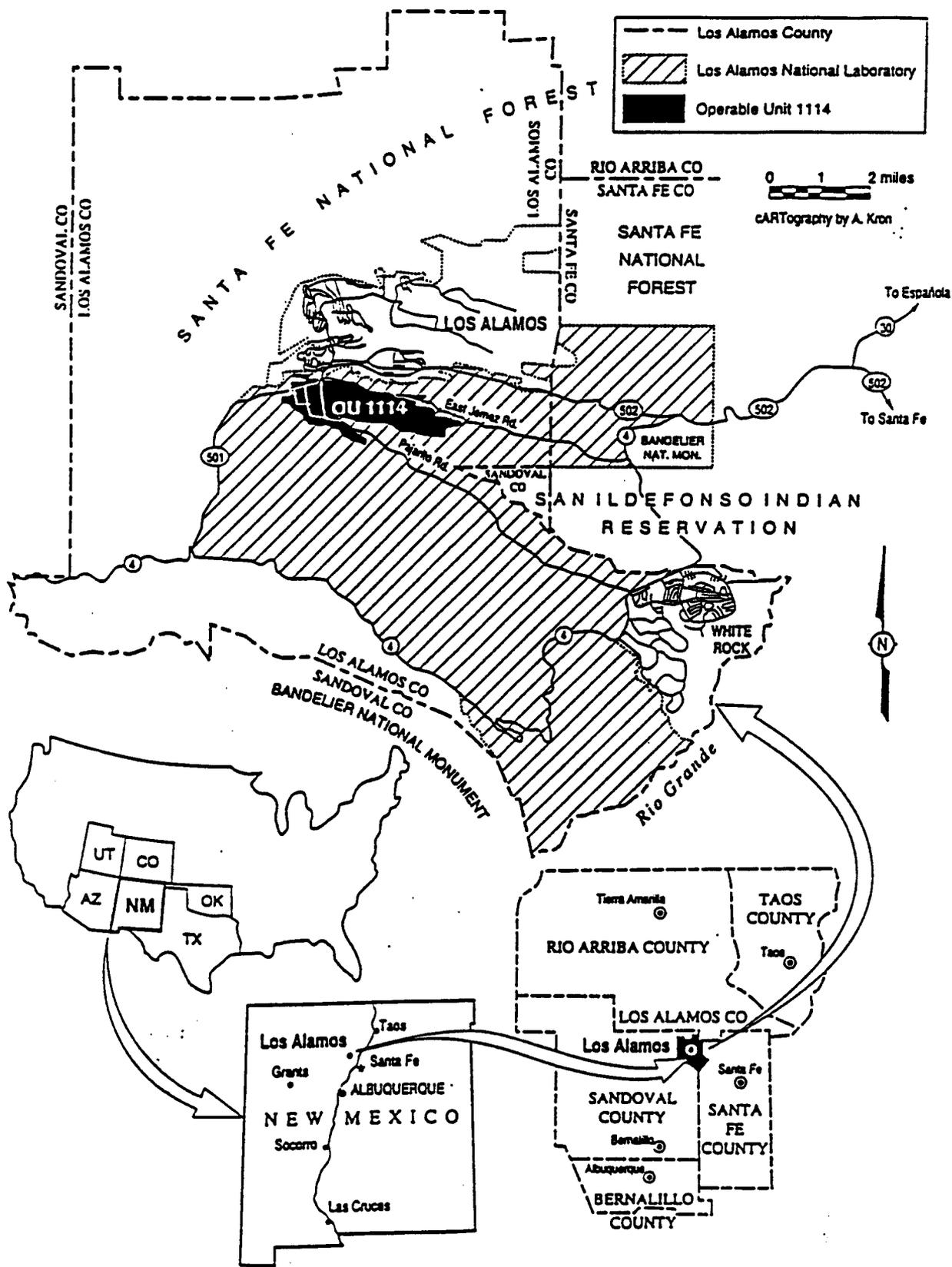


Figure 2. Location of Los Alamos County within New Mexico.

The Pajarito Plateau extends eastward from the base of the mountains as finger-like mesas separated by deep canyons. A geological substrate of Bandelier Tuff (LANL, 1988) was deposited from volcanic eruptions in the Jemez Mountains ca. 1.1-1.4 million years ago. The tuff overlaps other volcanic layers that are underlain by conglomerate of the Puye Formation (LANL, 1988). This conglomerate intermixes with Chino Mesa basalts along the Rio Grande River (Fig. 3).

The area has a semiarid, temperate mountain climate with summer temperatures typically ranging from a low of 10°C to a high of 22°C (50°F to 80°F) during a 24-hr period (Bowen, 1990). Winter temperatures generally range from -10°C to +10°C (the teens F) during a 24-hr period. The annual precipitation in the vicinity of Los Alamos varies between 33 and 46 cm (13 and 18 in), much of it falling in July and August as rain showers (Fig. 4).

The large diversity of ecosystems in the Los Alamos area is primarily caused by the 1494 m (4900 ft) elevation gradient from the Rio Grande to the Jemez Mountains. Studies in 1972 characterized the plant and animal communities of Los Alamos County into six major vegetative types: subalpine grassland, spruce-fir, mixed conifer, ponderosa pine, piñon-juniper, and juniper grassland. Within the boundaries of the Laboratory, the predominant community types are ponderosa pine (2104 to 2303 m [6900 to 7550 ft]), piñon-juniper (1891 to 2204 m [6200 to 6900 ft]) and juniper grassland (1708 to 1906 m [5600 to 6250 ft]). The northern aspects of the canyons have stands of mixed conifer (LANL, no date).

3.2 Description of OU 1114

OU 1114 is located in the north central portion of LANL (Fig. 5). It is bounded on the north by Los Alamos Canyon and on the south by Twomile Canyon. New Mexico State Plane Coordinates are

<u>Zone</u>	<u>Easting</u>	<u>Northing</u>
NW	476240	1774945
SW	475274	17732768
NE	492395	1771169
SE	490946	1769720

The OU contains upper sections of Mortandad and Sandia Canyons. The elevation ranges between approximately 2104 m (6900 ft) at the eastern boundary to 2287 m (7500 ft) at the western boundary. Topography within the OU includes fairly level grassy mesa tops, forested slopes, steep canyon cliffs, and canyon bottoms.

In the western portion of OU 1114, soils are primarily Carjo loam and the Seaby series of loam and banded pumice (Fig. 6). Areas of Pogna fine sandy loam and rock outcrop also exist in TA-3. The eastern portion contains Nyjack loam while mesa perimeters have the Tocal series of loam. In TA-3, the potentiometric surface of the main aquifer lies between 2035 m (6675 ft) and

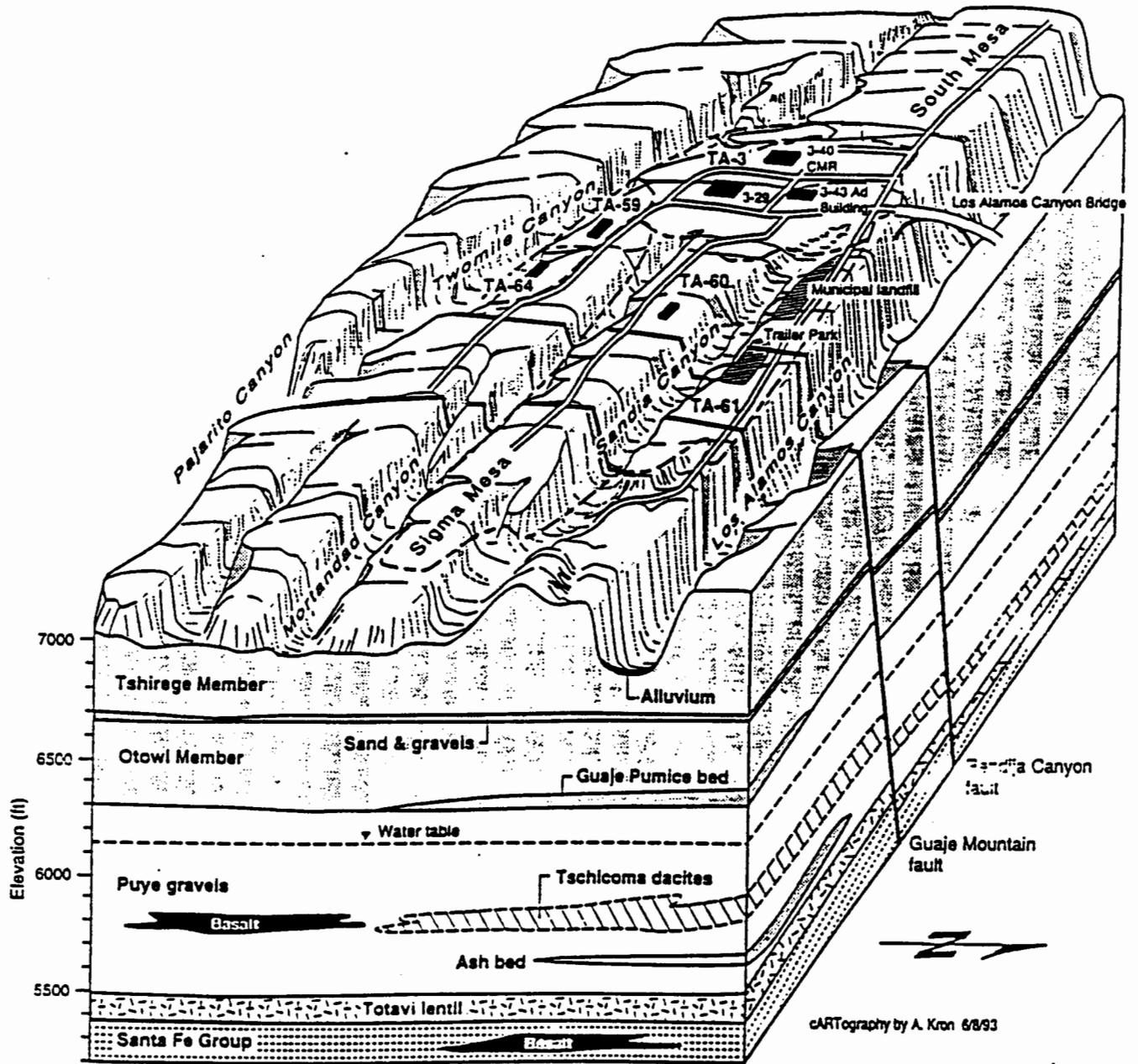


Figure 3. Conceptual geologic model of OU 1114.

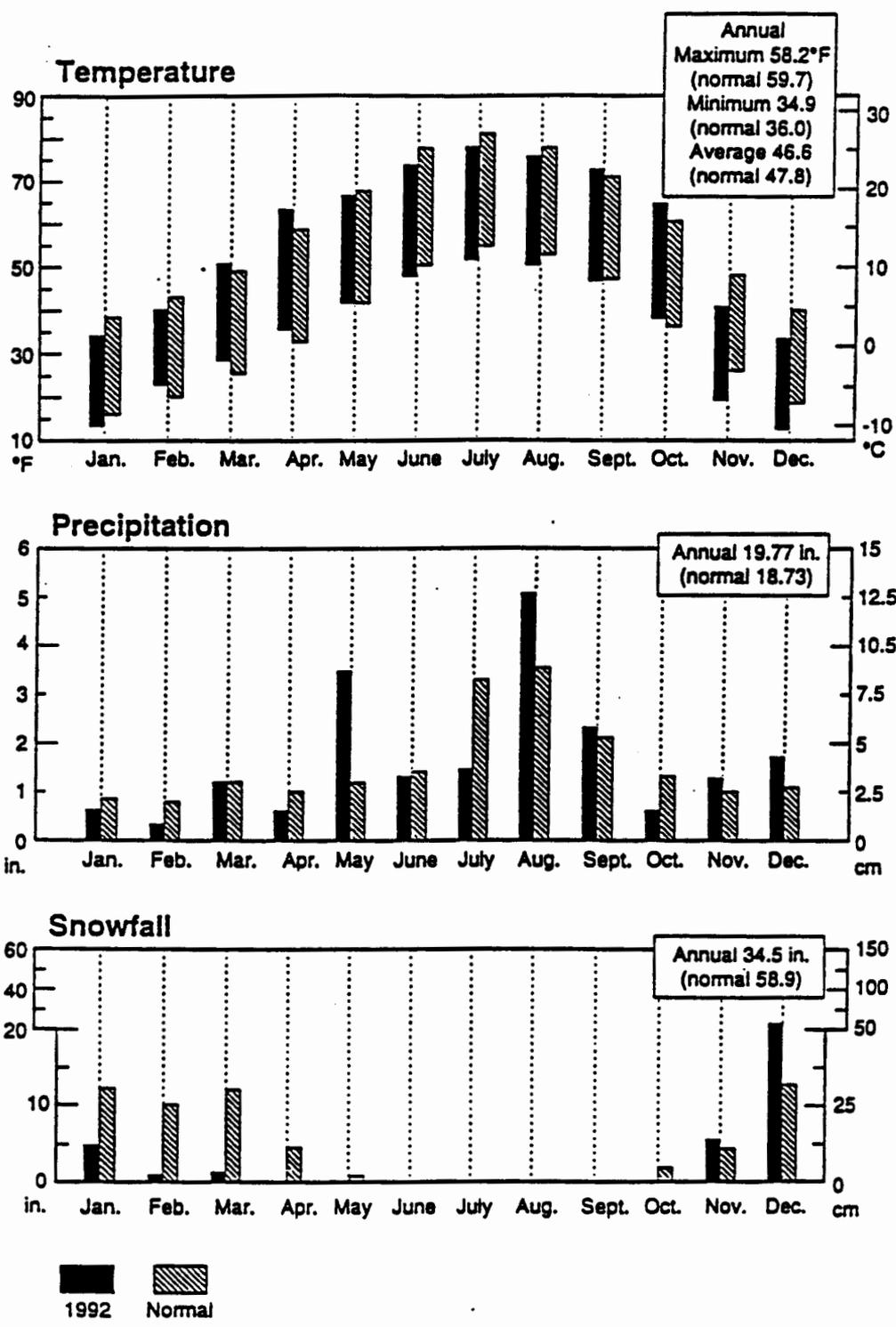


Figure 4. 1992 weather summary for Los Alamos, New Mexico.

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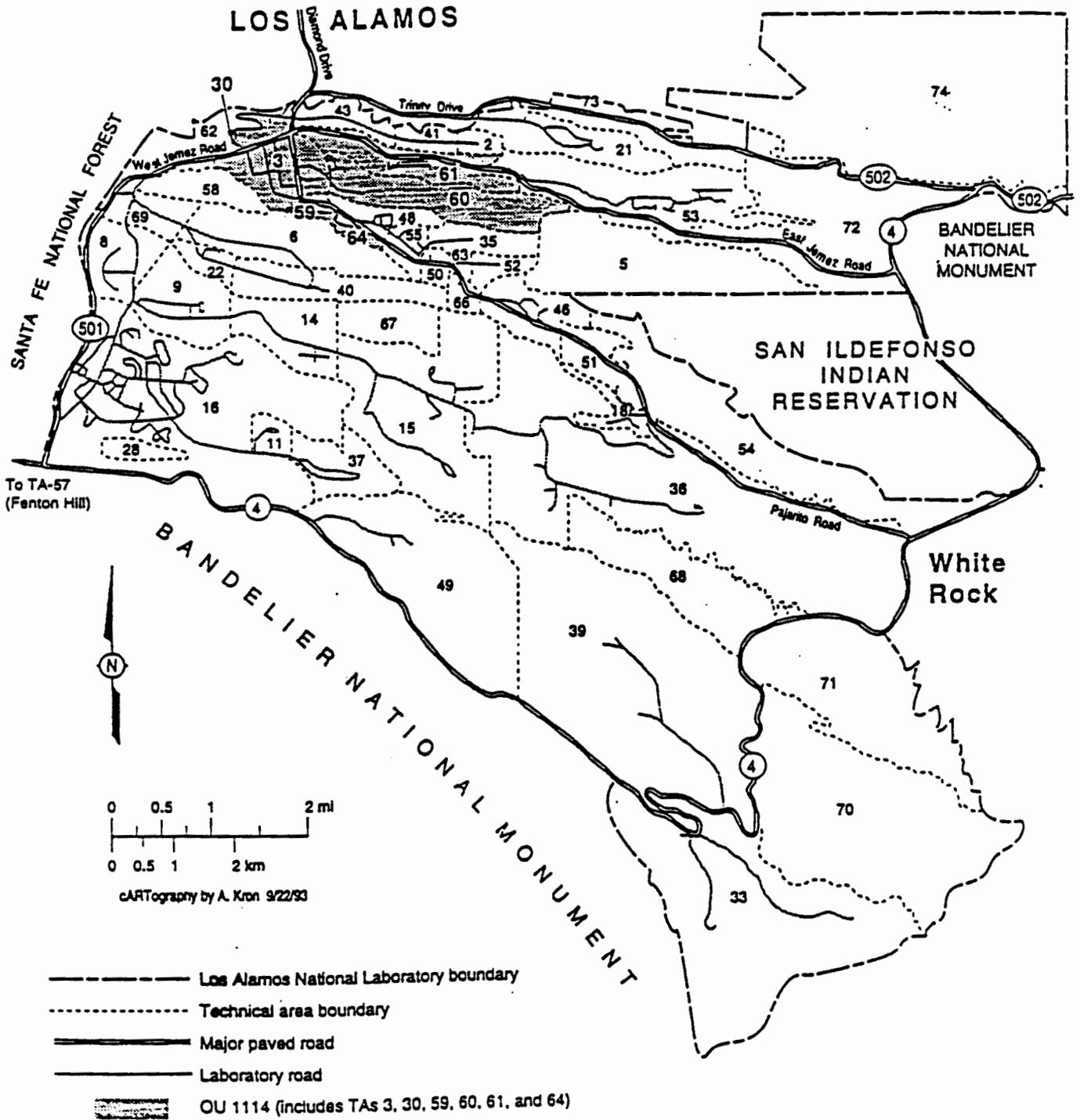
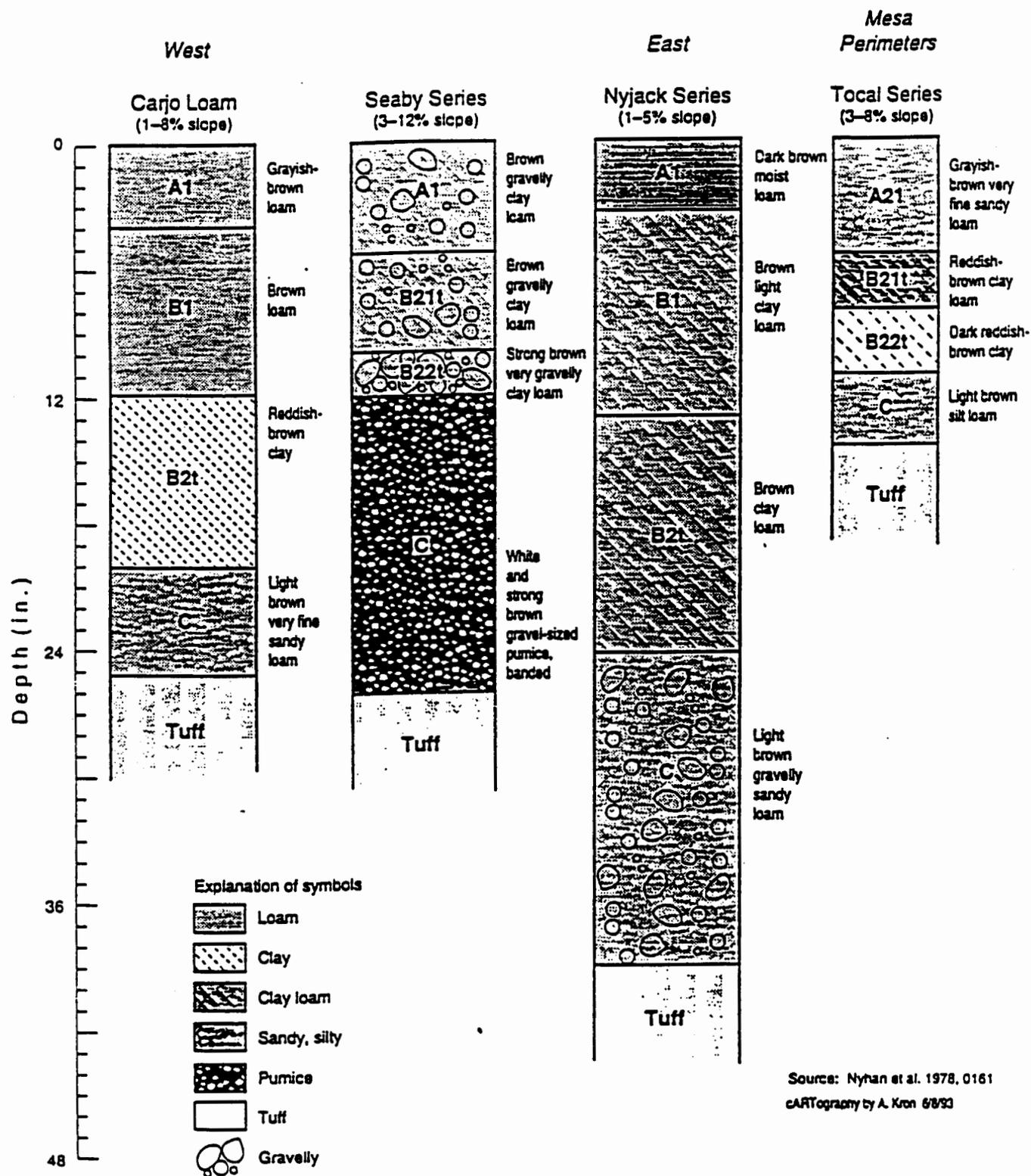


Figure 5. Location of OU 1114 with respect to Laboratory TAs and surrounding landholdings.



Source: Nyhan et al. 1978, 0161
 CARTography by A. Kron 8/8/93

Figure 6. Typical soil profiles in OU 1114.

1066m (6775 ft) asl under OU 1114. Over 290 m (950 ft) of unsaturated tuff and volcanic rock separate the surface from the aquifer in TA-3 (IT, 1987a).

In the western portion of OU 1114, soils are primarily Carjo loam and the Seaby series of loam and banded pumice (Fig. 6). Arcas of Pogna fine sandy loam and rock outcrop also exist in TA-3. The eastern portion contains Nyjack loam while mesa perimeters have the Tocal series of loam. In TA-3, the potentiometric surface of the main aquifer lies between 2035 m (6675 ft) and 1066m (6775 ft) asl under OU 1114. Over 290 m (950 ft) of unsaturated tuff and volcanic rock separate the surface from the aquifer in TA-3 (IT, 1987a).

OU 1114, the most developed OU at LANL, is composed of TA-3 (the largest TA at the Laboratory), -20, -59, -60, -61, and -64. The mesa top on which these TAs are located contains the LANL administrative area, office buildings, roads, parking lots, warehouses, landfills, experimental areas and other facilities, septic tank and outfall, and solar pond. Soil sampling for site characterization is expected to occur only in these disturbed areas.

3.3 Historical Background

Prehistorically, the vicinity of OU 1114 never supported a large population due to its high elevation and associated short growing season. OU 1114 does contain prehistoric lithic scatters, trails, cavates, and small pueblo ruins which are currently being inventoried (Schillaci, et al., in preparation).

An interview with Peggy Pond Church, long-time Los Alamos County resident, indicates that wetlands existed on the Pajarito Plateau during historic times. She mentioned the "place of the cattails" (*aqua pah*) in Sandiá Canyon and relevant references in the annual report of the Bureau of American Ethnology (Harrington, 1914).

A number of historic homesteads occur within OU 1114. A cement cistern, cabin foundation, and associated historic trash related to the Montoya Brothers Homestead lies within TA-60. The E. Vigil/E. Montoya Homestead in TA-61 has been test-excavated in conjunction with the proposed Infrastructure Support Facilities (ISF) gasoline (Manz, et al., 1993). The foundation, privy, horno, and outbuildings associated with the Montoya Cabin in TA-61 will be excavated in the fall of 1993 (McGehee and Larson, 1993).

4 PREVIOUS STUDIES

Prior to the 1992 surveys, several site-specific studies were completed within or adjacent to OU 1114. These studies include information about the biological resources of the sites and potentially-occurring TES species. Much of the species information presented in this section can be extrapolated for use as a general description of the project area's biological make-up. The 1992 surveys were necessary to characterize the biological community more completely.

Table 1. Previous Vegetation Surveys Conducted within OU 1114.

Authors	Date	Survey Title
Foxx, T.S., and G.D. Tierney	1984-1985	Status of the Flora of the Los Alamos National Environmental Research Park
Ripley, J. D.	1985	A Reconnaissance Vegetation Survey of Mortandad Canyon
Foxx, T.S., and G.D. Tierney	1986	Proposed Location of Selected Rubble Landfill in Sandia Canyon
Foxx, T.S.	1988	Sanitary Landfill Extension in Sandia Canyon
Foxx, T.S. and S.G. McLin	1988	Floodplain Assessment for an Unnamed Tributary in Mortandad Canyon for the Materials Science Building
Foxx, T.S.	1990	Sulfuric Acid Spill Wetlands Report for Sandia Canyon
Bennett, K.	1991	Human Genome
Edeskuty, B., Foxx, T.S., and Raymer, D.	1992	Outfall Study
Bennett, K.	1992	Sludge Farm

4.1 Plants

Several vegetation surveys have been conducted since 1980 within the boundaries of OU 1114 (Table 1). Appendix A contains a checklist of plant species identified during these and the 1992 surveys. The study of NPDES outfalls included several sites within OU 1114 which drained effluent into Twomile, Mortandad and Sandia Canyons (see Appendix H). Information on flow rates was sometimes unavailable because not all outfalls were operational at the time of the survey.

4.2 Wildlife

A limited number of studies characterizing the fauna of the area have been conducted since 1975. These studies are grouped according to the type of organism investigated.

4.2.1 Insects

Information in a comprehensive ant study conducted by MacKay (1986) indicates that numerous ant species are likely to be present in ponderosa pine and ponderosa pine-riparian areas similar to those within OU 1114 (See Appendix B).

BRET has sampled aquatic invertebrates in upper Sandia Canyon since 1990, when there was an accidental sulfuric acid discharge into the canyon. A list of identified families is given in Appendix C. Chemical and physical measurements affecting water quality (pH, dissolved oxygen, temperature, conductivity) have also been monitored in this on-going study. The recorded measurements fall within acceptable levels for natural waters of the area.

A team from Advanced Aquatics of Fort Collins, Colorado has also conducted aquatic sampling in Sandia Canyon.

4.2.2 Mollusks

No comprehensive field surveys for terrestrial mollusks have been conducted within Los Alamos County. However, a 1991 survey found no aquatic mollusks in the effluent stream channel of Sandia Canyon.

4.2.3 Reptiles and Amphibians

In 1978, Charles Bogart, consultant to LANL, surveyed the reptiles and amphibians within the boundaries of the Laboratory (Bogart, 1986). His research included three canyons within or adjacent to OU 1114. Appendix D contains a checklist of identified amphibians and reptiles.

4.2.4 Birds

Wenzel and Kent conducted bird surveys in Sandia Canyon during April, 1986, and identified 21 species of birds. A county-wide study of breeding birds was conducted by the Pajarito Ornithological Society over a five year period (J. Travis, 1992), and is summarized in the *Atlas of the Breeding Birds of Los Alamos County, New Mexico* (see Appendix E).

4.2.5 Fish

The stream in Mortandad Canyon is ephemeral and incapable of supporting fish. In November, 1992, members of Advanced Aquatics conducted electro-shocking in Sandia Canyon to determine if fish were present. None were found.

4.2.6 Mammals

Since 1977, several small mammal studies have been conducted within OU 1114 (Table 2). Most of these investigations employed live-trapping techniques, and provided information on species diversity, weight, length, age classes, and sex of animals, distances moved between traps, and population densities. Appendix F contains a species list of small mammals found in these studies.

Table 2. Previous Small Mammal Surveys Conducted within OU 1114.

Investigator	Date	Site studied
F.R. Miera. T.E. Hakonson	May and June 1977	Mortandad Canyon
Jim Kent	June 1986	Sandia Canyon
Jim Kent	August 1986	Mortandad Canyon
Joan Morrison	1986	Sandia Mesa
Joan Morrison. Delia Raymer	May and June 1990	Sandia Canyon

Researchers studied the movements of mule deer on LANL land from 1975 to 1978 (Eberhardt and White, 1979). Of 36 captured deer, 11 were fitted with radio-collars and 24 given visual markings (ear tags, streamers, and neck collars). Deer home ranges tended to be elongated

areas following LANL mesas and canyons, and the average home range size was 5.3 square miles. Since the deer did not make long seasonal migrations, they are considered to be a resident population. The deer did not seem to avoid areas of high human activity, but their movements were affected by the 2.4 m-high (8 ft) security fences.

A biotelemetry study monitored elk in the eastern Jemez Mountains from 1978 to 1980 (White, 1981). He radio-collared 30 elk, and found that elk use Cerro del Medio on Baca Land for calving and nursing areas. In general, the elk avoided areas of high human activity and preferred areas in early successional stages of vegetative development.

A number of studies have researched the movements and habits of large browsing mammals on LANL property. These have investigated movements of mule deer (Eberhardt and White, 1979), management plans for elk (White and Lissoway, 1980), biotelemetry studies on elk (White 1981), and winter diets of elk (Rowland, 1983).

4.3 Threatened, Endangered, and Sensitive Species

4.3.1 Plants

The state-endangered/federal candidate wood lily (*Lilium philadelphicum* var. *andium*) has been found in Los Alamos County several times. It is known to occur in upper Pajarito Canyon in ponderosa and mixed conifer vegetation. OU 1114 contains similar areas.

Fox and Tierney conducted several TES plant species and NEPA compliance surveys for proposed projects (see Table 1) within OU 1114. To date, no TES plant species have been found in OU 1114 although suitable habitat is present for several species of concern.

4.3.2 Wildlife

Jemez Mountains salamander: The Jemez Mountains salamander (*Plethodon neomexicanus*) is designated as a state threatened species and a Federal Candidate 1 species. It has been found in Los Alamos County in three separate surveys.

In 1985, Schmitt found the salamander in various locations in Los Alamos County at various montane locations. The species occurred in coniferous areas with cool, moist, and shaded habitat. All areas found to contain the salamander are considered key habitat.

During the summer of 1985, Cynthia Ramotnik conducted a survey specifically for the Jemez Mountains salamander (Ramotnik 1986). She found specimens near the reservoir in Los Alamos Canyon. A single specimen was discovered 1601 m (5250 ft) east of the Diamond Drive bridge on the north-facing slope at an elevation of 2373 m (7780 ft). This location is very near the northern boundary of TA-61. The lowest elevation at which Ramotnik found the Jemez Mountains salamander (2189 m [7180 ft]) was also in Los Alamos Canyon.

Northern goshawk: The northern goshawk is a federal candidate species. In an ongoing study, Patricia Kennedy has observed goshawks and Cooper's hawks on LANL property over several years. She used radio-tagged adults to gather data on home range size and activity patterns. Topography and vegetative structure and composition of each nest site was characterized using standard United States Forest Service (USFS) silvicultural examination techniques. The study included diet determination, prey identification, and reproductive success monitoring. Bird surveys conducted in Sandia Canyon in 1986 and 1990 found no goshawks there.

Peregrine falcon: The peregrine falcon (*Falco peregrinus*), state and federally listed as endangered, inhabits wooded and forested areas, and its breeding territories are centered on cliffs. Terrell Johnson, a peregrine falcon expert, examined locations within Los Alamos Canyon to determine their suitability for peregrine falcon breeding habitat. Nests usually occur in cliff faces within the transition zone from piñon-juniper woodland to ponderosa pine forest. Johnson stated that lower Los Alamos Canyon provides breeding habitat that would have been designated as suitable were it not for the presence of more attractive habitat in nearby Pueblo Canyon. He concluded that Los Alamos Canyon provides viable alternative nesting habitat. Bird surveys conducted in Sandia Canyon in 1986 and 1990 found no peregrines there.

5 METHODOLOGY

5.1 Floodplain and Wetlands Assessments

Wetlands: The "Federal Manual for Identifying and Delineating Wetlands" has three mandatory technical criteria for wetland identification: hydrophytic vegetation, hydric soils, and hydrology.

An area is considered to have wetland hydrology if the growing season has permanent or periodic inundation or soil saturation for at least one week a year. An area with a water table less than 15 cm (0.5 ft) from the surface for one week or more is also classified as a wetland. Field observations, recorded data, aerial photographs, and field indicators can be utilized to determine inundation or soil saturation either directly or indirectly.

Hydric soils are formed when prolonged inundation produces anaerobic soil conditions. This changes the solubility, movement, and aggregation of iron oxides and manganese oxides. Soil color is determined with a Munsell soil color chart and is used as a field indication of wetlands. Soil pits at least 46 cm (18 in.) deep can be dug to determine changes in physical characteristics which indicate inundation such as soil saturation, soil color, mottling, gleying, and aquic or peraquic moisture regimes.

Hydrophytic vegetation are plants adapted to withstanding the anaerobic soil conditions caused by inundation or periodic saturation. Hydrophytic vegetation was noted during Level 2

surveys. This vegetation is classified into five categories: obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL).

Hydrophytic vegetation is indicated under normal circumstances when:

- more than 50% of the dominant species forming all strata (trees, shrubs, understory) are obligate wetland, facultative wetland, and/or facultative species, or
- a frequency analysis of all species within the community yields a prevalence index less than 3 (where OBL=1, FACW=2, FACU=3, FACU=4, and UPL=5). This numbering system was developed in the "National List of Plant Species that Occur In Wetlands: Southwest, Region 7."

Floodplains. Floodplains are identified as "lowlands adjoining inland and coastal water and relatively flat areas." The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain. Floodplains are protected from disturbance under EO 19900. Floodplain maps indicating the base floodplain have been generated for LANL (McLin 1992).

5.2 Level 1 (Reconnaissance) Surveys

Three levels of surveys were conducted within and near the OU. The primary purpose of these surveys was to determine if there were any sensitive habitats or species of concern that might be affected by site characterization sampling.

The Level 1 (reconnaissance) survey is a walk-through of the area in which we note general habitats and site features. It is an initial survey conducted to determine placement of line transects, potential impacts of the transects, presence or absence of water or floodplains, presence or absence of disturbance. From the results of the Level 1 survey of OU 1114, we determined that Level 2 (habitat evaluation) surveys were required.

5.3 Level 2 (Habitat Evaluation) Surveys

Using Level 1 survey results, Level 2 (habitat evaluation) surveys were undertaken in OU 1114. Level 2 surveys are designed to quantitatively measure the habitat, to document the habitat parameters, and to determine if sensitive species habitats are present. In addition, the habitat evaluation can be used to determine environmental settings, to run habitat evaluation procedures, and to provide base line information.

The habitat evaluation survey uses standard ecological techniques to measure cover, density, and frequency of both overstory and understory vegetative components. Species information obtained from vegetation transects was summarized for mapping with a hierarchical system of classification, and this data will ultimately be used to map vegetation on Geographic Information Systems (GIS).

Table 3 provides a definition for each element of the classification. The classification for both upland and wetland vegetation types for the Pajarito Plateau is in Appendix G. This listing

includes known and potential habitat types and phases. It is based on information mentioned in Brown (1982), Moir and Ludwig (1979), and an unpublished USFS document. We made no attempt to develop new habitat types for the area. Any study area that does not fit within a designated habitat type defined for northern New Mexico is considered to be a potential habitat site; that is, it is classified with that type with which it shares the most elements.

Table 3. Definitions of Biotic Community Classifications.

Vegetation Type: Vegetation established under existing climate zones; includes upland or wetland.

Formation Type: Formations that are vegetative responses to various environmental factors, primarily available soil moisture, and includes the following:

UPLAND	WETLAND
Tundra	Wet tundra
Forest and Woodland	
Scrub land	Swamp scrub
Grassland	Marshland
Desert land	Strand
Nonvascular	Submergent

Climatic Zone: One of the four world climatic zones in which the minimum temperature is the primary factor in separation of formation types. These include Arctic-Boreal, Cold Temperature, Warm Temperate, and Tropical-Subtropical.

Biotic Community: A unit characterized by a distinct evolutionary history within a formation and centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Series: A principal plant and animal community within a biotic community. These are based on distinct climax plant dominants.

Habitat Type: A portion or series defined by the occurrence of a particular dominant species of local or regional distribution.

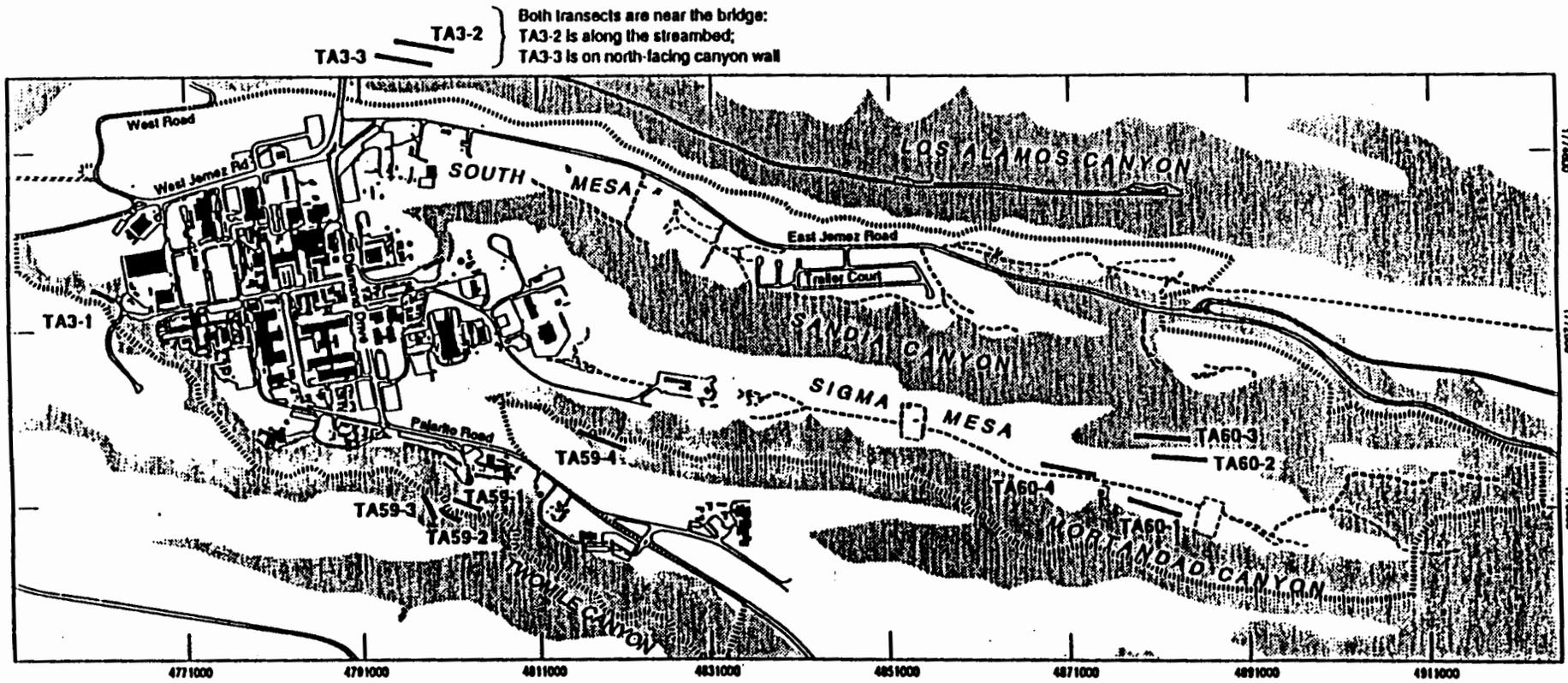
Phase: A sub-category of habitat type established by determining codominants, understory, and other associated species.

BRET surveyed three sites in TA-3, four sites in TA-59, and four sites in TA-60. At each site, we established transects in which both understory and overstory components were identified and measured. The transect number is composed of the TA number, the order in which the transect was read, and a "u" for understory or a "c" for overstory or canopy layer. For example, transect TA3-2c is the second overstory transect read within TA-3 (see Figure 7 for transect locations).

In the following sections, both the American Standard and metric system will be used to conform with established methods of measurement.

5.3.1 Overstory Evaluation

BRET used the line intercept technique (Lindsey 1955; Woodin and Lindsey 1954) to measure overstory components within coniferous forest areas. We collected data within a 20-ft



- ==== Paved road
- Unimproved road or trail
- Building or structure

- OU 1114 boundary
- ▨ Canyon areas
- Transect location



Figure 7. Transect locations within and near OU 1114.

wide strip centered on a transect line through the habitat (Fig. 8). Within the strip, the DBH of all single-stemmed trees (i.e., ponderosa) was determined, and all shrub stems were counted. We estimated foliar cover by measuring the total length of vegetation intercept along the transect line. To estimate foliar cover of trees and shrubs within each segment, the areas where foliage intercepted the actual transect line were measured and recorded (Fig. 9). Each 50-ft strip segment measured from the start of the transect, constituted a plot for frequency estimation.

The team used a circular plot technique to measure the overstory components within riparian zones and piñon-juniper woodlands. Field technicians placed a transect line within the habitat to be evaluated and established circular plots every 100 ft along the transect (Fig. 10). All trees within a 30-ft radius of the center point on the transect line were measured for basal diameter if multistemmed or DBH if single-trunked. All shrub stems were counted and the cover was estimated within each of the plot's four quarters.

We calculated an importance index for all trees and shrubs within the transects by averaging their relative cover, relative density, and relative frequency. The derived number is a reliable measure of species dominance within a transect.

5.3.2 Understory Evaluation

BRET used the quadrat method with a Daubenmire plot of 20 x 50 cm (Daubenmire 1959) to measure cryptogamic and herbaceous layers, percentage of bare soil and litter, and shrubs less than 3 ft tall. We made visual estimates of foliar cover to determine percent cover. Using the transect established for overstory evaluation, quadrats were read at 10-ft intervals (Fig. 11) until no new species were encountered (the species area curve had flattened) or a maximum of 100 quadrats along a transect had been read.

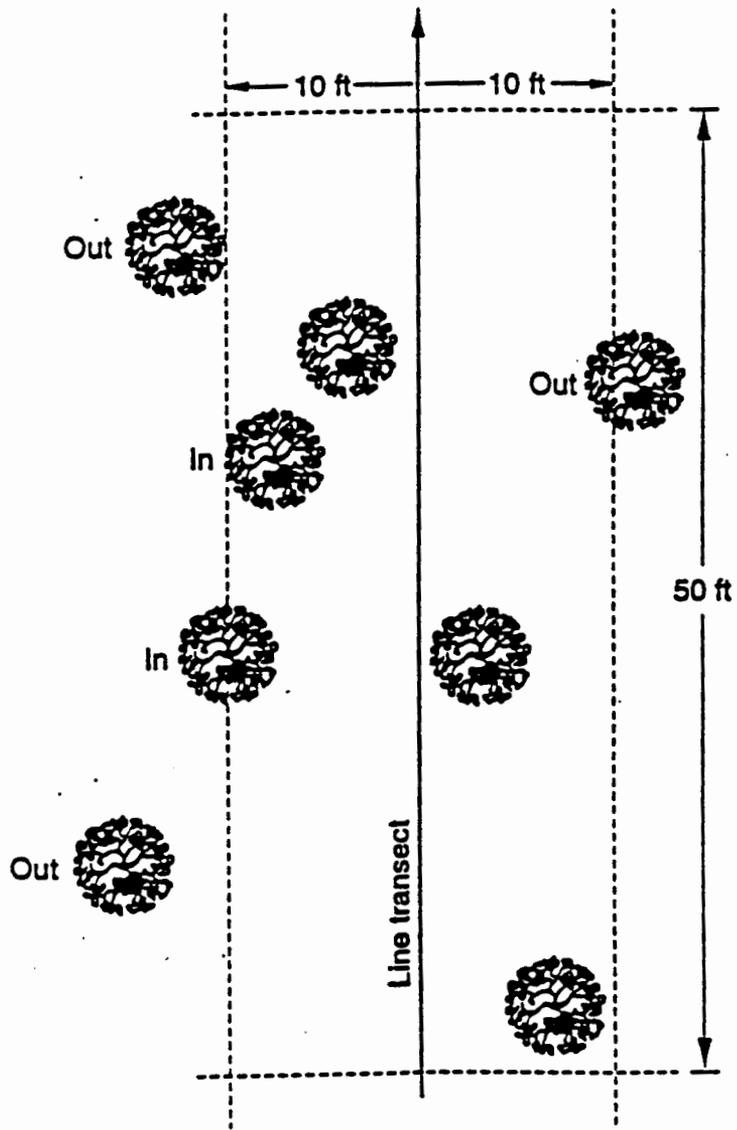
All plants were identified using Hitchcock (1950), Martin and Hutchins (1980), Foxx and Hoard 1984, and Foxx and Tierney 1985. When necessary, voucher specimens were collected and archived in the herbarium at ESH-8. Any questionable identifications were confirmed at the University of New Mexico Herbarium.

5.4 Level 3 (Species-Specific) Surveys

A Level 3 (species-specific) survey uses established protocols to search for a single species of concern. These surveys are primarily conducted for TES species.

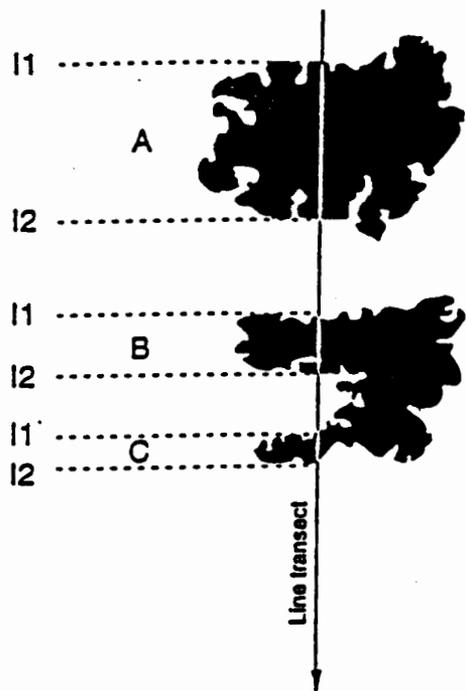
5.4.1 Spotted Bat

Spotted bat surveys were conducted by 3D/Environmental Services, Inc. Mist nets raised at dusk and run for several hours at night, are closely monitored and checked for bats every few minutes. Site selection is based on characteristics of suitable foraging or roosting habitat. Nets were placed over a stream, at the edge of a pond, along cliff faces, or in other open areas that bats

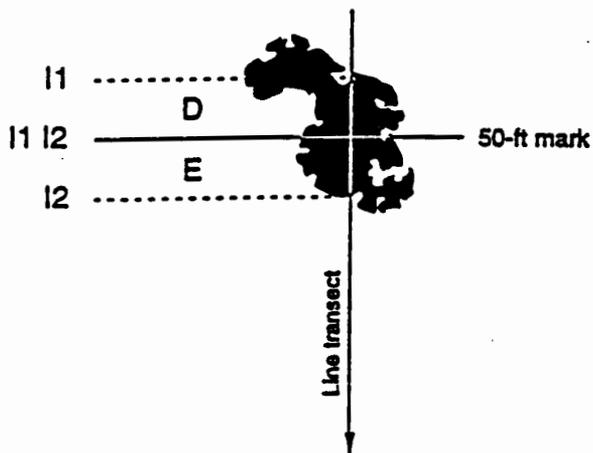


Tree boles or stems should be counted in when 50% or greater of the bole or stem is in the plot

Figure 8. Line transect method of tree bole measurements and stem counts.

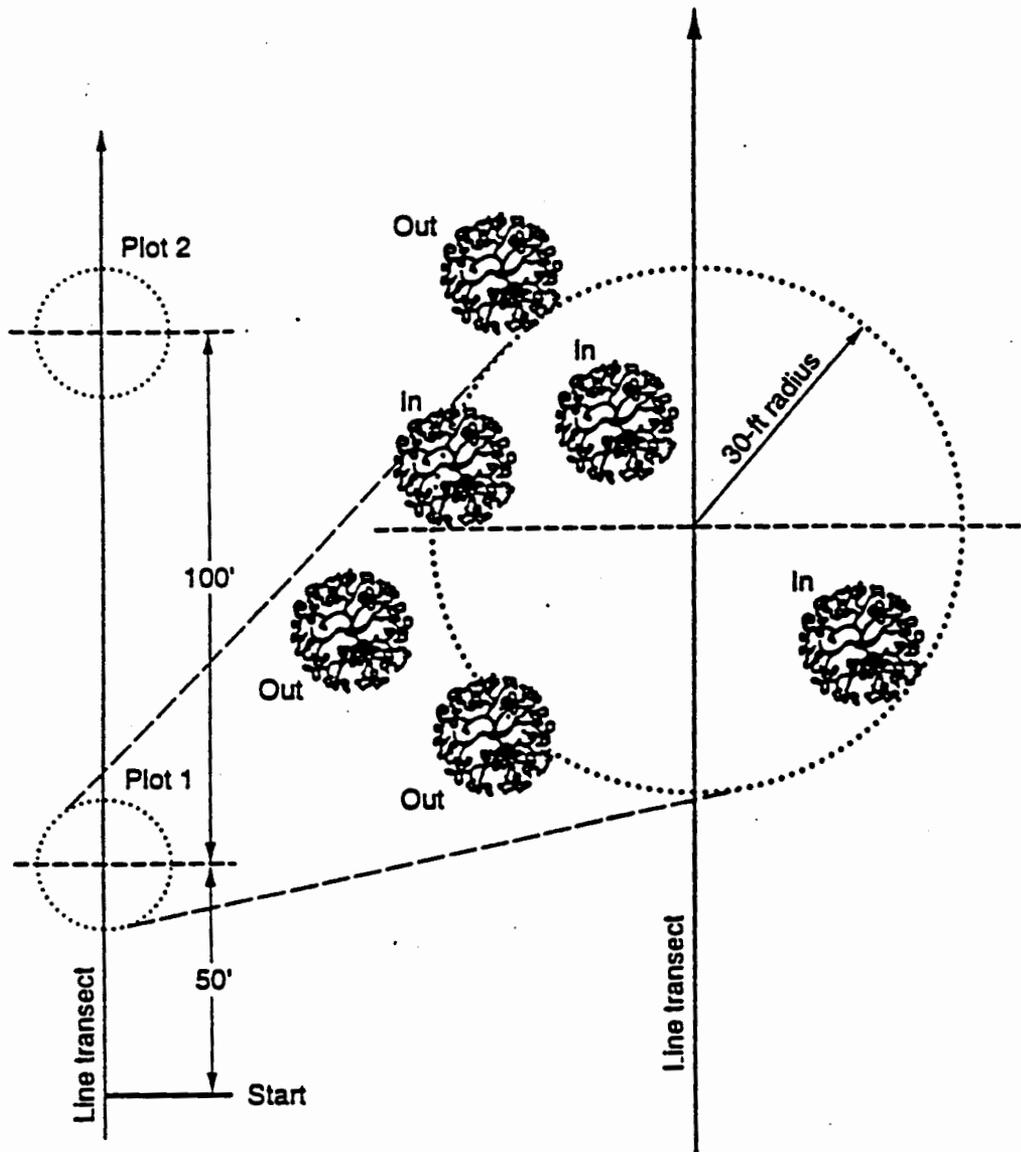


View from above the line showing a transect with tree and shrub intercepts indicated.
 I1 = beginning intercept
 I2 = ending



When the intercept crosses the 50-ft mark, intercepts should be read separately, with a new intercept beginning at the 50-ft mark.

Figure 9. Reading foliar intercepts.



Tree boles and shrub stems should be counted in when 50% or greater of the bole or stem is in the plot.

Figure 10. Circular plot method diagram for trees and shrubs.

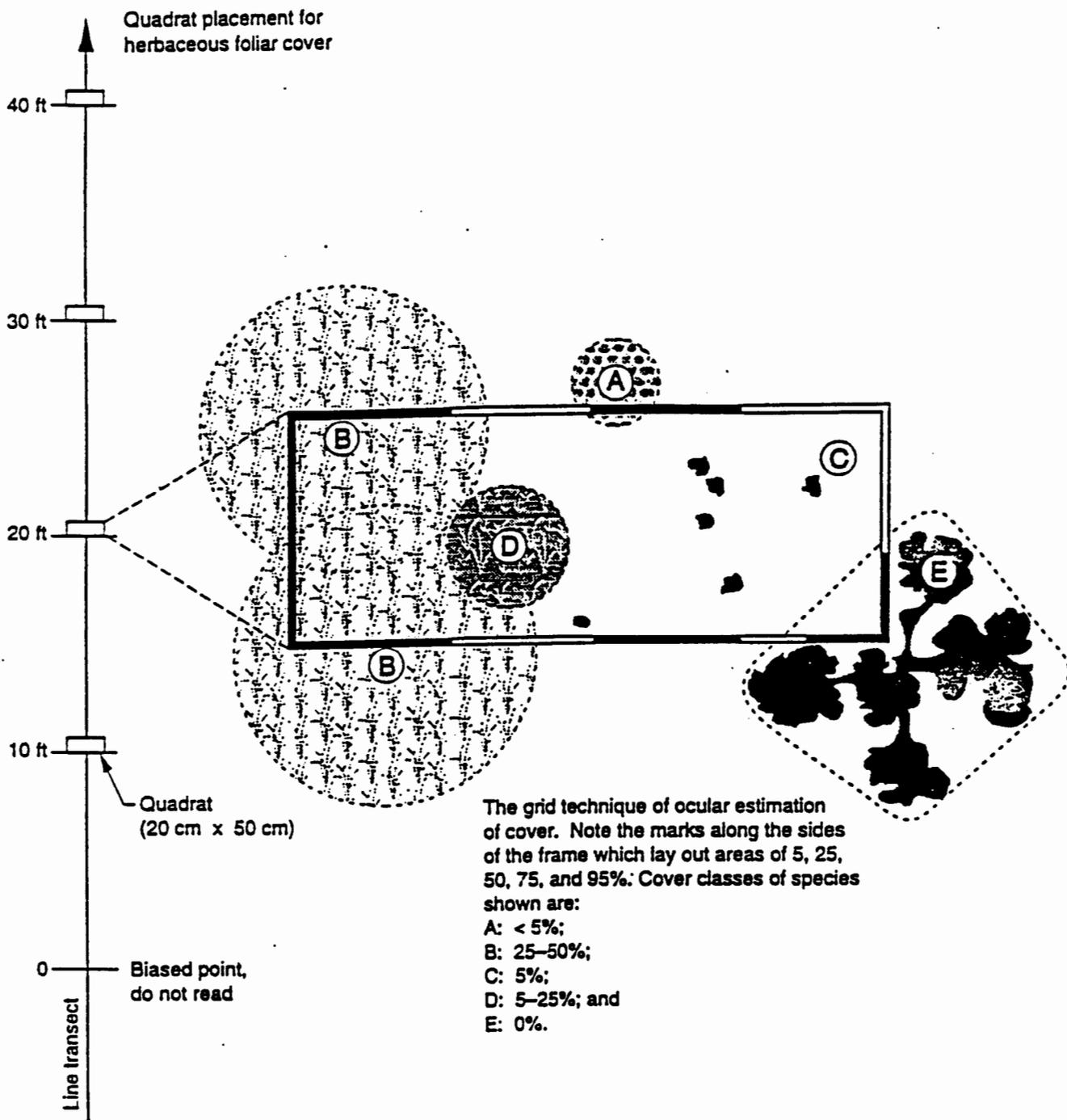


Figure 11. Location of quadrats for understory transects of herbaceous foliar cover, and the grid technique of ocular estimation of cover (from Daubermire 1973).

might use as flyways (Tyrell and Brack 1992). This method of capture is not specific to spotted bats (*Euderma maculatum*) and allows general inventory data to be collected. When a bat is caught in the net, it is carefully removed by gently holding it while pulling the net strands away from its body and wings. Species are identified, sexed, photographed, and immediately released by rabies-immunized researchers. Identifications were made using Whitaker 1980 and Burt and Grossenheider 1976.

5.4.2 Jemez Mountains Salamander

Jemez Mountains salamander (*Plethodon neomexicanus*) surveys are conducted only under optimal conditions from June to August, and within four or five days of a rainfall. The USFS protocol "A" is used to determine the presence or absence of salamanders. It is a time-constrained search requiring two person-hours of searching and has become the New Mexico state protocol for Jemez Mountains salamander surveys. A team of searchers uses a four-pronged potato rake to turn over cover objects such as rocks, bark, small logs, fallen branches, and moss mats, and to tear apart large rotten logs. Searches continue for two hours unless a salamander is encountered, in which case searching was discontinued. Habitat is characterized using the USFS log classification scheme.

BRET found salamanders in upper Pajarito Canyon, and in an area to the southwest of OU 1114. To date, no salamanders have been found within the OU boundaries.

5.4.3 Northern Goshawk

The species-specific survey transects recommended by Kennedy and Stahlecker (1993) uses transects with 500 ft between calling stations during incubation, and 650 ft during early nestling to fledgling-dependency. Distances are measured by pacing. At each station, a broadcast of the goshawk alarm call taped from commercial recordings is played. Any vocal or aggressive response from any accipiter leads to an intensive nest search in the response area. The search area covers approximately 3000 square yards and varies in shape according to terrain and vegetation (Sinton and Kennedy 1993). Each tree in the immediate area is scanned with binoculars for an active nest. In addition, searchers looked for the plucked remains of prey, feces, molted feather, and inactive stick nests. If no nest is found, additional calling is conducted.

5.4.4 Meadow Jumping Mouse

Meadow jumping mouse (*Zapus hudsonius luteus*) surveys were conducted in areas with permanent running water. The jumping mouse is found within habitats consisting of tall, dense understory vegetation of grasses, forbs, and occasional shrubs, along permanent streams. The snap trap method sets traps near the waterway in streamside riparian zones and in wet meadow areas adjacent to the stream (Morrison 1990). Trapping continues for four consecutive nights or

until a jumping mouse is caught. Traps are not baited as capture of a jumping mouse is incidental and the attraction of other small mammal species is not desired.

The capture-release method is used to obtain a species list and may be employed in conjunction with meadow jumping mouse surveys. Two trap lines consisting of 210 traps are established, each running on either side of a canyon bottom stream for 165 ft. Trap stations are spaced 33 ft apart with three ventilated aluminum 9 x 3 x 12 inch Sherman live traps at each station. The traps are baited with sweet feed in late afternoon. They are set on a level surface under cover from exposure to heat and precipitation. Traps left open overnight to capture animals, are checked as early as possible the following morning. After recording species, sex, body weight, tail, and body length for each capture, the animal is released at their capture site. The line transects are run for four consecutive nights.

5.4.5 Mexican Spotted Owl

Two techniques were used to evaluate Twomile and Pajarito Canyons for the Mexican spotted owl (*Strix occidentalis* var. *lucida*). The first was a reconnaissance survey to evaluate the components of the habitat, and the second was a broadcast survey. During the 1993 breeding season, Terrell Johnson and a LANL biologist, conducted a one-night broadcast survey. Recorded owl hoots were broadcast at several locations along the rim of Twomile Canyon, west of the junction of Twomile and Pajarito Canyons. All owl responses were noted, including information on species and location relative to the calling station (Johnson 1993). No spotted owls were detected.

5.5 Small Mammal Trapping

The standard BRET small mammal trapping program uses Sherman live traps, opened for three consecutive nights at each area. A 5 x 20 grid was established at each site for totals of 100 traps and 300 trap-nights. Traps were placed 33 ft apart. Sherman traps were baited with sweet feed in late afternoon, and checked in the early morning to record nocturnal species. Incidental captures of diurnal species were not included in analysis. We recorded the location of capture, species name, sex, weight, body length, tail length, ear length, foot length and tag number. Animals were marked with #FF rodent ear tag from Salt Lake Stamp Company, Salt Lake City, Utah. If appropriate, each grid also contained ten shrew pit traps, plastic bucket that with a depth of 7 in. and a circumference of 6 in., buried along logs or beside cattail ponds. The dominant overstory, shrubstory, and understory vegetation within 20 ft of each trap station were also recorded for each site.

6 RESULTS

6.1 Wetlands and Floodplains

Floodplains (Fig. 12) and wetlands are located within the OU. Delineation of wetlands was not conducted since exact site characterization sampling locations were not known. However, when the exact sampling plan is determined, strict delineation of the wetlands will be conducted in those areas where applicable.

The National Wetlands Inventory has identified two wetland types within Sandia Canyon: riverine which are contained within a channel, and palustrine which are dominated by vegetation. A palustrine wetland in upper Sandia is maintained by effluent flows from the TA-3 steam plant, and run-off primarily from parking areas. These areas have been broadly mapped by U.S. Fish and Wildlife Service using a hierarchical system described by Cowardin (1979) based solely on aerial photography.

OU 1114 contains 15 outfalls (see Appendix H). The largest amount of effluent empties into Sandia Canyon, and maintains the wetlands area there. The combined discharge into Sandia Canyon measured 1 638 390 $\frac{1}{2}$ (432 817 gal) per day while the sanitary waste treatment plant was still active. Most of the effluent is now once-through cooling water and treated cooling water. The effluent flows to approximately East Jemez Road and then sinks into the sands.

Using the 1987 "Corps of Engineers Wetlands Delineation Manual," (Dunke, et al. 1989) BRET compiled a plant checklist noting the wetlands indicator status for each plant species found in the surveys (Appendix I).

6.2 Level 1 (Reconnaissance) Surveys

Reconnaissance surveys were conducted within the OU to determine potential habitats, identify sampling locations, determine access, and record seasonal observations. The general plant communities, level of disturbance, terrain, and physical features of the site were noted. All sampling locations were readily accessible, either by vehicle or a relatively brief walk.

Based on the Level 1 surveys, we defined the following vegetation zones and used them as search criteria:

- Piñon-juniper
- Ponderosa
- Ponderosa-piñon pine
- Mixed conifer
- Wetlands
- Riparian zones

We reviewed the TES species database to determine if any threatened, endangered, or sensitive plant or animal species occur within the vegetation zones of OU 1114 (Table 4).

Appendix J provides a printout from the database.

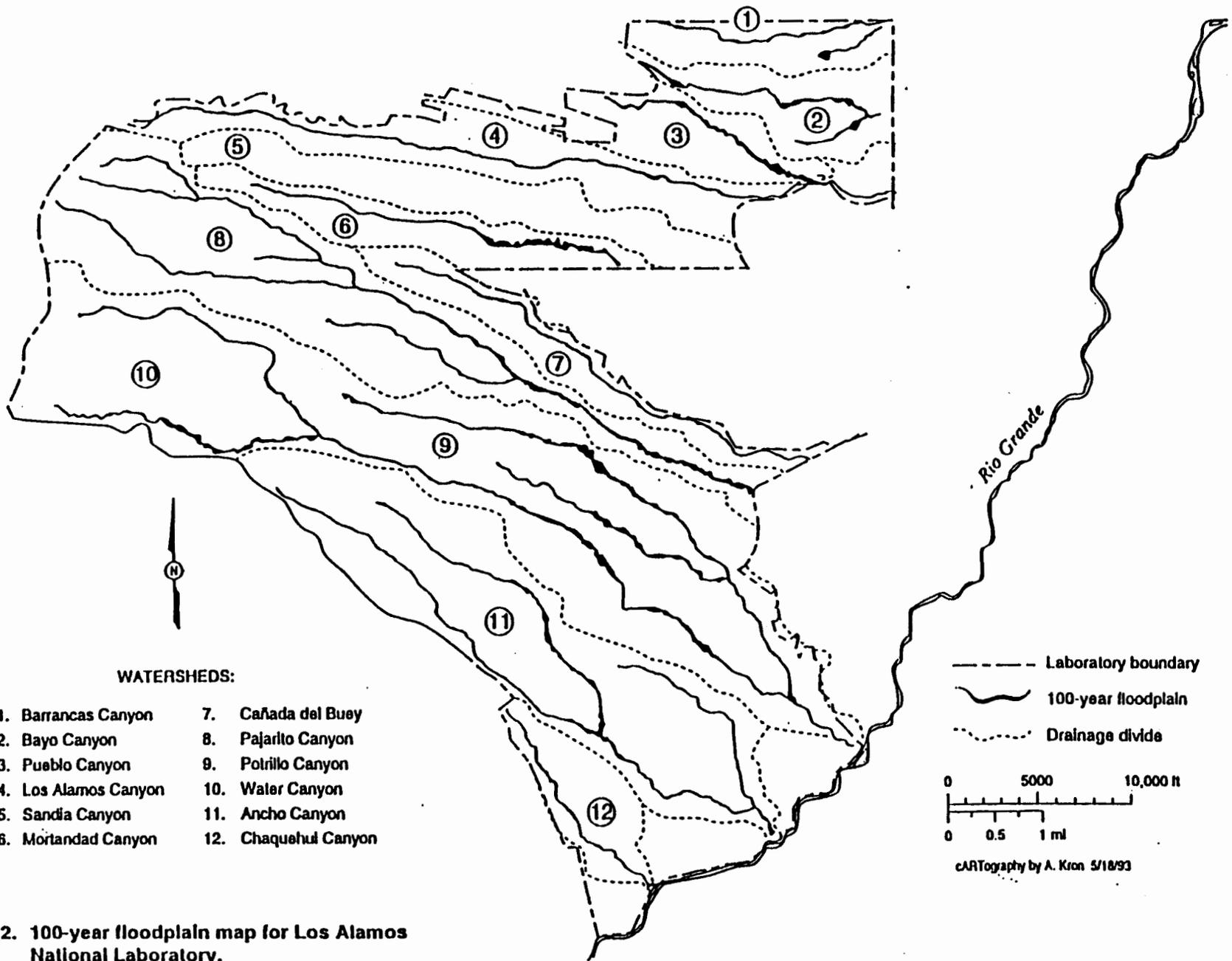


Figure 12. 100-year floodplain map for Los Alamos National Laboratory.

6.2.1 Plants

Federally Listed Species: Three candidate species for the federal endangered or threatened list have potential to occur in the OU.

Candidate

Tufted sand verbena
Grama grass cactus
Wood lily

Abronia bigelovii
Toumeyia papyracantha
Lilium philadelphicum var. *andium*

Table 4. Listing of Threatened, Endangered, and Sensitive Species for OU 1114.

SCIENTIFIC NAME	COMMON NAME	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**
ANIMALS				
<i>Accipiter gentilis</i>	Northern goshawk	FC	Ponderosa pine-Gambel's oak; ponderosa	Medium
<i>Buteogallus anthracinus</i>	Common black hawk	SE	Riparian with cottonwood	Medium
<i>Cynanthus latirostris</i>	Broad-billed hummingbird	SE	Riparian woodlands	Low
<i>Empidonax traillii</i>	Willow flycatcher	FPE SPG2	Riparian woodlands	Medium
<i>Euderma maculatum</i>	Spotted bat	SPG2 FC	Riparian; pinon-juniper; ponderosa; cliffs and rock crevices	Medium
<i>Falco peregrinus</i>	Peregrine falcon	FE SPG2	Ponderosa-pinon; cliffs and rock crevices	Medium
<i>Haliaeetus leucocephalus</i>	Bald eagle	FE	Riparian near streams and lakes	Low
<i>Ictinia mississippiensis</i>	Mississippi kite	SE	Riparian and shelterbelts	None
<i>Lymnaea captera</i>	Say's pond snail	SE	Wetlands in Cerro la Jara, Jemez Mountains	Low
<i>Martes americana</i>	Pine marten	SE	Mature spruce-fir	Low
<i>Plethodon neomexicanus</i>	Jemez Mountains salamander	FC SE	Spruce-fir	Medium
<i>Strix occidentalis lucida</i>	Mexican spotted owl	FT SE	Mixed conifer; mountains and canyons	Low
<i>Zapus hudsonius</i>	Meadow jumping mouse	FC SE	Mesic habitats along permanent streams and wet meadows	Medium

PLANTS				
SCIENTIFIC NAME	COMMON NAME	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**
<i>Abronia bigelovii</i>	Tufted sand verbena	FC SS	Pinon-juniper, Todilto gypsum or its derivatives	Low
<i>Aletes sessiliflorus</i>	Sessile-flowered false carrot	SS	Pinon-juniper, rocky canyons and slopes	Low
<i>Astragalus cyaneus</i>	Cyanic milkvetch	SS	Pinon-juniper, sandy or gravelly hillsides	Low
<i>Astragalus feensis</i>	Santa Fe milkvetch	SS	Pinon-juniper, dry slopes	Low
<i>Astragalus puniceus</i> var. <i>gertudis</i>	Taos milkvetch	SS	Pinon-juniper, open, loose soil	Low
<i>Fritillaria atropurpurea</i>	Checker lily	SS	Cliff faces	Medium
<i>Heuchera pulchella</i>	Sandia alumroot	SS	Mixed conifer	Low
<i>Lilium philadelphicum</i> var. <i>andium</i>	Wood lily	SE FC	Mixed conifer	Medium
<i>Mammillaria wrightii</i>	Wright fishhook cactus	SE2	Pinon-juniper, gravelly or sandy hills	Low
<i>Phlox carvophylla</i>	Pagosa phlox	SS	Ponderosa-pinon	Low
<i>Silene plankii</i>	Plank's catchfly	SS	Pinon-juniper, crevices and pockets in igneous cliff faces	Low
<i>Toumeyia papyracantha</i>	Grama grass cactus	FC SPG1	Pinon-juniper, sandy basalt outcrops	Low

*** CODES FOR LEGAL STATUS**

FE = Federally listed as endangered

FC = Federal candidate species

FT = Federally listed as threatened

FPE = Federally proposed as endangered

SE1 = State protected and listed as threatened or endangered under the provisions of Federal Endangered Species Act.

SE2 = State protected, rare across its entire range with limited distribution and population size that unregulated collection could jeopardize its survival in New Mexico.

SE3 = State protected, widespread in adjacent states or 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

**** CODES FOR POTENTIAL OF OCCURRENCE**

High = The species is known to occur in the area.

Medium = The area has some species habitat components.

Low = The area does not have species habitat components.

State Listed Species: Three plant species listed as state endangered met the search criteria (New Mexico Natural Heritage Program 1991):

Endangered

Wood lily	<i>Lilium philadelphicum</i> var. <i>andium</i>
Wright fishhook cactus	<i>Mamillaria wrightii</i>
Grama grass cactus	<i>Toumeyia papyracantha</i>

6.2.2 Sensitive Plant Species

Under the Federal Endangered Species Act and state statutes, only those plant species that are listed or are candidates for listing are protected. New Mexico also lists species occurring within the state that are considered to be rare due to restricted distribution or low numerical density. Because these plants are rare, they are sensitive to long-term or cumulative land-use impacts and vulnerable to threatening biological or climatic events. The state monitors these species to determine if they should be elevated to endangered status. The following species occur in the vegetation zones found within OU 1114 and are listed as state sensitive:

Checker lily	<i>Fritillaria atropurpurea</i>
Pagosa phlox	<i>Phlox caryophylla</i>
Sandia alumroot	<i>Heuchera pulchella</i>
Sessile-flowered false carrot	<i>Aletes sessiliflorus</i>
Plank's flycatch	<i>Silene plankii</i>
Cyanic milkvetch	<i>Astragalus cyaneus</i>
Santa Fe milkvetch	<i>Astragalus feensis</i>
Taos milkvetch	<i>Astragalus puniceus</i> var. <i>gertudis</i>
Tufted sand verberna	<i>Abronia bigelovii</i>

6.2.3 Wildlife

Federally listed species: Two endangered, one threatened, one proposed, and three candidate species listed by the US Fish and Wildlife Service (1991a-b) met the data base search criteria:

Endangered

Bald eagle	<i>Haliaeetus leucocephalus</i>
Peregrine falcon	<i>Falco peregrinus</i>

Proposed as Endangered

Willow flycatcher	<i>Empidonax traillii</i>
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Threatened

Mexican spotted owl	<i>Strix occidentalis</i>
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Candidate

Northern goshawk	<i>Accipiter gentilis</i>
Jemez Mountains salamander	<i>Plethodon neomexicanus</i>
Spotted bat	<i>Euderma maculatum</i>

State listed species: The following species listed as endangered in New Mexico met the search criteria (New Mexico Department of Game and Fish 1988, 1990):

Endangered

Bald eagle	<i>Haliaeetus leucocephalus</i>
Broad-billed hummingbird	<i>Cyanthus latirostris</i>
Common black hawk	<i>Buteogallus anthracinus</i>
Gray vireo	<i>Vireo vicinior</i>
Jemez Mountains salamander	<i>Plethodon neomexicanus</i>
Meadow jumping mouse	<i>Zapus hudsonius luteus</i>
Mississippi kite	<i>Ictinia mississippiensis</i>
Peregrine falcon	<i>Falco peregrinus</i>
Pine marten	<i>Martes americana</i>
Willow flycatcher	<i>Empidonax traillii</i>
Say's pond snail	<i>Lymnaea captera</i>
Spotted bat	<i>Euderma maculatum</i>

The Migratory Bird Treaty Act (16USC 703-711) provides federal protection for all wild birds except resident game birds, English sparrows, starlings, and feral pigeons. The Bald Eagle Protection Act further protects eagles, including golden eagles. These species are protected from collection, maiming, and nest disturbances.

6.3 Level 2 (Habitat Evaluation) Surveys

We established 11 vegetation transects within OU 1114 to evaluate the understory and overstory components. We placed transects to survey a variety of habitat types in TAs 3, 59, and 60. Overstory, shrub layer, and understory vegetation are discussed below by habitat type (see Appendix K for raw data summaries).

6.3.1 Overstory Evaluation

Following a reconnaissance survey of OU 1114, we placed vegetation transects in habitats displaying different plant compositions. Survey sites were selected to sample areas that would undergo site characterization, and do not necessarily represent the entire length of the canyon systems. However, north-facing and south-facing canyon slopes, mesa tops, and riparian areas were representative of the overall habitat in OU 1114. Locations of the overstory transects are discussed in the appropriate sections for trees.

Specific site characteristics (e.g., dominant species, density, cover, frequency) are discussed and compared. While using the line intercept and circular plot techniques to determine the overstory composition, we separated the woody species into trees and shrubs for subsequent analysis. The DBH of trees was recorded while the number of stems were counted for shrubs. Every tree species encountered in the overstory transects with an importance index greater than 5.0 is listed in the accompanying tables. Appendix K contains complete data from each transect.

6.3.1.1 North-facing slopes. Typically, north-facing slopes have denser vegetation than south-facing slopes because of their capacity to retain more moisture. We surveyed north-facing transects in upper Los Alamos Canyon (TA-3), mid-Twomile Canyon (TA-59), and Sandia Canyon (TA-60). Douglas-fir, an indicator of the mixed conifer zone, was a dominant species in all transects (Table 5). Ponderosa pine and white fir occurred as codominants. Although percentage cover of trees was low for transect TA3-3, percentage cover for shrubs was very high.

Table 5. Overstory Vegetation on North-Facing Slopes.

Transect	Species	Average DBH	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA3-3c	Ponderosa pine	3.76	15.53	38.79	14.81	23.04
	Limber pine	2.61	13.80	2.65	18.52	14.45
	Douglas-fir	0.99	32.78	14.09	29.63	25.50
	Rocky Mountain maple	0.19	20.66	11.73	11.11	14.50
	White fir	0.55	6.89	2.64	11.11	6.88
TA59-3c	Gambel's oak	4.92	8.63	21.72	11.11	13.82
	Ponderosa pine	6.44	14.40	14.09	27.66	18.71
	Limber pine	5.86	6.86	7.61	12.77	9.08
	Douglas-fir	2.99	39.76	32.34	29.79	33.96
TA60-3c	White fir	5.55	38.30	45.97	27.66	37.31
	Ponderosa pine	7.33	89.47	99.14	74.07	87.56

6.3.1.2 South-facing slopes. South-facing slopes are normally drier than adjacent north-facing slopes and thus usually have a lower vegetative cover. We surveyed a south-facing transect in upper Twomile Canyon (TA-59). Upper Twomile Canyon is in the mixed conifer community with ponderosa pine and Douglas-fir as dominants (Table 6).

Table 6. Overstory Vegetation on South-Facing Slopes

Transect	Species	Average DBH	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA59-1c	Ponderosa pine	7.70	68.97	76.06	48.28	64.44
	Limber pine	7.67	10.35	3.79	17.24	10.46
	Douglas-fir	8.74	15.52	20.15	24.14	19.93

6.3.1.3 Mesa tops. Three mesa top transects were read along Sigma Mesa (TA60-1 near the end of the mesa on the south side, TA60-2 near the end of the mesa on the north side, and TA60-4 in the middle of the mesa) and one in upper Mortandad Canyon. Sigma Mesa is in the piñon-juniper community; and the dominant overstory species were piñon pine, one-seed juniper, and ponderosa pine (Table 7). The Mortandad Canyon transect is in mixed conifer; and the dominant trees were ponderosa pine, Douglas-fir, and Gambel's oak.

6.3.1.4 Riparian zones. Riparian zones tend to have more species diversity than surrounding habitats. We surveyed three riparian transects along stream channels in upper Twomile Canyon (TA-3), Los Alamos Canyon (TA-3), and mid-Twomile Canyon (TA-59). The

species diversity is higher than in other habitat types and several trees were not listed in Table 8 due to low importance indices. Cover values ranged from 50.03% to 66.12%.

Table 7. Overstory Vegetation on Mesa Tops.

Transect	Species	Average DBH	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA59-4	Gambel's oak	4.83	10.72	17.20	6.67	11.53
	Ponderosa pine	3.78	46.44	47.58	60.00	51.34
	Limber pine	5.80	3.57	15.69	6.67	8.64
	Douglas-fir	3.57	10.72	19.53	6.67	12.31
	Gambel's oak snag	1.13	21.43	0.00	6.67	9.37
	Ponderosa pine snag	21.05	7.13	0.00	13.33	6.82
TA60-1c	One-seed juniper	4.56	44.74	26.64	37.50	36.29
	Ponderosa pine	8.08	5.26	29.13	18.75	17.72
	Piñon pine	5.84	50.00	44.22	43.75	45.99
TA60-2c	One-seed juniper	5.46	25.00	27.32	29.41	27.25
	Piñon pine	1.99	18.18	13.96	23.53	18.56
	Ponderosa pine		54.55	58.71	41.18	51.48
TA60-4c	Piñon pine	6.45	14.29	41.18	28.57	28.01
	Ponderosa pine	9.90	42.86	35.29	28.57	35.57
	One-seed juniper	7.37	42.86	23.53	42.86	36.41

6.3.2 Shrubs

Each shrub encountered in the transects with an importance index greater than 5.0 is listed in the tables below. Complete data from each transect are contained in Appendix K.

Table 8. Overstory Vegetation in Riparian Areas.

Transect	Species	Average DBH	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA3-1c	Ponderosa pine	6.94	30.85	17.55	23.08	23.83
	Limber pine	5.15	6.38	16.03	15.38	12.60
	Douglas-fir	4.62	41.49	26.29	19.23	29.00
	White fir	3.94	11.70	15.04	19.23	15.32
	Gambel's oak	4.54	7.45	9.99	15.38	10.94
TA3-2c	Narrow-leaf cottonwood	5.18	41.33	19.85	21.05	27.41
	Ponderosa pine	2.61	32.00	18.15	15.79	21.98
	Douglas-fir	0.91	9.33	5.14	10.53	8.33
	River birch	6.86	4.00	37.81	15.79	19.20
	White fir	0.70	9.33	9.14	15.79	11.42
TA59-2c	Gambel's oak	4.57	5.17	8.50	12.50	8.72
	Ponderosa pine	6.04	6.90	20.39	16.67	14.65
	Limber pine	8.06	6.03	18.85	12.50	12.46
	Douglas-fir	5.72	25.86	23.36	29.17	26.13
	Rocky Mountain maple	0.75	25.86	5.56		10.47
	White fir	6.03	30.17	23.34	29.17	27.56

Table 9. Shrub Species on North-Facing Slopes.

Transect	Species	# Stems/ Acre	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA3-3c	Gambel's oak	1012.8	15.11	51.61	6.52	24.42
	Wax currant	1103.5	16.47	10.36	19.57	15.47
	Fendler's rose	326.7	4.88	8.32	6.52	6.57
	Chokecherry	196.0	2.93	6.76	8.70	6.13
	Cliffbush	2871	42.85	10.74	17.39	23.66
	Raspberry	707.8	10.56	9.82	15.22	11.87
TA59-3c	Gambel's oak	497.8	61.54	97.76	41.18	66.82
	Wax currant	90.2	11.15	1.50	11.76	8.14
	Mountain mahogany	59.1	7.31	0.43	17.65	8.32
	Barberry	140.0	17.31	0.75	20.59	12.88
TA60-3c	Gambel's oak	1776.6	79.09	98.09	46.67	74.61
	Mountain mahogany	199.1	8.86	1.91	20.00	10.26
	Barberry	211.6	9.42	0.00	23.33	10.92

6.3.2.1 North-facing slopes. On the north-facing slopes, the shrubs were more varied than the trees (Table 9). Gambel's oak had the highest cover values and importance indices in all 3 transects. It should be noted that the tree form of Gambel's oak occurs in transect TA3-3 and is also listed in the overstory section for trees with an importance index of 13.82. Barberry, cliffbush, and wax currant also occurred in all north-facing slope transects. The number of stems per acre ranged from 808 (TA59-3) to 6701 (TA3-3).

6.3.2.2 South-facing slopes. As on north-facing slopes, our single south-facing transect had Gambel's oak as the most important shrub (Table 10). It is surprising that chokecherry, frequently found in moist areas, occurs here. However, the number of chokecherry stems per acre is low.

Table 10. Shrub Species on South-Facing Slopes.

Transect	Species	# Stems/ Acre	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA59-1c	Gambel's oak	87.1	30.11	100.00	50.00	60.04
	Chokecherry	15.6	5.38	0.00	10.00	5.13
	Cliffbush	186.7	64.52	0.00	40.00	34.84

6.3.2.3 Mesa tops. The transect near Mortandad Canyon (TA59-4) had very low percentage cover and frequency values. It was also the only mesa top transect with willow (Table 11). The other three transects were on Sigma Mesa and were dominated by species of oak, mountain mahogany, and wax currant.

6.3.2.4 Riparian zones. Riparian areas typically support a large variety of plant species, and our transects had the highest shrub diversity (19 total species) of any habitat type surveyed in this OU. There was also a great variety of shrub species between the three riparian transects (Table 12). Gambel's oak was the only dominant present in all transects.

Table 11. Shrub Species on Mesa Tops.

Transect	Species	# Stems/ Acre	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA59-4c	Gambel's oak	18.7	2.14	0.00	20.00	7.38
	Wax currant	56.0	6.41	0.00	10.00	5.47
	Willow	781.0	89.32	11.84	60.00	83.11
TA60-1c	Wavyleaf oak	593.4	32.41	40.32	26.32	33.02
	Gambel's oak	404.4	22.09	30.25	15.79	22.71
	Oak hybrid	290.1	15.85	24.69	15.79	18.77
	Mountain mahogany	536.3	29.29	4.55	31.58	21.81
TA60-2c	Wavyleaf oak	527.5	14.96	32.87	9.09	18.98
	Gambel's oak	1013.2	28.74	46.67	10.61	28.67
	Wax currant	55.0	1.56	1.65	60.61	21.27
	Mountain mahogany	1822.0	51.68	14.91	10.61	25.73
TA60-4c	Gambel's oak "	22.0	2.29	19.66	3.57	8.51
	Hybrid oak	364.8	37.99	25.80	14.29	26.02
	Wax currant	112.1	11.67	13.76	57.14	27.52
	Mountain mahogany	411.0	42.79	25.06	10.71	26.19
	Barberry	15.4	1.60	9.83	3.57	5.00

Table 12. Shrub Species in Riparian Areas.

Transect	Species	# Stems/ Acre	Relative Density	Relative Cover	Relative Frequency	Importance Index
TA3-1c	Gambel's oak	428.2	18.03	29.94	11.76	19.91
	Red-osier dogwood	182.0	7.67	24.48	1.96	11.37
	Wax currant	215.4	9.07	4.94	56.86	23.63
	Barberry	169.2	7.13	2.71	5.88	5.24
	Cliffbush	1051.3	44.28	12.82	7.84	21.65
	Raspberry	256.4	10.80	23.32	1.96	12.03
TA3-2c	Gambel's oak	70.3	9.94	5.33	20.00	11.75
	Gooseberry	81.3	11.49	3.60	10.00	8.36
	Fendler's rose	189.0	26.71	8.85	15.00	16.85
	New Mexico locust	147.2	20.81	15.07	25.00	20.29
	Red elderberry	22.0	3.11	14.11	5.00	7.40
	Unknown 1	96.7	13.66	10.58	5.00	9.75
TA59-2c	Unknown 1 "	65.9	2.75	7.46	5.00	5.07
	Gambel's oak	169.2	7.06	15.51	8.75	10.44
	Wax currant	294.5	12.28	6.05	45.00	21.11
	Willow	674.7	28.14	22.17	8.75	19.69
	Chokecherry	156.0	6.51	4.95	7.50	6.32
	Cliffbush	848.4	35.38	13.66	8.75	19.26
	Red-osier dogwood	94.5	3.94	15.98	1.25	7.06

6.3.3 Understory Evaluation.

Tables list the relative cover, relative frequency, and importance index of all understory species having an importance index value greater than 5.0. Since density is not measured in an understory evaluation, the importance index for understory plants was calculated by averaging the

relative cover and relative frequency values. Complete data from each transect are contained in Appendix K. Transect locations are given in the appropriate sections.

6.3.3.1 North-facing slopes. We surveyed north-facing transects in upper Los Alamos Canyon (TA-3), mid-Twomile Canyon (TA-59), and Sandia Canyon (TA-60). A number of species usually considered as shrubs (Gambel's oak, wax currant, barberry) turned up in these surveys (Table 13). Total understory cover ranged from 9.17% (TA60-3) to 17.75 (TA3-3)%.

Table 13. Understory Vegetation on North-Facing Slopes.

Transect	Species	Relative Cover	Relative Frequency	Importance Index
TA3-3u	Raspberry	7.04	8.16	7.60
	Junegrass	6.57	4.08	5.33
	Strawberry	11.36	11.22	11.29
	Alumroot	7.51	5.10	6.31
	Mountain parsley	6.29	5.10	5.70
	Penstemon	6.57	4.08	5.33
TA59-3u	Mountain muhly	9.28	16.50	12.89
	Gambel's oak	18.38	10.68	14.53
	Sedge	7.09	9.71	8.40
	Pussytoes	7.12	7.77	7.44
	Kinnikinnik	12.71	5.83	9.27
	Myrtle boxleaf	5.69	8.74	7.21
TA60-3u	Wax currant	11.31	5.83	8.57
	Mountain muhly	7.79	6.59	7.19
	Gambel's oak	38.97	25.27	32.12
	Barberry	10.13	6.59	8.36
	Bluegrass	11.02	21.98	16.50
	Bromegrass	6.26	9.89	8.08
	Pussytoes	16.39	14.29	15.34

6.3.3.2 South-facing slopes. We surveyed a south-facing transect in upper Twomile Canyon (TA-59). Total plant cover was only 4.14% and only 4 species had an importance index greater than 5.0 (Table 14).

Table 14. Understory Vegetation on South-Facing Slopes.

Transect	Species	Relative Cover	Relative Frequency	Importance Index
TA59-1u	Kinnikinnik	12.07	6.67	9.37
	Mountain muhly	37.93	40.00	38.97
	Little bluestem	31.03	28.89	29.96
	Mountain muhly	14.39	8.33	11.36

6.3.3.3. Mesa tops. Three mesa top transects were read along Sigma Mesa (TA60-1 near the end of the mesa on the south side, TA60-2 near the end of the mesa on the north side, and TA60-4 in the middle of the mesa) and one near Mortandad Canyon. Most transects had abundant

Table 15. Understory Vegetation on Mesa Tops.

Transect	Species	Relative Cover	Relative Frequency	Importance Index
TA59-4u	Redtop	26.28	31.25	28.76
	Smooth brome	8.99	11.88	10.43
	Slender wheatgrass	4.56	7.50	6.03
	Sedge	45.37	25.00	35.18
	Coyote willow	6.50	4.38	5.44
TA60-1u	Blue grama	45.73	39.42	42.58
	Perky Sue	4.92	10.58	7.75
	Side-oats grama	10.89	8.65	9.77
	Mountain muhly	15.90	11.54	13.72
TA60-2u	Wormwood	3.74	6.96	5.35
	Sedge	9.33	11.30	10.32
	Mountain muhly	54.49	38.26	46.38
	Bluegrass	6.21	7.83	7.02
	Gambel's oak	11.76	7.83	9.79
TA60-4u	Bitterweed	6.81	11.33	9.07
	Wormwood	5.54	11.33	8.44
	Blue grama	24.94	17.33	21.14
	Mountain muhly	32.53	16.67	24.60
	Bottlebrush squirreltail	6.34	6.00	6.17
	Barberry	6.76	4.00	5.38

little bluestem and mountain muhly (Table 15), major grasses in the piñon-juniper community. Sedges and redtop were also important components in some transects. Understory cover values ranged from 11.5% (TA60-2) to 51.6% (TA59-4).

6.3.3.4 Riparian zones. We surveyed three riparian transects along stream channels in upper Twomile Canyon (TA-3), Los Alamos Canyon (TA-3), and mid-Twomile Canyon (TA-59). Riparian zones tend to have more species diversity than surrounding habitats; and these transects

Table 16. Understory Vegetation in Riparian Areas.

Transect	Species	Relative Cover	Relative Frequency	Importance Index
TA3-1u	Strawberry	1.84	8.54	5.19
	Gambel's oak	6.16	6.10	6.13
	Redtop	34.38	14.63	24.51
	Bluegrass	8.49	7.32	7.90
TA3-2u	Redtop	57.73	36.67	47.20
	Mutton grass	9.92	11.67	10.79
	Bromegrass	6.49	5.00	5.75
TA59-2u	Meadowrue	8.26	8.73	8.49
	Myrtle boxleaf	5.66	7.94	6.80
	Redtop	14.89	11.11	13.00
	Bromegrass	25.14	7.94	16.54
	Unknown grass 1	10.30	7.94	9.12
	Unknown grass 2	5.14	5.56	5.35

had the highest number of understory species of any habitat type surveyed (TA3-1 had 46 species). There was also a great species diversity between the different riparian transects (Table 16).

6.4 Small Mammal Trapping

During the summer of 1992, BRET members conducted small mammal live-trapping in upper Sandia Canyon, and at three sites near the borders of OU 1114. Transects were placed in three habitat types: dry, outfall, and naturally-occurring stream channels. The species captured in this trapping program are listed in Appendix L. We found no significant differences in total number of unique species between habitat types. However, significant differences were found between some individual sites. Significant differences also existed in percentage capture rates between outfall areas.

7 DISCUSSION

7.1 Level 2 (Habitat Evaluation) Surveys

The classification breakdown for both upland and wetland vegetation types for the Pajarito Plateau is included in Appendix G. This list includes known and potential habitat types and phases based on Brown et al. (1982), Moir and Ludwig (1979), and USFS (ND). No attempt was made to develop new habitat types for this area. If a study area did not fit within one of the designated habitat types previously defined for northern New Mexico, the habitat type was considered to be potential. Further studies would be necessary to make a complete and accurate determination.

The surveys showed two types of vegetation in OU 1114: upland and wetland. The upland vegetation communities within and adjacent to OU 1114 are the Rocky Mountain Montane Conifer-Forest Community and the Great Basin Conifer-Woodland Community. The wetland vegetation is within the Rocky Mountain Riparian-Deciduous Forest Community. These communities can be further separated into series and, more specifically, habitat types.

7.1.1 Rocky Mountain Montane-Conifer Forest Community

Much of OU 1114 is within the Rocky Mountain Montane-Conifer Forest Community. This community consists of three vegetation series and can be further divided into habitat types.

Series	Habitat Type	Transect
<i>Pseudotsuga menses</i>	Psme/Muhlenbergia montana	TA3-3
<i>Pseudotsuga menziesii</i>	Psme/Quercus gambelii	TA60-3
<i>Pinus ponderosa</i>	Pipo/Muhlenbergia montana	TA59-1
<i>Pinus ponderosa</i>	Potential	TA59-4
<i>Pinus ponderosa</i>	Pipo/Muhlenbergia montana	TA60-2
<i>Abies concolor</i>	Abco/Quercus gambelii	TA59-3

7.1.2 Great Basin Conifer-Woodland Community

Several eastern mesa tops within OU 1114 are within the Great Basin Conifer-Woodland Community. This community consists of a single series and two habitat types:

Series	Habitat type	Transect
Piñon-juniper	P-j/Muhlenbergia montana	TA60-1
Piñon-juniper	P-j/Bouteloua gracilis	TA60-4

7.1.3 Rocky Mountain Riparian-Deciduous Forest Community

Two wetlands areas surveyed (TA3-1 and TA3-2) have dominant coniferous trees more characteristic of upland vegetation. The other wetland transect is within the Rocky Mountain Riparian-Deciduous Forest Community and the *Populus angustifolia* series.

7.2 Level 3 (Species-Specific) Surveys

No protected species were found during the Levels 1 and 2 surveys conducted in OU 1114. However, habitat information from those field surveys was compared to data base information for each species of concern. Previous data and threats to each taxon were also studied. Based on this information, species were dismissed from further consideration, or additional surveys were conducted to confirm the presence or absence of the species within the area.

7.2.1 Species Dismissed from Further Consideration

Based on the information gained from the Level 1 and Level 2 field surveys and previously gathered data, the following species are unlikely to occur within OU 1114:

7.2.1.1 Plants. The following species are dismissed from further consideration because none has been found in OU 1114; they are unlikely to occur in the OU; and there is a low potential for impact.

The Wright fishhook cactus occurs on gravelly or sandy hills or plains, in desert grasslands, and in piñon-juniper zones. Although there is potential habitat for this species with the OU, it has not been found within Los Alamos County nor was it found during our field surveys.

The grama grass cactus occurs in sandy soils within basalt outcrops. It has been found in Los Alamos County near the White Rock overlook. OU 1114 does not have similar outcrops of basalt. This species is noticeable only during its two-week-long flowering period in June. Therefore if a grama grass cactus survey is required, adequate advance notice must be given.

The sessile-flowered false carrot occurs in rocky canyons and slopes, usually in areas of basalt or sandstone. This species is found primarily in south-central New Mexico and has not been reported for Los Alamos County.

Plank's flycatcher grows in piñon-juniper habitat and is known to occur in mountains along the Rio Grande. It is found in crevices and pockets in protected cliff faces of igneous rock. This species has not been found in Los Alamos County.

The cyanic milkvetch occurs on sandy or gravelly hillsides within piñon-juniper. Usually growing adjacent to the Rio Grande, this species has not been found in Los Alamos County.

The Santa Fe milkvetch is found on dry slopes of piñon-juniper woodlands. It has not yet been reported for Los Alamos County.

The Taos milkvetch is found in loose soil within open areas of piñon pine and juniper. This species has not been recorded for Los Alamos County.

The tufted sand verbena is entirely restricted to Todilto gypsum or its derivatives. These soils do not occur within OU 1114.

The Pagosa phlox grows on open slopes in mountain woodlands and forests. It has not been recorded for Los Alamos County.

The Sandia alumroot is a state endangered species which occurs in the mixed conifer plant community. It is described as a cliff-loving plant and normally occurs at elevations between 2440 m to 3660 m (8000 ft to 12000 ft). The elevations in OU 1114 are considerably lower than 3600 m.

7.2.1.2 Wildlife. The following species are being dismissed from further consideration because none has been found in the OU; they are unlikely to occur in OU 1114; and there is a low potential for impact.

There has been only one verified sighting of a pine marten in the Jemez Mountains. They have large home ranges (8 to 16 km), but are intolerant of man's presence. Their habitat is mature old-growth spruce-fir communities with more than 30% canopy cover and fallen logs. OU 1114 does not contain this habitat type, and its high levels of human activity would be a strong deterrent to pine martens.

The bald eagle winters along the Rio Grande, and winter roosts have been observed at Cochiti Lake. Large trees which are protected from the wind form suitable roosting sites. OU 1114 is sufficiently far from the river to dismiss the bald eagle from further consideration.

The common black hawk is found in cottonwoods and other woodlands along permanent streams. This medium-sized raptor is primarily affected by destruction of riparian zones. It has been found in small numbers in the Rio Grande Valley. Although limited riparian areas are found in OU 1114, these are not dominated by cottonwoods. The common black hawk is usually found in lower elevations than occur within OU 1114.

The Mississippi kite generally inhabits the lower Rio Grande and Pecos Valleys in riparian zones and shelter belts. This species has not been reported in the Los Alamos area. Riparian areas

within OU 1114 are probably too limited in size and extent to form prime habitat for the Mississippi kite.

The broad-billed hummingbird has been identified in the riparian woodlands in Bandelier National Monument. Breeding primarily in the southern part of the State, they usually occur only as vagrants near Los Alamos. OU 1114 is north of the reported sightings. In addition, bird surveys conducted by Joan Morrison in 1986, 1987, and 1988, in Los Alamos Canyon did not reveal any sightings of broad-billed hummingbirds.

Say's pond snail is only known to occur in the Cerro la Jara area of the Jemez Mountains in Sandoval County. It is found in vegetated ditches, marshes, streams, and ponds that are seasonally dry or in areas of perennial water. Say's pond snail is not expected to occur in Los Alamos County.

7.2.2 Species for Which Level 3 Surveys were Conducted

7.2.2.1 Checker lily. The checker lily is a state sensitive plant which is threatened by habitat destruction and collection pressure. It occurs predominantly in moist areas of mixed conifers. It has previously been found in Los Alamos County and may occur in upper canyons within OU 1114. The checker lily was not encountered in any of the vegetational surveys within OU 1114.

7.2.2.2 Wood lily. The wood lily occurs in moist ponderosa pine and mixed conifer communities. It ranges in elevation from 1876 m to 3126 m (6150 to 10250 ft.) The wood lily has previously been found in Los Alamos County near seeps and streams in well shaded areas. No wood lilies have been found in OU 1114, but they have been reported from upper Pajarito, Water, and Frijoles Canyons.

7.2.2.3 Spotted bat. Based on Level 1 and 2 survey results, and on consultation with experts, we conducted Level 3 surveys for the spotted bat at various LANL sites. The spotted bat is found near standing water in riparian, piñon-juniper, ponderosa pine, and spruce-fir areas. They roost in cliffs or rock crevices. A contract group, 3D/Environmental Services, Inc., conducted surveys for bats with emphasis on the spotted bat on LANL lands. Surveys were carried out at various LANL locations during the summers of 1992 and 1993. The sites included locations in mid-Los Alamos and Pajarito Canyons in 1992, and upper and lower Los Alamos Canyon in 1993. Thirteen species of bats were captured, but no spotted bats were taken (Appendix M). Some required habitat components for this species are present in the OU. However, open areas of standing water are, for the most part, absent. Further surveys will be necessary to confirm the presence or absence of this far-ranging species in OU 1114, and in Los Alamos County.

7.2.2.4 Jemez Mountains salamander. The Jemez Mountains salamander inhabits mixed conifer to spruce-fir plant communities. The distribution of salamanders is very dependent on high

soil moisture content, and therefore most often found in areas of closed canopies, north-facing slopes, or near streams and seeps. Salamanders are primarily found within decaying logs and litter or in talus slopes.

During early August 1991 after very heavy rains, BRET conducted a salamander survey approximately 430 m (0.25 mi) west of the bridge in Los Alamos Canyon on the north-facing slope. The area was a mixed-conifer plant community with a down log cover of less than 5%. Soil moisture was relatively low. The survey efforts did not reveal any salamanders. Since no salamanders were found on the north-facing slope, no survey of the drier south-facing slope was performed.

BRET did find salamanders in upper Pajarito Canyon. To date, no salamanders have been found within the OU boundaries although Sandia Canyon appears to contain acceptable habitat.

7.2.2.5 Northern goshawk. The northern goshawk nests primarily in dense, mature, or old growth coniferous forests containing trees of at least 18 in. diameter (Reynolds 1989). In addition, goshawks are usually found nesting within 430 m (0.25 mi) of water. Studies by Patricia Kennedy (1987) indicate the highest percentage of nests were in the ponderosa pine/Gambel's oak habitat type. The home range of goshawks usually includes a variety of forest conditions.

Goshawk nests have been found on Santa Fe National Forest land in the northwest portion of Los Alamos County and adjacent to LANL property (Kennedy 1993, Travis 1992). Goshawk post-fledgling areas and foraging areas are known to overlap LANL (Sinton and Kennedy 1993).

In 1993, Patricia Kennedy surveyed optimal habitat within LANL boundaries for northern goshawks including all main and side drainages of upper Pajarito Canyon. No goshawks were observed within the LANL inventory area. However, active territories and nest sites have been found just beyond Laboratory boundaries. The foraging area for this species is approximately 5 400 acres and is located primarily in middle-aged, mature, and old coniferous forest. Sightings have been made near the boundaries of OU 1114, and it appears likely that goshawks use the OU for foraging especially Twomile Canyon. At least one more year of field surveys are needed to complete Kennedy's inventory.

7.2.2.6 Meadow jumping mouse. The meadow jumping mouse prefers wetlands and other moist habitats such as permanent streams and wet meadows. Joan Morrison, state expert on the jumping mouse, evaluated habitat in Los Alamos Canyon where the water was more permanent. She reported that an area near the Los Alamos Reservoir might have potential habitat.

During the summer of 1991, a trapping grid (see Section 5.4.4) was set up in Los Alamos Canyon, west of the Los Alamos Canyon skating rink and east of the reservoir, in an area where the stream channel is somewhat permanent due to the flow out of Los Alamos Reservoir. Trapping was done for four consecutive nights, and no meadow jumping mice were found. Since no mice

were trapped in this area where the stream was fairly permanent, no trapping of mice was performed further down the stream, which is an intermittent reach within OU 1114.

In 1992, the capture-release method (Section 5.4.4) was used within Pajarito Canyon. Although no meadow jumping mice were found there, this species has been found in Los Alamos County previously, and it may occur within Sandia Canyon.

7.2.2.7 Peregrine falcon. The peregrine falcon establishes breeding territories near cliffs that are within areas of ponderosa and piñon. Optimal habitat includes 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).

Los Alamos County has an historical eyrie in Pueblo Canyon, north of Los Alamos Canyon. Terrell Johnson, peregrine falcon expert, examined locations within Los Alamos Canyon to determine the suitability of breeding habitat for peregrine falcons. He stated that lower Los Alamos Canyon provides breeding habitat that would have been designated as suitable were it not for the presence of more attractive habitat in nearby Pueblo Canyon (Johnson 1992). Johnson concluded that lower Los Alamos Canyon provides viable alternative nesting habitat. This canyon area is north of OU 1114.

7.2.2.8 Mexican spotted owl. The Mexican spotted owl inhabits mixed-conifer and ponderosa-Gambel oak forest in mountains and canyons in the southwestern U.S. and northern Mexico. This habitat has the following characteristics ((U.S. Fish and Wildlife 1990):

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

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

Terrell Johnson (1993) has developed a topographic model of potential spotted owl habitat in New Mexico. In addition to this model, Johnson has started developing a similar model to be used for the Laboratory (in preparation). Results from initial modeling activity have indicated three areas within Laboratory boundaries that could have potential owl habitat. The areas include the junction of Twomile and Pajarito Canyons (nesting), a section of Cañon de Valle (nesting), and a section of Los Alamos Canyon below the Omega Site (perching).

BRET conducted spotted owl surveys in upper Los Alamos Canyon during the summer of 1994. The surveys began below the Omega Site, TA-2, and continued for approximately 1.75 mile (2.8 km) along Los Alamos Canyon. One survey was a point count, which played recorded owl hoots for 15 minutes every 0.5 mile (0.8 km). The other two surveys used continuous callings for several minutes. No owl responses were heard. Additional spotted owl surveys will be conducted in the summer of 1995.

Although no spotted owls were detected at the junction of Twomile and Pajarito Canyons or in Los Alamos Canyon, further surveys are planned for 1995. At this time, the presence of spotted owls within OU 1114 cannot be ruled out.

7.8.2.9. Willow flycatcher. The willow flycatcher nests in cottonwood-willow associations and structurally similar riparian vegetation associations, including thickets dominated by tamarisk and Russian olive. Nesting thickets are approximately 4 to 7 m (13 to 23 ft) tall and have dense canopies and large amounts of foliage from 0 to 4 m (0 to 13 ft) above ground. Surface water or saturated soils are almost always present in or adjacent to nesting thickets (Tibbitts 1994). Willow flycatchers do not nest in narrow riparian habitats with large distances between willow patches and individual willow patches (Sedgwick and Knopf 1992). Willow flycatchers build nests and lay eggs in late May and early June, and fledge young in late June or early July (Tibbitts 1994).

No willow flycatchers have been found during the bird atlas project (Travis 1992) or any BRET bird surveys. However, three vegetation transects read in and near OU 1114 suggest possible willow flycatcher habitat. Transect TA3-2 has 20 % narrow-leaf cottonwood cover, but it lies within Los Alamos Canyon, to the north of OU 1114. Transect TA59-2 has a coniferous overstory with 17% willow cover, but it lies in Twomile Canyon, to the south of OU 1114. Transect TA59-4 occurs in an open coniferous area of Mortandad Canyon. Willow was the only shrub present in this transect, and it had a cover value of 12%. Willow flycatchers have been found in the Jemez Mountains during their breeding season, but breeding there has not been confirmed. The species has not been previously recorded in Los Alamos County, although it has been sighted in Bandelier National Monument.

8 IMPACTS

The following section discusses several of the more obvious potential impacts due to soil characterization procedures or carelessness. It concentrates on sensitive species and habitats, and is not intended to be an inclusive listing of all possible impacts to the environment of OU 1114.

Soil sampling should be planned so that erosion is not increased. Indiscriminate driving of heavy equipment through the area can adversely impact understory ground cover and soil crust.

BRET must be given advance notification of all activities, other than soil sampling and associated disturbances, to ensure a thorough review and assessment of their impact on the biological resources.

8.1 Wetlands and Floodplains

The impacts to wetlands and floodplains that are listed here are primarily associated with soil sampling and related disturbances. Sampling may include core drilling to a depth of 15 cm (6 in.) or deep-core drilling to a depth of more than 61m (200 ft). Heavy equipment and coring should remain outside of wetland areas. If sampling or other disturbances occur within or near wetlands or within floodplains, the following impacts could occur:

- Disturbance to the stream channel, or smaller drainages leading into the stream channel, could result in an alteration of existing wetlands, which could lead to partial or complete loss of those wetlands.
- Excessive disturbance to the vegetation and soil surface could result in an alteration of the water flow or a widening of the channel.
- Disturbance along the drainages or on steep slopes could initiate or increase soil erosion. This could also lead to localized alterations in wetlands.
- Hazardous fuel spills or leaks from vehicles could negatively affect water quality in riparian zones and could negatively impact hydrophytic vegetation.

8.2 Threatened, Endangered, and Sensitive Species

8.2.1 Wood Lily and Checker Lily

Both checker lilies and wood lilies have previously been found in Los Alamos County in the mixed conifer zone. These species are affected by over-collection and urbanization. Sampling is not projected to occur outside of previously disturbed areas; however any use of heavy equipment traveling off established roads could present a threat to this species, especially in moist areas.

8.2.2 Spotted Bat

Spotted bats are not known to occur in Los Alamos County, but all habitat components necessary to support them are present. Sampling is projected to remain on mesa tops in areas that have already been developed. Very little disturbance to rock crevices is anticipated for site characterization since most sampling will occur along mesa tops, not on the slopes. However, should sampling occur in canyons, impacts to the bats would include destruction of roosting sites (rock crevices) and removal of water sources. Nearby streams or water sources may be damaged if

heavy equipment such as drill rigs are driven through them. Dumping of soil and sediment into streams can also alter the waterway.

8.2.3 Jemez Mountains Salamander

Jemez Mountains salamanders were not discovered in the survey conducted in the summer of 1991 on the north-facing slope in Los Alamos Canyon. However, in the past years, specimens have been found in the general area. Sampling for the site characterization should not require extensive tree removal, but some soil disturbance may occur. Impacts to the salamander would include habitat destruction due to any tree removal, soil disturbance, and removal of downed logs. Potential salamander habitat could be damaged by driving heavy machinery through it.

8.2.4 Northern Goshawk

No goshawks have been discovered in any raptor surveys conducted in Los Alamos or Sandia Canyons. However, some of their habitat components exist within this area. Over 95% of soil sampling in OU 1114 will be with hand augers and occur in previously disturbed areas. Sampling with hand augers for site characterization should not produce a significant level of disturbance. However, the use of drill rigs in sampling could cause a great increase in noise levels. Impacts to goshawk would include human disturbance and disturbance by heavy equipment during the mating and nesting season (March-September). Canopy or tree removal could decrease nesting and perching habitat and alter habitat for prey species. Removing or disturbing large areas of vegetation could affect prey species availability, which may result in decreased goshawk use of the area.

8.2.5 Meadow Jumping Mouse

Although meadow jumping mice have not been found within the boundaries of OU 1114, their presence there remains a possibility. The following impacts could occur to the potential meadow jumping mouse habitat in OU 1114:

- Heavy equipment sampling, or backfilling of stream channels, could damage riparian or wetland areas, and destroy breeding and foraging habitat.
- Mowing of riparian areas or other removal of dense, tall streamside vegetation could result in destruction of potential habitat.

8.2.6 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. (To date, no nests have been found in Los Alamos Canyon.) In

addition, Johnson suggests delineating sensitive core areas around suitable nest sites of up to 1950 m (3000 ft), depending on the type of disturbance and surrounding habitat (Johnson ND). Based on this information, soil sampling with hand-held augers should have no effect on peregrine falcons if conducted greater than 1950 m 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 react to disturbances up to 3.2 km (2 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 to vegetation than hand sampling, were expected to have only slight effects on prey species.

8.2.7 Mexican Spotted Owl

The majority of site characterization sampling proposed for this OU will occur on the mesa tops in association with the SWMUs. These areas occur in and around existing facilities, roads, parking lots, and firing site areas that have existing physical and human disturbances. Over 95% of the sampling activity will require the collection of soil samples with hand scoops. Therefore, impacts to potential spotted owl habitat from mesa top sampling would be extremely small, and should not cause an adverse impact. However, sampling scheduled for effluent outfalls could result in the collection of samples along drainages into Pajarito Canyon. In this instance (less than 10% of the scheduled sampling), the following impacts could be expected:

- Removal of overstory components could decrease the potential for future nesting and perching within the area.
- Removal of overstory components may also decrease the habitat potential for spotted owls by opening the canopy and increasing light and heat penetration.
- During the mating and breeding season (February through August), noise from heavy equipment and increased human activity occurring within 403 m (0.25 mi) of the nest could disturb mating and nesting owls, and lead to nest abandonment.
- Removal or damage to large areas of vegetation could affect densities of associated prey species, which could result in a decreased use of the area by spotted owls.

8.2.8 Willow Flycatcher

The primary impact to the willow flycatcher is damage or destruction of riparian habitat. A small amount of habitat suitable for the willow flycatcher may exist at some of the effluent outfalls within this OU. If sampling would be conducted with any intrusive equipment (drill rigs,

backhoes, gasoline powered equipment, etc.) near effluent drainages, stream channels or riparian areas in this OU the following impacts can occur:

- Removing or disturbing understory vegetation or removal of trees can decrease the habitat available for nesting and foraging, which may result in decreased use of the area by the willow flycatcher.
- Nearby streams or water sources may be damaged if heavy equipment such as drill rigs and other vehicles are driven through these features. Dumping soil and sediment into the stream can also alter water sources. Altering water sources may destroy or change the current habitat thus making the area unsuitable for nesting or foraging of flycatchers.
- During the breeding and nesting season (May to July), human activity and mechanical disturbance such as vehicles, drill rigs, back hoes, generators, and machine sampling within a riparian area may cause the willow flycatcher to abandon its nest.

8.3 Nonsensitive Species

8.3.1 Plants

Heavy machinery could impact topographic features and riparian zones of OU 1114 in the following ways:

- Removal of, or excessive disturbance to, existing vegetative cover could increase or initiate erosion and alter drainage patterns both within the canyon bottoms (including stream channels), and along the canyon slopes.
- Disturbance or damage to riparian vegetation could result in partial or complete loss of wetlands which could further result in partial loss of the associated riparian vegetation.
- Heavy equipment indiscriminately driven throughout the area could adversely impact understory ground cover and soil crust.

8.3.2 Wildlife

The habitat in OU 1114 is suitable for nesting, foraging, and perching for a variety of birds, large mammals, and other wildlife species. Excessive disturbance or disturbance during critical periods could result in one or more of the following:

- Loss of habitat due to removal of trees, vegetation, and other habitats that serve for nesting, perching, cover, and foraging along the canyon slopes, and within the riparian zones and canyon bottoms.
- Abandonment of nests and loss of young due to excessive noise or other disturbance during critical times which interfere with mating, breeding, or rearing young.
- Contamination of wildlife water sources from fuel spills or leaks from vehicles, machinery, etc. resulting in illness or mortality of wildlife species.

- The disruption of migration routes (i.e., elk and deer) by excessive noise or disturbance from heavy vehicle and equipment use within areas within those areas.

9 MITIGATION

BRET must be notified as soon as Phase II sampling procedures are defined. Some of the necessary biological fieldwork must be conducted at specific times of the year or over an extended period. Considerable delays may result if sufficient advance notice is not provided. BRET also requests notification before disturbances, other than soil sampling, are initiated to allow more accurate and effective mitigation measures to be defined.

No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action level, workers must cease operations, shut down the site, and reassess the sampling.

9.1 Wetlands and Floodplains

No impact is expected from surface sampling; however, heavy equipment and coring within a wetland area could discharge fill into the wetland and destroy hydrophytic vegetation. Wetland boundaries will be delineated at the time of sampling, and all sampling must be conducted outside of designated wetlands. These delineations must be done within two years of the sampling; after two years, the delineation is no longer valid and must be redone.

If heavy equipment is to be used during site characterization, the following measures must be adhered to in order to prevent unnecessary impacts:

- Prohibit all excessive off-road travel that may disturb vegetation and cause erosion.
- Restrict excessive disturbance to vegetation and the soil surface that could alter the water flow and/or widen the channel.
- Restrict disturbances along the drainages and steeper slopes that could produce or initiate erosion.
- Eliminate hazardous fuel spills or leakage from vehicles or sampling machinery.
- Prohibit unnecessary disturbance (i.e. parking areas, equipment storage areas, and off-road travel) to stream-side areas and their surrounding vegetation during travel to sampling sites and sampling.

9.2 Threatened, Endangered, and Sensitive Species

9.2.1 Plants

Although no TES plant species were found in OU 1114 during the most recent vegetation surveys, the checker lily and wood lily are known to occur in the general area. Qualified BRET personnel must conduct a walk-through of any riparian area where vehicles or heavy equipment would be taken off established roads.

9.2.2 Wildlife

9.2.2.1 Spotted bat. There are no known occurrence of the spotted bat in Los Alamos County. However, OU 1114 supports habitat parameters. If equipment larger than hand augers is to be used on the slopes of Los Alamos Canyon, a biologist from ESH-8 must be present prior to sampling to conduct a survey of all rock crevices in the sampling area. If any evidence of bats is found in the sampling area, all sampling with heavy equipment on that slope would be canceled. Any sampling that may alter existing water sources, including vehicular travel through water courses and backfilling of streams, is prohibited without prior approval by BRET personnel. If such an alteration would damage potential spotted bat habitat, it would not be approved.

9.2.2.2 Jemez Mountains Salamander. North-facing slopes and moist or shaded riparian areas in mixed conifer between 2196 to 3294 m (7200 and 10 800 ft) asl may provide suitable habitat for the Jemez Mountains salamander. If sampling is scheduled to occur in such habitat, or if heavy machinery is to be driven through such habitat, BRET must be notified to conduct Level III surveys. Sampling will not be allowed until these surveys are completed. These surveys must be conducted under appropriate weather conditions (e.g., during the rainy season from June to August), when the salamanders are most active. If any salamanders are found in the Level III survey, sampling with heavy equipment (drill rig, backhoe, etc.) will not be allowed. If no salamanders were found in Level III surveys, the following mitigation measures must be followed when sampling occurs within potential salamander habitat:

- Activity must not be permitted when the soil surface has a high moisture content.
- A biologist from ESH-13 must be present during sampling. If any salamanders are discovered, all ground disturbing activities at that site will cease at once.
- BRET must approve all tree removal. If tree removal would open the tree canopy and cause a loss of soil moisture, tree removal will not be approved. Any trees that are cut must be left to enhance habitat.
- If proposed sampling will disturb downed logs and/or talus slopes, BRET must first evaluate the habitat. If BRET finds that the proposed disturbance will alter habitat characteristics, the proposed disturbance will not be approved and sampling in these areas will not occur.

9.2.2.3 Northern Goshawk. There is no evidence that goshawks nest in OU 1114. However, many of the habitat components required for the goshawk are present, and they may forage within the OU. To protect this potential goshawk habitat, sampling with heavy equipment (drill rig, backhoe, gasoline powered equipment, etc.) in Twomile and upper Mortandad Canyons must be limited to October through February, leaving the months of March through September free of heavy disturbance. If scheduling requirements mandate that sampling be conducted from May through September, BRET must first conduct broadcast surveys between May 15 and June 30 to

determine nest sites and occupancy. If nest sites are found or if the survey is not conducted, sampling for that area cannot begin until October 1. If nest sites are not occupied and goshawks are not found, sampling can be initiated in Twomile and upper Mortandad Canyons.

If any sampling activity will disturb or destroy over one-tenth acre of understory, BRET must be contacted to evaluate the vegetation removal. BRET will use a species expert (Pat Kennedy) to aid in evaluating forage area loss. If an adverse impact is expected, the removal will not be approved and will not be allowed to occur. If no adverse impact is expected, BRET will approve the removal.

Tree removal in Twomile and upper Mortandad Canyons should be minimized. Any tree removal (live or snag) must be approved by BRET. BRET will determine if the tree(s) could be used for goshawk perching or nesting, and if such removal would change the canopy characteristics. If BRET determines that the proposed removal would be detrimental to the goshawk habitat, it will not be approved.

9.2.2.4 Meadow jumping mouse. The presence of the meadow jumping mouse within OU 1114 has not been confirmed. The great majority of sampling there is scheduled to occur in previously disturbed areas near buildings and parking lots. However, to protect meadow jumping mice habitat from impacts, all site sampling will be conducted in a manner which leaves streamside habitat and vegetation undisturbed. Nearby dry areas which could be used as winter shelters should also be preserved intact.

If any sampling is scheduled to occur in undisturbed areas near the stream, BRET must evaluate the need for a species-specific survey sixty days prior to sampling. If a survey is deemed necessary, riparian sampling will not proceed until the meadow jumping mouse survey has been completed. Such surveys will only be conducted during periods when mice are active. Joan Morrison (personal communication) states that the optimal time for meadow jumping mice surveys is in July during the rainy season. If meadow jumping mice are present, sampling will not occur within their habitat.

9.2.2.5 Peregrine falcon. There have been no known peregrine nests within Los Alamos Canyon. Although there are no expected impacts to peregrine falcons in OU 1114, disturbance in the middle to lower section of Los Alamos Canyon (starting at the western boundary of OU 1106 and extending to State Road 4) must be kept to a minimum. (Note: this area is not within the boundary of OU 1114)

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

prohibition on sampling from March 1 to August 30 and avoiding the area after dark from February 1 to August 30 (Johnson 1992).

9.2.2.6 Mexican spotted owl. When sampling with heavy equipment (backhoes, drill rigs, machine sampling, generators, etc.) or other intrusive methods near the junction of Twomile and Pajarito Canyons, sampling must be scheduled between September 1 through January 31. However, if scheduling requirements mandate that sampling be conducted outside this time, the following must occur:

- BRET will conduct broadcast surveys and determine nest site locations and occupancy of spotted owls prior to sampling. Surveys will be done between May 15 and June 30 using USFS established methodology. If spotted owls are found and nest sites are occupied, or if the survey is not conducted, sampling cannot begin until September 1. However, if nest sites are not occupied and spotted owls are not found, sampling can be initiated.
- Any tree removal (live or snag) must be approved by BRET. BRET will determine if the tree(s) could be used for owl perching or nesting and if the tree removal will change canopy characteristics. If BRET determines the tree could be used for nesting or perching, or if the character of the canopy will be altered, the tree removal will not be approved and will not occur.
- If any sampling activity will damage or destroy vegetation within potential spotted owl habitat, BRET must be contacted to evaluate the vegetation removal. BRET will use a species expert (Terrell Johnson) to aid in the evaluation of foraging area loss. If an adverse impact is expected, removal of vegetation will not be approved and will not occur. If no adverse impact to foraging is expected, BRET will approve the vegetation removal.

9.2.2.7 Willow flycatcher. Intrusive sampling (i.e., requiring the use of heavy equipment) in riparian areas associated with effluent outfalls, streams, and drainages must be scheduled between August and April 30. If scheduling requirements mandate that sampling be conducted outside this time, the following must occur:

- BRET will conduct a willow flycatcher survey following USFWS survey protocol. The survey must be conducted during a restricted season (June 10 - July 20) to eliminate the chance of counting late spring and early fall migrants. If willow flycatchers are found, no sampling will be permitted until August.
- If any sampling would disturb or destroy vegetation within potential willow flycatcher habitat, BRET must be contacted to evaluate the vegetation removal. BRET and a species expert from NM DGF will evaluate forage and nesting area loss. If an adverse impact is expected, BRET will not approve understory removal. If no adverse impact is expected, BRET will approve removal.
- BRET must approve all tree removal (live or snag). BRET will determine if the tree(s) could be used for willow flycatcher nesting, and if removal will change the canopy characteristics. If BRET determines the tree removal will be a detriment to the willow flycatcher, the removal will not be approved.

10 CONCLUSIONS

We summarized historical information and biological reports of previous site surveys to provide background information on OU 1114. These summaries provided inventory information that may be used in future ecological risk assessments and in pathway analyses. Compiled species lists are contained in the appendices to this report.

We conducted Level 1, 2, and 3 field surveys within and near OU 1114. In addition, the TES species data base was searched for a listing of potential species that could occur within the OU's habitat types. Species on state or federal protection lists known to occur in mixed conifer, ponderosa pine, ponderosa-piñon, piñon-juniper, wetlands, or riparian areas of Los Alamos and surrounding counties were identified.

A habitat evaluation survey was conducted to determine if the specific requirements of the species could be met in the project locations. As a result, a number of species of concern were identified. Checker lilies and wood lilies may exist in the moist mixed conifer areas of OU 1114. A 1992 bat survey captured no spotted bats in Los Alamos County, but further surveys are necessary to establish its presence or absence. Jemez Mountain salamanders are known to exist in the vicinity of OU 1114, and site-specific surveys may be required if sampling is scheduled to occur on north-facing slopes. There appears to be good foraging habitat for the northern goshawk within the OU, and additional surveys may be required to verify its presence or absence. Sandia Canyon appears to offer good habitat for the meadow jumping mouse and additional surveys may be required to verify its presence or absence there. Previous surveys for the peregrine falcon had shown that only marginal habitat was available for this species within OU 1114 although Level 3 surveys conducted outside OU 1114 were used to determine its status in the area. If sampling is scheduled to occur in their habitat, additional species specific surveys may be required. Mitigation measures have been included for the species of concern to prevent adverse impacts to their potential habitat.

The National Wetlands Inventory has identified two wetland types within Sandia Canyon: riverine which are contained within a channel, and palustrine which are dominated by vegetation. A palustrine wetland in upper Sandia is maintained by effluent flows from the TA-3 steam plant, and run-off primarily from parking areas. Delineation of wetland boundaries was not done during these surveys, but will be conducted prior to sampling. This will assure that all sampling is conducted outside of areas meeting wetland criteria (hydrophytic plants, hydric soils, and hydrology).

Mitigation measures (or best management practices) to reduce impacts to nonsensitive plant and wildlife species include

- (1) determining when sampling should be conducted,

- (2) using preventive measures to avoid excessive disturbance to the habitat, and
- (3) notifying BRET before disturbances other than soil sampling are initiated.

11 ACKNOWLEDGMENTS

This study was funded by and completed in cooperation with the Environmental Restoration Program of Los Alamos National Laboratory (LANL).

The study was directed by Teralene Foxx, Project Ecologist for the Biological Resource Evaluations Team (BRET). BRET is included in the Environmental Assessments and Resource Evaluations section of the Environmental Protection Group, ESH-8.

Field personnel included Kathryn Bennett (Field Leader), Environmental Scientist; Saul Cross, Botanist, EPA Fellow; Dan Dunham, Botanist; Delia Raymer, Wildlife Biologist (GRA); James Biggs, Wildlife Biologist; Mary Salisbury, Computer Support; and Alethea Banar (UGS).

12 DEFINITIONS

Biological Resources Evaluations Team (BRET): Persons within the Environmental Protection Group (ESH-8) responsible for the biological assessments.

Cavate: A shallow invagination in the base of a rock wall, usually a natural nook modified by human activity.

Colonizing: A plant that has attributes which enable it to become easily established in areas of environmental disturbance or where is not wanted.

Critical habitat:(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the ESA, on which are found those physical or biological features essential to the conservation of the species and which may require species management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA, upon a determination by the Secretary of the Interior that such areas are essential for the conservation of the species.

Facultative: Plants equally likely to occur in wetlands or non wetlands (estimated probability 34-66%).

Facultative Upland: Plants usually occurring in non wetlands (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%).

Facultative Wetland: Plants usually occurring in wetlands (estimated probability 67-99%), but occasionally found in non wetlands.

Federal Candidate (C1) Species: A species that may be proposed for federal listing as threatened or endangered.

Federal Candidate (C2) Species: A species that may be proposed for federal listing as threatened or endangered although conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

Federal Endangered Species: Any species which is in danger of extinction throughout all or a significant portion of its range.

Federally Proposed as Endangered: Taxa already proposed to be listed as endangered. Proposed species receive the protection of the Endangered Species Act.

Federally Proposed as Threatened: Taxa already proposed to be listed as threatened. Proposed species receive the protection of the Endangered Species Act.

Federal Threatened Species: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Floodplains: Lowlands adjoining inland and coastal waters and relatively flat areas and flood-prone areas of offshore islands including, at a minimum, that area inundated by 1 percent or greater chance of flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500 year (0.2 percent) floodplain.

Hydric soil: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrology: The presence of, distribution of, and circulation of water.

Hydrophyte: Any plant that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wetlands and other aquatic habitats.

Level 1 Survey: A reconnaissance survey to determine if a proposed project is in a developed Technical Area or in an area that is otherwise disturbed. Non-quantitative data about the area is obtained.

Level 2 Survey: A detailed quantitative vegetation survey that is used to evaluate critical habitat requirements for a TES species is present at the proposed project area.

Level 3 Survey: A survey aimed at obtaining information on a specific threatened or endangered species, floodplain or wetland.

Lithic scatter: A group of chipped stone artifacts, usually the result of working other objects such as arrowheads or spear points.

National Environmental Policy Act (NEPA): A major environmental law which became effective in 1970. The law requires all projects/programs which receive federal funds to be evaluated for environmental impacts.

Nationwide Permits (NWP): Permits issued by the Corps of Engineers that pertain to specific conditions stated in the regulations regarding impacts to wetlands.

Obligate Upland: Plants occurring in wetlands in another region, but occurring almost always (estimated probability >99%) under natural conditions in non wetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the "National List".

Obligate Wetland: Plants occurring almost always (estimated probability >99%) under natural conditions in wetlands.

Riparian: Green-belts along streams, lakes, or other wet areas. These areas have become of concern although they are presently have only marginal protection under state and federal law.

Silviculture: The care and cultivation of forest trees; forestry.

Solid Waste Management Unit (SWMU): Any discernible unit at which solid wastes have been placed at any time, whether or not the unit was intended for the management of solid or hazardous wastes.

Species Area Curve: Calculated by comparing total number of individual plant species recorded along a transect by total number of plots.

State Endangered Plant: A plant which has been listed on New Mexico's state endangered list. The plant is rare in numbers and/or occurrences and its further existence in the state is threatened without protection.

State Endangered Group 1: Any wildlife species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

State Endangered Group 2: Any wildlife species or subspecies whose prospects of survival or recruitment in New Mexico are likely to be in jeopardy within the foreseeable future. These species are protected by State law.

State Endangered Plant (E1): The taxon is listed as threatened or endangered under the provisions of the Federal Endangered Species Act, or is considered proposed under the tenets of the act.

State Endangered Plant (E2): The taxon is a rare plant across its entire range and of such limited distribution and population size that unregulated collection could adversely impact it and jeopardize its survival in New Mexico.

State Endangered Plant (E3): The taxon may be widespread in its distribution and may occur in adjacent states or Mexico, but its numbers are being significantly reduced to such a degree that within the foreseeable future the survival of this species in New Mexico is jeopardized.

State Sensitive Plant: A plant species whose numbers or occurrences are low in the state. These species are monitored by the state to see if their status needs to be upgraded to endangered. Currently, state sensitive plants are not protected by state law.

TES Species Data Base: A data base constructed by LANL that lists and provides information on all state and federal endangered/threatened species in Los Alamos County and surrounding counties.

Wetlands: Those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mud flats, and natural ponds.

13 SUMMARY OF PERTINENT REGULATIONS

Executive Order 11990 (Protection of Wetlands) calls for avoidance "to any extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands...avoid direct or indirect support of new construction in wetlands..."

Executive Order 11998 (Floodplain Management) was initiated to "protect lives and property with the need to restore and preserve natural and beneficial floodplain values...."

National Environmental Policy Act declares a national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 requires "that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations...."

Section 404 Clean Water Act provides for issuance of "permits", of discharged of dredged or fill materials into navigable waters..." after notice and opportunity for public hearings.

Endangered Species Act (16 USC 1531 et. seq.) declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which those species depend.

Migratory Bird Treaty Act (16 USC 703-711) protects wild birds from collection and maiming. All wild birds are covered by the act except resident game birds, English sparrows, starlings, and feral pigeons.

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APPENDIX A

Plant Checklist for OU 1114

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
ACERACEAE	<i>Acer glabrum neomexicanum</i>	Acgl	New Mexico maple
AMARANTHACEAE	<i>Amaranthus retroflexus</i>	Amre	Red pigweed
ANACARDIACEAE	<i>Rhus radicans</i>	Rhra	Poison ivy
	<i>Rhus trilobata</i>	Rhtr	Skunk bush
ASCLEPIADACEAE	<i>Asclepias speciosa</i>	Assp	Showy milkweed
BERBERIDACEAE	<i>Berberis fendleri</i>	Befe	Fendler barberry
BETULACEAE	<i>Alnus tenuifolia</i>	Alte	Thinleaf alder
	<i>Betula occidentalis</i>	Beoc	Water birch
BORAGINACEAE	<i>Lithospermum multiflorum</i>	Limu	Puccoon
CACTACEAE	<i>Opuntia polyacantha</i>	Oppo	Starvation cactus
	<i>Opuntia</i> sp.	Opux	Prickly pear cactus
CAMPANULACEAE	<i>Campanula rotundifolia</i>	Caro	Harebell
CAPRIFOLIACEAE	<i>Sambucus microbotrys</i>	Sami	Red elderberry
	<i>Symphoricarpos</i> sp.	Symx	Snowberry
CELASTRACEAE	<i>Pachystima myrsinites</i>	Pamy	Myrtle boxleaf
COMPOSITAE	<i>Achillea lamulosa</i>	Acla	Yarrow
	<i>Ambrosia</i> sp.	Ambx	Ragweed
	<i>Antennaria parvifolia</i>	Anpa	Pussytoes
	<i>Artemisia carruthii</i>	Arca	Wormwood
	<i>Artemisia dracuncululus</i>	Ardr	False tarragon
	<i>Artemisia frigida</i>	Arfr	Estafiata
	<i>Artemisia ludoviciana</i>	Arlu	Wormwood
	<i>Aster</i> sp.	Astx	Aster
	<i>Bahia dissecta</i>	Badi	Wild chrysanthemum
	<i>Brickellia</i> sp.	Brix	Brickelbush
	<i>Chrysopsis foliosa</i>	Chfo	Golden aster
	<i>Chrysothammus nauseosus</i>	Chna	Chamisa, Rbbitbrush
	<i>Cirsium</i> sp.	Cirx	Thistle
	<i>Conyza canadensis</i>	Coca	Horseweed

	<i>Erigeron divergens</i>	Erdi	Fleabane daisy
	<i>Erigeron flagellaris</i>	Erf1	Spreading fleabane
	<i>Erigeron jamesii</i>	Erja	Antelope sage
	<i>Erigeron philadelphicus</i>	Erph	Common fleabane
	<i>Erigeron sp.</i>	Erix, Erigx	Daisy
	<i>Erigeron speciosus</i>	Ersp	Oregon fleabane
	<i>Eupatorium herbaceum</i>	Euhe	Desert thoroughwort
	<i>Eupatorium sp.</i>	Eupx	Thoroughwort
	<i>Franseria acanthicarpa</i>	Frac	Bursage
	<i>Grindelia aphanactis</i>	Grap	Gumweed
	<i>Gutierrezia sarothrae</i>	Gusa	Snakeweed
	<i>Helianthus annuus</i>	Hean	Annual sunflower
	<i>Hymenopappus filifolius</i>	Hyfi	Yellow cut-leaf
	<i>Hymenoxys argentea</i>	Hyar	Perky Sue
	<i>Hymenoxys richardsonii</i>	Hyri	Bitterweed
	<i>Lactuca sp.</i>	Lacx	Prickly lettuce
	<i>Liatris punctata</i>	Lipu	Gayfeather
	<i>Machaeranthera sp.</i>	Macx	Aster
	<i>Senecio fendleri</i>	Sefe	Fendler's snecio
	<i>Solidago sp.</i>	Solx	Goldenrod
	<i>Sonchus asper</i>	Soas	Spiny-leaved sow-thistle
	<i>Taraxacum officinale</i>	Taof	Dandelion
	<i>Taraxacum sp.</i>	Tarx	Dandelion
	<i>Thelesperma trifidum</i>	Thtr	Greenthread
	<i>Townsendia exscapa</i>	Toex	Easter daisy
	<i>Townsendia incana</i>	Toin	Townsend's aster
	<i>Tragopogon dubius</i>	Trdu	Goatsbeard
	<i>Viguiera multiflora</i>	Vimu	Goldeneye
	<i>Viguiera sp.</i>	Vigx	Goldeneye
CONVOLVULVACEAE	<i>Convolvulus arvensis</i>	Coar	Bindweed
CORNACEAE	<i>Cornus stolonifera</i>	Cost	Red-osier dogwood
CRUCIFERAE	<i>Roripa sp.</i>	Rorx	Yellow cress
CUPRESSACEAE	<i>Juniperus communis</i>	Juco	Common juniper
	<i>Juniperus monosperma</i>	Jumo	One-Seeded juniper
	<i>Juniperus scopulorum</i>	Jusc	Rocky Mountain juniper

CYPERACEAE	<i>Carex</i> sp.	Carx	Sedge
ELAEAGNACEAE	<i>Elaeagnus angustifolia</i>	Elan	Russian olive
ERICACEAE	<i>Arctostaphylos uva-ursi</i>	Aruv	Kinnikinnik
	<i>Monotropa latisquama</i>	Mola	Pinesap
FAGACEAE	<i>Quercus gambelii</i>	Quga	Gambel oak
	<i>Quercus</i> sp.	Quex	Hybrid oak
	<i>Quercus undulata</i>	Quun	Wavyleaf
GENTIANACEAE	<i>Gentiana bigelovii</i>	Gebi	Blue gentian
GERANIACEAE	<i>Geranium caespitosum</i>	Geca	James geranium
	<i>Geranium richardsonii</i>	Geri	Richardson's geranium
GRAMINEAE	<i>Agropyron smithii</i>	Agsm	Wheatgrass
	<i>Agropyron trachycaulum</i>	Agtr	Slender wheatgrass
	<i>Agrostis alba</i>	Agal	Red top
	<i>Andropogon gerardii</i>	Ange	Big bluestem
	<i>Andropogon scoparius</i>	Ansc	Little bluestem
	<i>Aristida longiseta</i>	Arlo	Red three-awn
	<i>Blepharoneuron tricholepis</i>	Bltr	Pine dropseed
	<i>Bouteloua gracilis</i>	Bogr	Blue grama
	<i>Bromus anomalus</i>	Bran	Nodding brome
	<i>Bromus inermis</i>	Brin	Smooth brome
	<i>Bromus</i> sp.	Brox	Bromegrass
	<i>Bromus tectorum</i>	Brte	Cheatgrass, Downy chess
	<i>Elymus canadensis</i>	Elca	Canada wildrye
	<i>Festuca octiflora</i>	Feoc	Six-weeks fescue
	<i>Festuca</i> sp.	Fesx	Fescue
	<i>Hordeum</i> sp.	Horx	Barley grass
	<i>Koeleria cristata</i>	Kocr	Junegrass
	<i>Muhlenbergia montana</i>	Mumo	Mountain muhly
	<i>Phleum pratense</i>	Phpr	Timothy
	<i>Poa fendleriana</i>	Pofe	Mutton grass
	<i>Poa</i> sp.	Poax	Bluegrass
	<i>Sitanion hystrix</i>	Sihy	Bottlebrush squirreltail
	<i>Sporobolus cryptandrus</i>	Spcr	Dropseed
JUNCAEAE	<i>Juncus</i> sp.	Junx	Rush
LABIATAE	<i>Monarda menthaefolia</i>	Mome	Horsemint

LEGUMINOSAE	<i>Lupinus caudatus</i>	Luca	Lupine
	<i>Melilotus albus</i>	Meal	Sweet clover
	<i>Melilotus officialis</i>	Meof	Yellow sweet clover
	<i>Melilotus sp.</i>	Melx	Sweet clover
	<i>Petalostemum candidum</i>	Peca	Prairie clover
	<i>Robinia neomexicana</i>	Rone	New Mexico locust
	<i>Thermopsis pinetorum</i>	Thpi	Big golden-pea
	<i>Trifolium pratense</i>	Trpr	Red clover
	<i>Trifolium repens</i>	Trre	White clover
	<i>Trifolium sp.</i>	Trix	Clover
	<i>Vicia americana</i>	Viam	American vetch
LILIACEAE	<i>Alium cernuum</i>	Alce	Nodding onion
	<i>Yucca angustissima</i>	Yuan	Narrowleaf yucca
	<i>Yucca baccata</i>	Yuba	Banana yucca
LINACEAE	<i>Linum neomexicana</i>	Line	New Mexico yellow flax
LOASACEAE	<i>Mentzelia sp.</i>	Menx	Blazingstar
LORANTHACEA	<i>Arceuthobium divaricatum</i>	Ardi	Dwarf mistletoe
	<i>Arceuthobium vaginatum</i>	Arva	Mistletoe
MALVACEAE	<i>Sphaeralcea coccinea</i>	Spc0	Globe mallow
OLEACEAE	<i>Forestiera neomexicana</i>	Fone	New Mexico olive
ONAGRACEAE	<i>Epilobium sp.</i>	Epix	Willowweed
	<i>Oenothera coronopifolia</i>	Oeco	Evening-primrose
	<i>Oenothera hookeri</i>	Oeho	Hooker's evening-primrose
	<i>Oenothera sp.</i>	Oenx	Evening-primrose
PINACEAE	<i>Abies concolor</i>	Abco	White fir
	<i>Pinus edulis</i>	Pied	Piñon pine
	<i>Pinus flexilis</i>	Pifl	Limber pine
	<i>Pinus ponderosa</i>	Pipo	Ponderosa pine
	<i>Pseudotsuga menziesii</i>	Psme	Douglas-fir
PLANTAGINACEAE	<i>Plantago major</i>	Plma	Rippleseed plantain
	<i>Plantago patagonica</i>	Plpa	Woolly Indian-wheat
POLEMONIACEAE	<i>Ipomopsis aggregata</i>	Ipag	Scarlet trumpet
	<i>Ipomopsis longiflora</i>	Iplo	Pale trumpet
POLYGONACEAE	<i>Eriogonum sp.</i>	Erix	Wild buckwheat
	<i>Rumex crispus</i>	Rucr	Curly dock

PRIMULACEAE	<i>Androsace septentrionalis</i> var. <i>subulifera</i>	Anse	Rock-jasmine
RANUNCULACEAE	<i>Anemone cylindrica</i> <i>Clematis ligusticifolia</i> <i>Clematis pseudoalpina</i> <i>Clematis</i> sp. <i>Thalictrum fendleri</i> var. <i>fendleri</i>	Ancy Clli Clps Clex Thfe	Candle anemone Western virgin's bower Rocky Mountain clematis Western virgin's bower
ROSACEAE	<i>Amelanchier alnifolia</i> <i>Cercocarpus montanus</i> <i>Fallugia paradoxa</i> <i>Fragaria americana</i> <i>Potentilla</i> sp. <i>Prunus virginiana</i> subsp. <i>melanocarpa</i> <i>Rosa</i> sp. <i>Rosa woodsii</i> var. <i>fendleri</i> <i>Rubus strigosus</i> <i>Sorbus scopulina</i>	Amal Cemo Fapa Fram Ponx Prvi Rosx Rowo Rust Sosc	Meadowrue Serviceberry Mountain mahogany Apache plume Wild strawberry Cinquefoil Chokecherry Wild rse Fendler's rose Wild raspberry Mountain-ash
RUBIACEAE	<i>Galium boreale</i>	Gabe	Northern bedstraw
SALICACEAE	<i>Galium aparine</i> <i>Populus angustifolia</i> <i>Populus tremuloides</i> <i>Salix exigua</i> <i>Salix</i> sp.	Gaap Poan Potr Saex Salx	Goosegrass Narrowleaf cottonwood Aspen Coyote willow Willow
SAXIFRAGACEAE	<i>Jamesia americana</i> <i>Heuchera parvifolia</i> <i>Ribes cerceum</i> <i>Ribes inerme</i>	Jaam Hepa Rice Riin	Cliffbush Alumroot Wax crrent Gooseberry
SCROPHULARIACEAE	<i>Castilleja lineata</i> <i>Penstemon secundiflorus</i> <i>Penstemon</i> sp. <i>Verbascum thapsus</i>	Cali Pese Penx Veth	Yellow paintbrush Beardtongue Penstemon, Beardtongue Mullein
SOLANACEAE	<i>Physalis foetens</i> var. <i>neomexicana</i>	Phfo	Groundcheery
TYPHACEAE	<i>Typha latifolia</i>	Tyla	Cattails
ULMACEAE	<i>Ulnus pumila</i>	Ulpu	Siberian elm
UMBELLIFERAE	<i>Pseudocymopterus montanus</i>	Psmo	Mountain parsley

VALERIANACEAE	<i>Valeriana capitata</i>	Vaca	Valeriana
VIOLACEAE	<i>Viola canadensis</i>	Vica	Canada violet
VITACEAE	<i>Parthenocissus inserta</i>	Pain	Virginia creeper

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

Human Genome Project, April 1988
 Materials Science Laboratory, July 1988
 Selected Rubble Landfill, August 1986

APPENDIX B

Potential Ant Species within OU 1114
(according to MacKay, 1986)

SUBFAMILY	SCIENTIFIC NAME	HABITAT TYPE	AUTHORITY	
DOLICHODERINAE	<i>Acanthomypos interjectus</i>	Ponderosa	Mayr	
	<i>Brachymyrmex depilis</i>	Ponderosa	Emery	
	<i>C. sansabeanus</i>	P-j and ponderosa	Buckley	
	<i>C. vicinus</i>	P-j and ponderosa	Mayr	
	<i>F. argentea</i>	Disturbed	Wheeler	
	<i>F. neogagates</i>	P-j and disturbed	Emery	
	<i>F. pergandei</i>	Disturbed	Emery	
	<i>F. podzolica</i>	P-j and disturbed	Francoeur	
	<i>F. subnuda</i>	Ponderosa	Emery	
	<i>L. pallitarsis</i>	Ponderosa	Provancher	
	<i>L. sitiens</i>	P-j and ponderosa	Wilson	
	<i>Polyergus breviceps</i>	Ponderosa	Emery	
	MYRMICINAE	<i>Crematogaster cerasi</i>	Ponderosa	Fitch
		<i>C. colei</i>	Disturbed	Buren
		<i>Leptothorax muscorum</i>	Ponderosa	Nylander
		<i>L. nitens</i>	Disturbed	Emery
		<i>L. obliquicanthus</i>	Disturbed	Cole
<i>Monomorium cyaneum</i>		Disturbed	Wheeler	
<i>Pheidole ceres</i>		Ponderosa,		
		Disturbed, and burned ponderosa	Wheeler	
<i>P. wheelerorum</i>		P-j and disturbed	MacKay	
<i>Pogonomyrmex occidentalis</i>		P-j and ponderosa	Cresson	
	<i>Solenopsis molesta</i>	P-j and disturbed	Say	

Ant species found in Riparian (R) and Ponderosa-Riparian (P-R) habitats similar to those found in OU 1114.

SUBFAMILY NAME	SCIENTIFIC NAME	HABITAT	AUTHORITY	
MYRMICINAE	<i>Leptothorax crassipilis</i>	R	Wheeler	
	<i>L. muscorum</i>	P-R	Nylander	
	<i>L. nitens</i>	P-R	Emery	
	<i>L. texanus texanus</i>	P-R	Wheeler	
	<i>L. tricarinatus</i>	P-R	Emery	
	<i>Monomorium cyaneum</i>	P-R	Buckley	
	<i>Myrmecina americana</i>	P-R	Emery	
	<i>Myrmica emeryana</i>	P-R	Forel	
	<i>Myrmica hamulata</i>	P-R	Weber	
	<i>Pheidole ceres</i>	P-R	Wheeler	
	<i>P. wheelerorum</i>	P-R	MacKay	
	<i>Pogonomyrmex occidentalis</i>	P-R	Cresson	
	<i>Solenopsis molesta</i>	P-R and R	Say	
	<i>Stenammina occidentale</i>	P-R	M R Smith	
	DOLICHODERINAE	<i>Tapinoma sessile</i>	P-R	Say
		<i>Acanthomyops latipes</i>	P-R	Walsh
		<i>Camponotus laevigatus</i>	P-R	F Smith
<i>C. vicinus</i>		P-R	Wheeler	
<i>F. densiventris</i>		P-R	Linnaeus	
<i>F. hewitti</i>		P-R	Wheeler	
<i>F. lasioides</i>		P-R	Emery	
<i>F. limata</i>		P-R	Wheeler	
<i>F. neorufibarbis</i>		R	Emery	
<i>F. obscuripes obscuripes</i>		P-R	Forel	
<i>F. obscuriventris clivia</i>		P-R	Creighton	
<i>F. occulta</i>		P-R	Francoeur	
<i>F. planipilis</i>		P-R	Creighton	
<i>F. podzolica</i>		P-R	Francoeur	
<i>Lasius alienus</i>		P-R	Foerster	
<i>L. crypticus</i>	P-R	Wilson		

SUBFAMILY NAME	SCIENTIFIC NAME	HABITAT	AUTHORITY
	<i>L. flavus</i>	P-R	Fabricius
	<i>L. neoniger</i>	P-R	Emery
	<i>L. niger</i>	P-R	Linnaeus
	<i>L. pallitarsis</i>	P-R	Provancher
	<i>L. subumbratus</i>	P-R	Viereck
	<i>Liometopum apiculatum</i>	P-R	Mayr
	<i>L. luctuosom</i>	P-R	Wheeler

APPENDIX C

AQUATIC INVERTEBRATES FOUND IN SANDIA CANYON from K. Bennett (1990-1992)

Order Coleoptera

family Dytiscidae
family Gyrinidae

Order Diptera

Family Chironomidae
Family Simuliidae
Family Syrphidae
Family Culicidae

Order Ephemoptera

Family Baetidae

Order Hemiptera

Family Corixidae
Family Gerridae
Family Mesoueliidae
Family Notonectidae

Order Odonata

Family Gomphidae
Family Libellulidae
Family Lestidae

Order Plecoptera

Family Perlidae

Order Trichoptera

Family Brachycentridae

Class Gordeaceae

Gordus sp.

Class Nematoda

Unidentified free-living

Class Oligochaeta

APPENDIX D

**REPTILES AND AMPHIBIANS of OU 1114
(Bogart, 1978-1979)**

FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCATION
BUFONIDAE	<i>Bufo woodhousei</i>	Woodhouse toad	Mortandad Canyon
COLUBRIDAE	<i>Masticophis flagellum</i>	Coachwhip	Mortandad Canyon
	<i>Opheodrys vernalis</i>	Smooth green snake	Upper LA Canyon (near reservoir)
	<i>Pituophis melanoleucus</i>	Gopher snake	Mortandad Canyon
	<i>Thamnophis elegans</i>	Western terrestrial garter snake	LA Canyon Sandia Canyon
HYLIDAE	<i>Hyla arenicolor</i>	Canyon treefrog	Sandia Canyon
IGUANIDAE	<i>Phrynosoma douglassi</i>	Short-horned lizard	Sandia Canyon
	<i>Sceloporus undulatus</i>	Eastern fence lizard	Found throughout LA County from 1640m to 2500m
PELOBATIDAE	<i>Scaphiopus multiplicatus</i>	Southern spadefoot	Mortandad Canyon
PLETHODONTIDAE	<i>Plethodon neomexicanus</i>	Jemez Mountains salamander	Upper LA Canyon
SCINCIDAE	<i>Eumeces multivirgatus</i>	Many-lined skink	Sandia Canyon
VIPERIDAE	<i>Crotalus viridis</i> subspecies <i>viridis</i>	Prairie rattlesnake	Sandia Canyon

APPENDIX E

BREEDING BIRDS OF OU 1114 from *Atlas of the Breeding Birds of Los Alamos County, New Mexico*

FAMILY	SCIENTIFIC NAME	COMMON NAME
ACCIPITRIDAE	<i>Buteo jamaicensis</i>	Red-tailed hawk
APODIDAE	<i>Aeronautes saxatalis</i>	White-throated swift
	<i>Tachycineta thalassina</i>	Violet-green swallow
CAPRIMULGIDAE	<i>Chordeiles minor</i>	Common nighthawk
	<i>Phalaenoptilus nuttallii</i>	Common poorwill
CERTHIIDAE	<i>Certhia americana</i>	Brown creeper
COLUMBIDAE	<i>Columba fasciata</i>	Band-tailed pigeon
	<i>Zenaida macroura</i>	Mourning dove
CORVIDAE	<i>Aphelocoma coerulescens</i>	Scrub jay
	<i>Corvus corax</i>	Common raven
	<i>Cyanocitta stelleri</i>	Steller's jay
	<i>Nucifraga columbiana</i>	Clark's nutcracker
EMBERIZIDAE	<i>Agelaius phoeniceus</i>	Red-winged blackbird
	<i>Chondestes grammacus</i>	Lark sparrow
	<i>Euphagus cyanocephalus</i>	Brewer's blackbird
	<i>Icterus galbula galbula</i>	Northern oriole
	<i>Junco hyemalis</i>	Dark-eyed junco
	<i>Molothrus ater</i>	Brown-headed cowbird
	<i>Passerina amoena</i>	Lazuli bunting
	<i>Melospiza melodia</i>	Song sparrow

	<i>Pheucticus melanocephalus</i>	Black-headed grosbeak
	<i>Pipilo chlorurus</i>	Green-tailed towhee
	<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee
	<i>Pipilo fuscus</i>	Canyon towhee
	<i>Piranga ludoviciana</i>	Western tanager
	<i>Pooecetes gramineus</i>	Vesper sparrow
	<i>Spizella passerina</i>	Chipping sparrow
FALCONIDAE	<i>Falco sparverius</i>	American kestrel
FRINGILLIDAE	<i>Carduelis pinus</i>	Pine siskin
	<i>Carduelis psaltria</i>	Lesser goldfinch
	<i>Carpodacus casinii</i>	Cassin's finch
	<i>Carpodacus mexicanus</i>	House finch
	<i>Coccothraustes verpertina</i>	Evening grosbeak
	<i>Loxia curvirostra</i>	Red crossbill
MUSCICAPIDAE	<i>Catharus guttatus</i>	Hermit thrush
	<i>Myadestes tosendi</i>	Townsend's solitaire
	<i>Polioptila caerulea</i>	Blue-gray gnatcatcher
	<i>Sialia currucoides</i>	Mountain bluebird
	<i>Sialia mexicana</i>	Western bluebird
	<i>Turdus migratorius</i>	American robin
PARIDAE	<i>Parus gambeli</i>	Mountain chickadee
	<i>Parus inornatus</i>	Plain titmouse
	<i>Psaltriparus minimus</i>	Bushtit
PARULIDAE	<i>Dendroica coronata</i>	Yellow-rumped warbler
	<i>Dendroica graciae</i>	Grace's warbler
	<i>Oporornis tolmiei</i>	MacGillivray's warbler
	<i>Vermivora celata</i>	Orange-crowned warbler
	<i>Vermivora virginiae</i>	Virginia's warbler

PASSERIDAE	<i>Passer domesticus</i>	House sparrow
PICIDAE	<i>Colaptes auratus</i>	Northern flicker
	<i>Melanerpes formicivorus</i>	Acorn woodpecker
	<i>Picoides villosus</i>	Hairy woodpecker
	<i>Sphyrapicus thyroideus</i>	Williamson's sapsucker
SITTIDAE	<i>Sitta carolinensis</i>	White-breasted nuthatch
	<i>Sitta pygmaea</i>	Pygmy nuthatch
STRIGIDAE	<i>Bubo virginianus</i>	Great horned owl
	<i>Otus flammeolus</i>	Flammulated owl
STURNIDAE	<i>Sturnus vulgaris</i>	European starling
TROCHILIDAE	<i>Selasphorus platycercus</i>	Broad-tailed hummingbird
TROGLODYTIDAE	<i>Catherpes mexicanus</i>	Canyon wren
	<i>Salpinctes obsoletus</i>	Rock wren
	<i>Troglodytes aedon</i>	House wren
TYRANNIDAE	<i>Contopus sordidulus</i>	Western wood-pewee
	<i>Empidonax hammondii</i>	Hammond's flycatcher
	<i>Empidonax oberholseri</i>	Dusky flycatcher
	<i>Empidonax occidentalis</i>	Cordilleran flycatcher
	<i>Empidonax wrightii</i>	Gray flycatcher
	<i>Myiarchus cinerascens</i>	Ash-throated flycatcher
	<i>Sayornis saya</i>	Say's phoebe
	<i>Tyrannus vociferans</i>	Cassin's kingbird
TYTONIDAE	<i>Bubo virginianus</i>	Great horned owl
	<i>Otus flammeolus</i>	Flammulated owl
VIREONIDAE	<i>Vireo gilvus</i>	Warbling vireo
	<i>Vireo solitarius</i>	Solitary vireo

APPENDIX F

SMALL MAMMALS OF OU 1114

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
CRICETIDAE	<i>Neotoma albigula</i>	White-throated woodrat	2
	<i>Neotoma mexicana</i>	Mexican woodrat	1,2,7
	<i>Neotoma</i> sp.	Woodrat	2
	<i>Microtus longicaudus</i>	Long-tailed vole	1,2,3,4,6,7
	<i>Microtus montanus</i>	Mountain vole	3,6
	<i>Peromyscus boylii</i>	Brush mouse	1,2,6,7
	<i>Peromyscus leucopus</i>	White-footed mouse	5,6,7
	<i>Peromyscus maniculatus</i>	Deer mouse	1,2,3,4,5,6,7
	<i>Peromyscus truei</i>	Pinon mouse	5,7
	<i>Reithrodontomys megalotis</i>	Western harvest mouse	3,7
	HETEROMYIDAE	<i>Perognathus flavescens</i>	Plains pocket mouse
<i>Perognathus intermedius</i>		Rock pocket mouse	7
MURIDAE	<i>Mus musculus</i>	House mouse	1
SCIURIDAE	<i>Citellus variegatus</i>	Rock squirrel	6
	<i>Eutamias minimus</i>	Least chipmunk	5,7
	<i>Eutamias quadrivittatus</i>	Colorado chipmunk	4
	<i>Tamias</i> sp.	Chipmunk	6
SORICIDAE	<i>Sorex vagrans</i>	Wandering shrew	3,6
	<i>Sorex monticolus</i>	Dusky shrew	7

Sources:

1. D. Raymer and J. Biggs, effluent 03A-081, 1992

2. **D. Raymer and J. Biggs, effluent 051-051, 1992**
3. **D. Raymer and J. Biggs, Sandia Canyon, 1992**
4. **J. Kent, Sandia Canyon, 1985-1986**
5. **F.R. Miera and T.E. Hakonson, Mortandad Canyon, 1977**
6. **J. Morrison, Sandia Canyon, 1990**
7. **J. Kent, Mortandad Canyon, 1986.**

APPENDIX G

PLANT CLASSIFICATION OUTLINE

Hierarchy Order

Vegetation type

Formation type

Climatic (thermal) zone

Biotic community

Series

Habitat type (association)

Phase

Definitions

Vegetation type: Vegetation established under existing climate and includes one of two types: Upland and Wetland.

Formation type: Formations that are vegetative responses to various environmental factors, primarily available soil moisture, and include the following:

UPLAND

Tundra

Forest and woodland

Scrub land

Grassland

Desert

Non-vascular

WETLAND

Wet tundra

Forest

Swamp-scrub

Marshland

Strand

Submergent

Climatic zone: One of the four world climatic zones which minimum temperature is the primary determining factor. These include Arctic-Boreal, Cold Temperate, Warm Temperate, and Tropical-Subtropical.

Biotic community: A unit characterized by a distinct evolutionary history within a formation and centered in a biogeographic region with a particular precipitation pattern or climatic regime.

Series: A principal plant-animal community within a biotic community. These are based on distinct climax plant dominants.

Habitat type: An area within a series defined by the occurrence of a particular dominant species of local or regional distribution.

Phase: A sub category established by analyzing detailed data collection to determine codominants, understory, and other associated species.

Only those formations, climatic zones, communities, etc., occurring in LANL will be listed. For a more complete description, see Brown *et al.* (1982). Appendix A explains plant code abbreviations.

APPENDIX H

NPDES OUTFALLS WITHIN OU 1114

EPA Number	Technical Area	Building	Canyon
03A-021	3		Mortandad
03A-022	3		Mortandad
03A-148	3		Sandia
03A-023	3		Sandia
04A-151	3		Sandia
01A-001	3		Sandia
03A-027	3	22	Sandia
04A-140	3	22	Sandia
SSS-01S	3	1617	Sandia
04A-094	3	22	Sandia
04A-109	3	1498	Sandia
03A-009	3	1538	Two Mile
03A-024	3	16	
03A-025	3	1567	
03A-098	59	OH-2	Two Mile

APPENDIX I

Plant Checklist Including Weediness and Indicator Status for OU 1114

FAMILY	SCIENTIFIC NAME	CODE*	COMMON NAME
ACERACEAE	<i>Acer glabrum</i> var. <i>neomexicanum</i>	NW, F	New Mexico maple
AMARANTHACEAE	<i>Amaranthus retroflexus</i>		Red pigweed
ANACARDIACEAE	<i>Rhus radicans</i>		Poison ivy
	<i>Rhus trilobata</i>	NW	Skunk bush
ASCLEPIADACEAE	<i>Asclepias speciosa</i>	EC	Showy milkweed
BERBERIDACEAE	<i>Berberis fendleri</i>	NW	Fendler barberry
BETULACEAE	<i>Alnus tenuifolia</i>	NW	Thinleaf alder
	<i>Betula occidentalis</i>	NW, FW	Water birch
BORAGINACEAE	<i>Lithospermum multiflorum</i>	NW	Puccoon
CACTACEAE	<i>Opuntia polyacantha</i>	ECO	Starvation cactus
	<i>Opuntia</i> sp.		Prickly pear cactus
CAMPANULACEAE	<i>Campanula rotundifolia</i>	NW, F	Harebell
CAPRIFOLIACEAE	<i>Sambucus microbotrys</i>		Red elderberry
	<i>Symphoricarpos</i> sp.		Snowberry
CELASTRACEAE	<i>Pachystima myrsinites</i>	NW	Myrtle boxleaf
COMPOSITAE	<i>Achillea lanulosa</i>	EC	Yarrow
	<i>Ambrosia</i> sp.		Ragweed
	<i>Antennaria parvifolia</i>	NW	Pussytoes
	<i>Artemisia carruthii</i>	NW	Wormwood
	<i>Artemisia dracunculus</i>	NW	False tarragon
	<i>Artemisia frigida</i>	CO	Estafiata
	<i>Artemisia ludoviciana</i>	NW	Wormwood
	<i>Aster</i> sp.		Aster
	<i>Bahia dissecta</i>	NW	Wild chrysanthemum
	<i>Brickellia</i> sp.		Brickelbush
	<i>Chrysopsis foliosa</i>		Golden aster
	<i>Chrysothamnus nauseosus</i>	EC	Chamisa, Rabbitbrush
	<i>Cirsium</i> sp.		Thistle
	<i>Conyza canadensis</i>	EC, FU	Horseweed

	<i>Erigeron divergens</i>	NW	Fleabane daisy
	<i>Erigeron flagellaris</i>	NW, F	Spreading fleabane
	<i>Erigeron jamesii</i>		Antelope sage
	<i>Erigeron philadelphicus</i>	NW	Common fleabane
	<i>Erigeron</i> sp.		Daisy
	<i>Erigeron speciosus</i>	NW	Oregon fleabane
	<i>Eupatorium herbaceum</i>	NW	Desert thoroughwort
	<i>Eupatorium</i> sp.		Thoroughwort
	<i>Franseria acanthicarpa</i>		Bursage
	<i>Grindelia aphanactis</i>	NW	Gumweed
	<i>Gutierrezia sarothrae</i>	EC	Snakeweed
	<i>Helianthus annuus</i>	EC, F	Annual sunflower
	<i>Hymenopappus filifolius</i>	NW	Yellow cut-leaf
	<i>Hymenoxys argentea</i>		Perky Sue
	<i>Hymenoxys richardsonii</i>	NW	Bitterweed
	<i>Lactuca</i> sp.		Prickly lettuce
	<i>Liatris punctata</i>	NW	Gayfeather
	<i>Machaeranthera</i> sp.		Aster
	<i>Senecio fendleri</i>	NW	Fendler's senecio
	<i>Solidago</i> sp.		Goldenrod
	<i>Sonchus asper</i>	EC, FW	Spiny-leaved sow-thistle
	<i>Taraxacum officinale</i>	EC, FU	Dandelion
	<i>Taraxacum</i> sp.		Dandelion
	<i>Thelesperma trifidum</i>		Greenthread
	<i>Townsendia exscapa</i>		Easter daisy
	<i>Townsendia incana</i>	NW	Townsend's aster
	<i>Tragopogon dubius</i>	EC	Goatsbeard
	<i>Viguiera multiflora</i>		Goldeneye
	<i>Viguiera</i> sp.		Goldeneye
CONVOLVULVACEAE	<i>Convolvulus arvensis</i>	NO	Bindweed
CORNACEAE	<i>Cornus stolonifera</i>	NW,FW	Red-osier dogwood
CRUCIFERAE	<i>Roripa</i> sp.		Yellow cress
CUPRESSACEAE	<i>Juniperus communis</i>	NW	Common juniper
	<i>Juniperus monosperma</i>	NW	One-Seeded juniper
	<i>Juniperus scopulorum</i>	NW	Rocky Mountain juniper

CYPERACEAE	<i>Carex</i> sp.		Sedge
ELAEAGNACEAE	<i>Elaeagnus angustifolia</i>	NW, FW	Russian olive
ERICACEAE	<i>Arctostaphylos uva-ursi</i>	NW	Kinnikinnik
	<i>Monotropa latisquama</i>		Pinesap
FAGACEAE	<i>Quercus gambelii</i>	NW	Gambel oak
	<i>Quercus</i> sp.		Hybrid oak
	<i>Quercus undulata</i>	NW	Wavyleaf
GENTIANACEAE	<i>Gentiana bigelovii</i>		Blue gentian
GERANIACEAE	<i>Geranium caespitosum</i>		James geranium
	<i>Geranium richardsonii</i>	NW, F	Richardson's geranium
GRAMINEAE	<i>Agropyron smithii</i>	NW, F	Wheatgrass
	<i>Agropyron trachycaulum</i>	NW, F	Slender wheatgrass
	<i>Agrostis alba</i>	FW	Red top
	<i>Andropogon gerardii</i>	NW, F	Big bluestem
	<i>Andropogon scoparius</i>	NW	Little bluestem
	<i>Aristida longiseta</i>	NW	Red three-awn
	<i>Blepharoneuron tricholepis</i>	NW	Pine dropseed
	<i>Bouteloua gracilis</i>	NW	Blue grama
	<i>Bromus anomalus</i>	NW	Nodding brome
	<i>Bromus inermis</i>	NW	Smooth brome
	<i>Bromus</i> sp.		Brome grass
	<i>Bromus tectorum</i>	EC	Cheatgrass, Downy chess
	<i>Elymus canadensis</i>	NW, F	Canada wildrye
	<i>Festuca octoflora</i>		Six-weeks fescue
	<i>Festuca</i> sp.		Fescue
	<i>Hordeum</i> sp.		Barley grass
	<i>Koeleria cristata</i>	NW	Junegrass
	<i>Muhlenbergia montana</i>	NW	Mountain muhly
	<i>Phleum pratense</i>	CO, FU	Timothy
	<i>Poa fendleriana</i>	NW	Mutton grass
	<i>Poa</i> sp.		Bluegrass
	<i>Sitanion hystrix</i>	NW	Bottlebrush squirreltail
	<i>Sporobolus cryptandrus</i>	NW	Dropseed
JUNCAEAE	<i>Juncus</i> sp.		Rush
LABIATAE	<i>Monarda menthaefolia</i>		Horsemint

LEGUMINOSAE	<i>Lupinus caudatus</i>	NW	Lupine
	<i>Melilotus albus</i>	CO, FU	Sweet clover
	<i>Melilotus officialis</i>	CO, FA	Yellow sweet clover
	<i>Melilotus</i> sp.		Sweet clover
	<i>Petalostemum candidum</i>		Prairie clover
	<i>Robinia neomexicana</i>	NW	New Mexico locust
	<i>Thermopsis pinetorum</i>	NW	Big golden-pea
	<i>Trifolium pratense</i>	CO	Red clover
	<i>Trifolium repens</i>	CO	White clover
	<i>Trifolium</i> sp.		Clover
	<i>Vicia americana</i>	NW	American vetch
LILIACEAE	<i>Alium cernuum</i>	EC	Nodding onion
	<i>Yucca angustissima</i>	NW	Narrowleaf yucca
	<i>Yucca baccata</i>	EC	Banana yucca
LINACEAE	<i>Linum neomexicana</i>		New Mexico yellow flax
LOASACEAE	<i>Mentzelia</i> sp.		Blazingstar
LORANTHACEA	<i>Arceuthobium divaricatum</i>		Dwarf mistletoe
	<i>Arceuthobium vaginatum</i>	NW	Mistletoe
MALVACEAE	<i>Sphaeralcea coccinea</i>	NW	Globe mallow
OLEACEAE	<i>Forestiera neomexicana</i>	NW, FU	New Mexico olive
ONAGRACEAE	<i>Epilobium</i> sp.		Willowweed
	<i>Oenothera coronopifolia</i>	NW	Evening-primrose
	<i>Oenothera hookeri</i>	NW	Hooker's evening-primrose
	<i>Oenothera</i> sp.		Evening-primrose
PINACEAE	<i>Abies concolor</i>	NW	White fir
	<i>Pinus edulis</i>	NW	Piñon pine
	<i>Pinus flexilis</i>	NW	Limber pine
	<i>Pinus ponderosa</i>	NW, FU	Ponderosa pine
	<i>Pseudotsuga menziesii</i>	NW	Douglas-fir
PLANTAGINACEAE	<i>Plantago major</i>	EC, FW	Rippleseed plantain
	<i>Plantago patagonica</i>		Woolly Indian-wheat
POLEMONIACEAE	<i>Ipomopsis aggregata</i>	NW	Scarlet trumpet
	<i>Ipomopsis longiflora</i>	NW	Pale trumpet
POLYGONACEAE	<i>Eriogonum</i> sp.		Wild buckwheat
	<i>Rumex crispus</i>	NO-CO, FW	Curly dock

PRIMULACEAE	<i>Androsace septentrionalis</i> var. <i>subulifera</i>	NW, F	Rock-jasmine
RANUNCULACEAE	<i>Anemone cylindrica</i>	NW	Candle anemone
	<i>Clematis ligusticifolia</i>	NW, F	Western virgin's bower
	<i>Clematis pseudoalpina</i>		Rocky Mountain clematis
	<i>Clematis</i> sp.		Western virgin's bower
ROSACEAE	<i>Thalictrum fendleri</i> var. <i>fendleri</i>	NW, FU	Meadowrue
	<i>Amelanchier alnifolia</i>		Serviceberry
	<i>Cercocarpus montanus</i>		Mountain mahogany
	<i>Fallugia paradoxa</i>	NW	Apache plume
	<i>Fragaria americana</i>		Wild strawberry
	<i>Potentilla</i> sp.		Cinquefoil
	<i>Prunus virginiana</i> subsp. <i>melanocarpa</i>	NW, F	Chokecherry
	<i>Rosa</i> sp.		Wild rose
	<i>Rosa woodsii</i> var. <i>fendleri</i>		Fendler's rose
	<i>Rubus strigosus</i>	F	Wild raspberry
	<i>Sorbus scopulina</i>		Mountain-ash
RUBIACEAE	<i>Galium aparine</i>	NW, FU	Goosegrass
	<i>Galium boreale</i>	NW, F	Northern bedstraw
SALICACEAE	<i>Populus angustifolia</i>	NW, FW	Narrowleaf cottonwood
	<i>Populus tremuloides</i>	NW, FU	Aspen
	<i>Salix exigua</i>	NW	Coyote willow
	<i>Salix</i> sp.		Willow
SAXIFRAGACEAE	<i>Heuchera parvifolia</i>	NW	Alumroot
	<i>Jamesia americana</i>	NW, FU	Cliffbush
	<i>Ribes cerceum</i>	NW	Wax currant
	<i>Ribes inerme</i>	NW, FW	Gooseberry
SCROPHULARIACEAE	<i>Castilleja lineata</i>	NW, FW	Yellow paintbrush
	<i>Penstemon secundiflorus</i>	NW	Beardtongue
	<i>Penstemon</i> sp.		Penstemon, Beardtongue
	<i>Verbascum thapsus</i>	EC	Mullein
SOLANACEAE	<i>Physalis foetens</i> var. <i>neomexicana</i>	NW	Groundcherry
TYPHACEAE	<i>Typha latifolia</i>	NW, OW	Cattails
ULMACEAE	<i>Ulmus pumila</i>		Siberian elm
UMBELLIFERAE	<i>Pseudocymopterus montanus</i>	NW	Mountain parsley

VALERIANACEAE	<i>Valeriana capitata</i>		Valeriana
VIOLACEAE	<i>Viola canadensis</i>	NW	Canada violet
VITACEAE	<i>Parthenocissus inserta</i>		Virginia creeper

* wetlands categories assigned on the basis of Region 7

Codes For Weediness:

EC = of economic importance
CO = a colonizing plant, often associated with weediness
NO = noxious, poisonous
NW = non-weedy

Codes for Indicator Status:

F = facultative
FU = facultative upland
FW = facultative wetland
OB = obligate wetland

Facultative: Plants equally likely to occur in wetlands or non wetlands (estimated probability 34-66%).

Facultative Upland: Plants usually occurring in non wetlands (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%).

Facultative Wetland: Plants usually occurring in wetlands (estimated probability 67-99%), but occasionally found in non wetlands.

Obligate Wetland: Plants occurring almost always (estimated probability >99%) under natural conditions in wetlands.

APPENDIX J

ENDANGERED SPECIES PRINTOUT FOR OU 1114

HABITATS: PINON-JUNIPER PONDEROSA-PINON, PONDEROSA PINE, MIXED-CONIFER
WETLANDS AND RIPARIAN

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Accipiter gentilis*

COMMON NAME: NORTHERN GOSHAWK

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: CURRENTLY, CANDIDATE FOR FEDERAL LISTING, FEDERAL
REGISTER, 1991, VOL. 56, NO. 225, PP.58810.

DISTRIBUTION:

SPECIFIC REQUIREMENTS: DENSE, MATURE, OR OLD GROWTH CONIFEROUS FOREST.

HABITAT: PONDEROSA

BREEDING HABITAT: PONDEROSA

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: LOGGING

BRIEF KEY DESCRIPTION: A LARGE ROBUST HAWK WITH A LONGISH TAIL, ROUNDED
WINGS. CROWN AND CHECK BLACKISH; BROAD WHITE
STRIPE OVER THE EYE. UNDER PARTS PALE GRAY,
FINELY BARRED. SIZE = 20-26".

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: KENNEDY, P.L., 1987

GENERAL MAP LOCATION:

COMMENTS: STUDIES BY PAT KENNEDY INDICATE THE HIGHEST
PERCENTAGE OF NEST WERE IN PONDEROSA PINE/GAMBEL'S
OAK, PONDEROSA PINE/GRAY OAK, AND MIXED CONIFER
(ABIES CONCOLOR-PSEUDOTSUGA MENZIESII-PINUS
PONDEROSA/QUERCUS GAMBELII) HABITAT TYPES.

REFERENCE: KENNEDY, P.L., 1987, FED.REGISTER, 1991, VOL.56, NO.225

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: Buteogallus anthracinus

COMMON NAME: COMMON BLACK HAWK

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed
1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Lower elevations in Gila, San Francisco and
Mimbres drainage. Has also occurred in smaller
numbers in Rio Grande Valley.

SPECIFIC REQUIREMENTS: In the Southwest, in cottonwoods and other
woodlans along permanent streams.

HABITAT: RIPARIAN ZONES

BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF RIPARIAN HABITAT AND SHOOTING HAWK.

BRIEF KEY DESCRIPTION: Medium-sized raptor, mainly black. Broader wings
than the Zone-Tail. Adults have bill black, iris
dark brown and cere and legs yellow. Length is
500-600 m.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

ANIMALS

BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Haliaeetus leucocephalus*

COMMON NAME: BALD EAGLE

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico endangered (group 2). First listed 1/24/75 (NMGF Reg. 563). Federally protected since 03/11/67.

DISTRIBUTION: Migrates and winters from the northern border, southward regularly to Gila, Lower Rio Grande, Middle Pecos and Candian Valleys, Rio Arriba and Sandoval Co.

SPECIFIC REQUIREMENTS: Found near streams, lakes and sometimes dry land. Also found in riparian areas.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: PESTICIDES AND STREAM DEGRADATION.

BRIEF KEY DESCRIPTION: Huge wingspan 2-2.4 m, white head and tail, iris, cere, bill and legs yellow. Immature resemble golden eagles.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: FIELD SIGHTINGS, 1991-1992

GENERAL MAP LOCATION: NEAR ANCHO CANYON IN WHITE ROCK CANYON

COMMENTS: Winter roost at Cochiti Lake and in Montoso Canyon. Mortandad Canyon appears to have some suitable roosting areas, but no confirmed roost. Suitable roost sites consist of protection from wind and large trees.

Potential roosting area has been found on LANL property near the Rio Grande River. A bald eagle was seen in the area in February 1992. Survey efforts are underway to confirm.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDE

SCIENTIFIC NAME: *Ictinia mississippiensis*

COMMON NAME: MISSISSIPPI KITE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed
Jan. 24, 1975 (NMGF Reg. 563).

DISTRIBUTION: In New Mexico summers regularly and breeds in the
Covis region, Portales, and Hobbs. Small numbers
occur in middle and lower Rio Grande and lower
Pecos valleys.

SPECIFIC REQUIREMENTS: Riparian zones, shelterbelts and golf courses.

HABITAT:RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON:DESTRUCTION OF RIPARIAN ZONES.

BRIEF KEY DESCRIPTION: Small raptor with length 335 mm and wingspan 1 m,
long. Has long pointed and notched wings. Has
whitish to black plumage.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE:N/A
GENERAL MAP LOCATION:N/A

COMMENTS:

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY FALCONIDAE

SCIENTIFIC NAME: Falco Peregrinus

COMMON NAME: PEREGRINE FALCON

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: NM: Endangered (group 1), 1/24/75, (NM Reg. 563);
Federal "American", F.p. antum, Endangered 6/2/70;
Tundra F.P. tundrius, Threatened 3/20/84.

DISTRIBUTION: New Mexico subspecies "American" breeds locally in mountainous areas, and it occurs in migration and winter statewide.

SPECIFIC REQUIREMENTS: Breeding territories center on cliffs that are wooded/forested habitats.

HABITAT: PONDEROSA-PINON BREEDING HABITAT: PONDEROSA-PINON

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DDT, DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Typical falcon, long pointed wings and long tails, moderate size, 380-500 mm in length, wingspan 1.0-1.5 m, gray above, whitish below, tail is dark gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: LA-6898-PR, PP.94
GENERAL MAP LOCATION: PUEBLO CANYON

COMMENTS: Two young males seen in the spring of 1990.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

ANIMALS

BIRD

FAMILY STRIGIDAE

SCIENTIFIC NAME: *Strix occidentalis lucida*

COMMON NAME: MEXICAN SPOTTED OWL

STATUS: FEDERALLY-THREATENED

FEDERAL/STATE REFERENCE: Currently listed as federaly threatened, 50 CFR PART 17, Vol. 58, No. 49, March 16, 1993, "Endangered and Threatened Wildlife and Plants: Final Rule to list Mexican Spotted Owl as Threatened Species, pp.14248-14271.

DISTRIBUTION: New Mexico, Arizona, Texas, Colorado, Utah and Mexico.

SPECIFIC REQUIREMENTS: The owl inhabits forested mountains and canyons. Its habitat is primarily uneven-aged, multi-storied forest with closed canopies.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: MIXED-CONIFER

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: LUMBERING

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: FEDERAL REGISTER 50 CFR PARTT 17, VOL.55, NO.60, 3/28/90.

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| ANIMALS |
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BIRD

FAMILY TROCHILIDAE

SCIENTIFIC NAME: *Cyananthus latirostris*

COMMON NAME: BROAD-BILLED HUMMINGBIRD

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Summers in Guadalupe Canyon (Hidalgo co.), Vagrants near Los Alamos, Bandelier National Monument, Las Vegas, Truth of Consequences, Las Cruces and Carlsbad Caverns.

SPECIFIC REQUIREMENTS: Riparian woodlands, low to moderate elevations.

HABITAT: RIPARIAN ZONES

BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Adult males have orange-red bills. Females and immatures similar to the violet-crowned hummingbird, but have small white line behind the eye. Upperparts of the hummingbird are greenish, the wings are blackish, and feet and eyes are dark. The tail is slightly forked.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF ENDANGERED
GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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BIRD

FAMILY TYRANNIDAE

SCIENTIFIC NAME: Empidonax traillii

COMMON NAME: WILLOW FLYCATCHER

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: New Mexico: "Southwestern", E.T. extimus, only.
Endangered , Group 2, 01/09/88 (NMGF reg 657).
Federal: Notice of Review as
Endangered/Threatened. Listed as a C1 species

DISTRIBUTION: Breeds through central New Mexico. Species occurs
statewide in spring and autumn migration. E.t.
extimus breeds in Chama, Rio Grande, Zuni, Gila,
San Francisco.

SPECIFIC REQUIREMENTS: Confined to riparian woodlands in breeding
seasons. Riparian areas are dominated by
cottonwoods.

HABITAT:RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 3700 MAXIMUM ELEVATION: 8900

THREATS TO TAXON:LOSS OF RIPARIAN HABITAT

BRIEF KEY DESCRIPTION: Small, double wingbars and eyering. Upperparts
are dark olive-brown, crown paler and more grayish
or brownish. Breast is light grayish-olive and
post. is pale yellow.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE:N/A
GENERAL MAP LOCATION:N/A

COMMENTS:

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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MAMMAL

FAMILY VESPERTILIONIDAE

SCIENTIFIC NAME: *Euderma maculatum*

COMMON NAME: SPOTTED BAT

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico :Endangered (Group 2), 01/09/88 (NMGF Reg. 657). Federal: Notice of review as endangered/threatened.

DISTRIBUTION: Rio Grande Valley westward, occurring regularly in the Jemez Mountains and on Mt. Taylor. Records also at Ghost Ranch and Lake Roberts.

SPECIFIC REQUIREMENTS: Riparian, Pinon-juniper, ponderosa, spruce-fir. Roost in cliffs or rock cervices. Needs a good source of water, a small area of standing water to slow moving water. Key food is moths.

HABITAT: MULTIPLE

BREEDING HABITAT: MULTIPLE

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: POSSIBLY PESTICIDES

BRIEF KEY DESCRIPTION: Upperparts are black with large white, roughly circular spots on the shoulders and another at the base of the tail, plus a small patch at the posterior base of each ear. Has very large ears (45-50 mm). Ears are naked, pinkish-red in color.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS: Note: Habitat can be varied--Riparian, Ponderosa, Spruce-Fir and Pinon Juniper.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

ANIMALS

MAMMAL

FAMILY ZAPODIDAE

SCIENTIFIC NAME: *Zapus hudsonius*

COMMON NAME: MEADOW JUMPING MOUSE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 07/22/83 (NMGF Reg. 624). Federal (Subspecies "New Mexico" *Z.H. luteus*) notice of review as endangered/threatened.

DISTRIBUTION: Localities in San Juan, Jemez and Scaramento Mountains in central-northern and central Rio Grande Valley. Has been recorded once in the Sangre de Cristo Mountains.

SPECIFIC REQUIREMENTS: Confined to holarctic region, mesic habitats, permanent streams and wet meadows.

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: HABITAT DESTRUCTION-GRAZING

BRIEF KEY DESCRIPTION: Well developed hind legs, long tail, jumping ability. Shades of brownish above and whitish below, sides yellow/orange brown. Feet are whitish. Length is 188-216 mm.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES END

GENERAL MAP LOCATION:

COMMENTS: Reports for Los Alamos are unsubstantiated or pre-1960 records.

REFERENCE: NM DEPT. OF GAME AND FISH, HANBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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MOLLUSK

FAMILY LYMNAEIDAE

SCIENTIFIC NAME: *Lymnaea caperata*

COMMON NAME: SAY'S POND SNAIL

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 1), first listed
07/22/83 (NMGF Reg. 624).

DISTRIBUTION: The species is known to occur only in the Cerro la
Jara area, Jemez Mountains (Sandoval Co.).

SPECIFIC REQUIREMENTS:

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 3700

MAXIMUM ELEVATION: 8600

THREATS TO TAXON: OVERGRAZING, POLLUTION, DEVELOPMENT AND DEATERING

BRIEF KEY DESCRIPTION: Medium sized (20 mm), absence of operculum on the
foot, shell is elongated and right spiralled.
Spiral length is greater than width of aperture.
Color is brown to brown-gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

PLANTS

CACTUS

FAMILY CACTACEAE

SCIENTIFIC NAME: *Mammillaria wrightii*, Engelm.

COMMON NAME: WRIGHT FISHHOOK CACTUS

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: Listed as an E2 for state status on nm Natural Heritage Program plant list 2/06/90. State Rank Date 12/22/89.

DISTRIBUTION: Bernalillo, Catron, Dona Ana, Guadalupe, Lincoln, McKinley, Sandoval, Santa Fe, Socorro, Torrance, and Valencia Counties in New Mexico.

SPECIFIC REQUIREMENTS: Gravey hills or sandy hills or plains, desert grassland to pinyon-juniper.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 3000

MAXIMUM ELEVATION: 7000

THREATS TO TAXON: POPULATIONS DECLINING - OVERCOLLECTION, HABITAT ALTERATION.

BRIEF KEY DESCRIPTION: Stems solitary, 10 cm tall and 5 cm wide; spines 10-15/cluster, outer spines tan or gray, central ones reddish and hooked; flowers pink-purple with yellowish tinge.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

CACTUS

FAMILY CACTACEAE

SCIENTIFIC NAME: *Opuntia viridiflora*, Britt. and Rose.

COMMON NAME: SANTA FE CHOLLA

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: Federal register as a C2. Information obtained from the 1991 natural Heritage Program Plant List.

DISTRIBUTION: Santa Fe County, New Mexico.

SPECIFIC REQUIREMENTS:

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 7200

MAXIMUM ELEVATION: 8000

THREATS TO TAXON: ROAD CONSTRUCTION, VANDALISM, EXPANSION OF CITY PARKS.

BRIEF KEY DESCRIPTION: Low-growing, branched shrub; stems cylindric, 30-100 cm tall; spines variable in number; flowers not open widely, pink with green/yellow outside.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

CACTUS

FAMILY CACTACEAE

SCIENTIFIC NAME: *Toumeyia papyracantha*, (Engelm.) Britt. & Rose

COMMON NAME: GRAMMA GRASS CACTUS

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: Federal Register, 15 December 1980, candidate for federal protection. Currently listed as a 2C in the Federal Register--still should be considered in management activities.

DISTRIBUTION: Bernalillo, Cibola, Dona Ana, Grant, Los Alamos, Otero, Rio Arriba, Sandoval, Santa Fe, Socorro, Torrance, and Valencia counties, New Mexico.

SPECIFIC REQUIREMENTS: Usually found in basalt outcrops and where the soil is sandy.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 5000

MAXIMUM ELEVATION: 7300

THREATS TO TAXON: OVERCOLLECTION, OVERGRAZING AND URBANIZATION.

BRIEF KEY DESCRIPTION: Stems solitary ribbed, 2.5 - 20 cm tall; central spines short, straight; flowers white, not spreading; fruit round, tan, dry; flowers from April to June.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE:

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM NATIVE PLANT PROTECTION ADVISORY COMMITTEE, 1984.

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| PLANTS |
+-----+

FORB

FAMILY APIACEAE

SCIENTIFIC NAME: *Aletes sessiliflorus*, Theobald and Tseng

COMMON NAME: SESSILE-FLOWERED FALSE CARROT

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Mckinley, Rio Arriba, Sandoval, and Taos Counties.

SPECIFIC REQUIREMENTS: Rocky canyons and slopes, usually in basaltic or sandstone areas.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6500

MAXIMUM ELEVATION: 8100

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Densely tufted perennial, 10-20 cm tall; leaves bright green, long pinnately divided into 5-9 narrow segments that have 3 lobes; flowers tiny pale yellow.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE:

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM NATIVE PLANT PROTECTION ADVISORY COMMITTEE, 1984

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| PLANTS |
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FORB

FAMILY ASTERACEAE

SCIENTIFIC NAME: *Tetradymia filifolia*, Greene

COMMON NAME: THREADLEAF HORSEBRUSH

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Lincoln, Otero, Sandoval, Socorro, and Valencia.

SPECIFIC REQUIREMENTS: Limestone or highly gypseous soils.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 7000

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Much-branched grayish shrub (1 m tall); leaves narrow and 1-2 in. long, often with hairs; flowers heads very narrow, yellow, with 4 flowers; rays absent.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE:

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM NATIVE PLANT PROTECTION ADVISORY COMMITTEE, 1984

PLANTS

FORB

FAMILY CARYOPHYLLACEAE

SCIENTIFIC NAME: *Silene plankii*

COMMON NAME: PLANK'S CATCHELY

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE: Was a candidate for Federal Register, ruled a 3C.
No longer proposed.

DISTRIBUTION: Mountains along the Rio Grande.

SPECIFIC REQUIREMENTS:

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE:

GENERAL MAP LOCATION:

COMMENTS: Similar in appearance to other species in our area.

REFERENCE: TIERNERY, G.D., 1987

PLANTS

FORB

FAMILY CARYOPHYLLACEAE

SCIENTIFIC NAME: *Silene plankii*, Hitchc. & Maguire

COMMON NAME: PLANK'S CATCHFLY

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE: Federal Register, 15 December 1980, candidate for federal protection. 1991 NM Natural Heritage Program working plant list indicates status change to a 3C---no longer under consideration for federal listing.

DISTRIBUTION: Bernalillo, Dona ana, Sandoval, Sierra, and Socorro counties, New Mexico.

SPECIFIC REQUIREMENTS: Cervices and pockets in protected cliff faces of igneous rock.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 5000

MAXIMUM ELEVATION: 6000

THREATS TO TAXON: BROWSED BY BIG HORN SHEEP.

BRIEF KEY DESCRIPTION: Low, clumped perinnial, wooly rootstock, 10-15 cm tall, finely hairy, glandular sticky near flowers, stem leaves in 5-8 pr, lance shaped; flowers scarlet-few.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANT PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

FORB

FAMILY FABACEAE

SCIENTIFIC NAME: *Astragalus cyaneus*, Gray

COMMON NAME: CYANIC MILK-VETCH

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Adjacent to the Rio Grande in Bernalillo, Rio Arriba, Santa Fe, and Taos Counties New Mexico.

SPECIFIC REQUIREMENTS: Sandy or gravelly hillsides.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 5500

MAXIMUM ELEVATION: 6500

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Low, tufted, covered with grayish hairs, stems to 6 cm; leaves 6-18cm, pinnately compiound, with 15-29 elliptic leaflets; flowers pea-like, pinkish-purple.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

FORB

FAMILY FABACEAE

SCIENTIFIC NAME: *Astragalus feensis* M.E. Jones

COMMON NAME: SANTA FE MILKVETCH

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Bernalillo, Santa Fe, and Tarrant Counties, New Mexico.

SPECIFIC REQUIREMENTS: Dry slopes.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 5000

MAXIMUM ELEVATION: 6500

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Loosely tufted; stems spreading upward, 10 cm long; leaves long, pinnately compound, 7-19 obovate blunt leaflets; flowers pealike, reddish purple.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NEW MEXICO NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984

PLANTS

FORB

FAMILY FABACEAE

SCIENTIFIC NAME: *Astragalus mollissimus* Torr. var. *mathewsii* (Wats)

COMMON NAME: MATHEW'S WOOLLY MILK-VETCH

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Cibola, McKinley, Santa Fe, and Sandoval counties,
New Mexico.

SPECIFIC REQUIREMENTS: Open slopes and ridges in pinyon pine forest, but
sometimes in canyons.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 5000

MAXIMUM ELEVATION: 6000

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Perennial herb, stems silkly-hairy, tufted to 15
cm; leaves pinnately compound, blunt leaflets;
flowers pea-like, long pale purple or
yellow-purple; pod curved.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984

PLANTS

FORB

FAMILY FABACEAE

SCIENTIFIC NAME: *Astragalus puniceus* Osterh. var. *gertudis* (Green)

COMMON NAME: TAOS MILK-VETCH

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Rio Arriba and Taos counties, New Mexico.

SPECIFIC REQUIREMENTS: On open, loose soil among pinyon and juniper.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 7000

MAXIMUM ELEVATION: 0

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Perennial herb, stems spreading; leaves pinnately compound, oval leaflets; flowers pea-like, pale to bright pink; pod spreading, fleshy when green, red spotted-ripe.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

FORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Fritillaria atropurpurea*

COMMON NAME: CHECKER LILY

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Los Alamos county??

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON:

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: TIERNERY, G.D., 1987

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: TIERNERY, G.D., 1987

PLANTS

FORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Lilium philadelphicum* var. *andium*

COMMON NAME: WOOD LILY

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: OT, RA, SA, SF, SM

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 10000

THREATS TO TAXON: COLLECTION AND HABITAT DESTRUCTION.

BRIEF KEY DESCRIPTION: Stems to 2 ft, leaves linear to lance-shaped, margin smooth, lower leaves alternate. flowers large, showy red or orange-red with purplish-black spots at base.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: KOELLE, A., 1978; FOXX, T., 1979; KOSIEWICZ

GENERAL MAP LOCATION: UPPER PAJARITO, WATER AND FRIJOLES CANYON

COMMENTS: can be found in ponderosa to mixed-conifer.

REFERENCE: FOXX & HOARD, 1984; NRIS, 1986; HARRINGTON, 1964

PLANTS

FORB

FAMILY NYCTAGINACEAE

SCIENTIFIC NAME: *Abronia bigelovii*, Heimerl

COMMON NAME: TUFTED SAND VERBENA

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE: Federal Register, 15 Dec. 1980, Candidate for federal protection. 1991 Natural Heritage plant checklist indicates status changed to 3C---no longer in consideration for protection.

DISTRIBUTION: Sandoval, Santa Fe, and Rio Arriba Counties, New Mexico.

SPECIFIC REQUIREMENTS: This species is entirely restricted to todilto gypsum or the derivative of.

HABITAT: PINON-JUNIPER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 0

THREATS TO TAXON: GYPSUM MINING.

BRIEF KEY DESCRIPTION: Tufted perennial herb, stems short; leaves mostly at the base, linear to oblong; flowers stems erect, clusters of flowers at top, pink tube-small white lobes.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

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| PLANTS |
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FORB

FAMILY ORCHIDACEAE

SCIENTIFIC NAME: *Epipactis gigantea*

COMMON NAME: HELLEBORINE ORCHID

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Montana to British Columbia, southern to western Texas, New Mexico and California.

SPECIFIC REQUIREMENTS: Damp woods, seepage slopes, springs, streams and riparian areas.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000 MAXIMUM ELEVATION: 8500

THREATS TO TAXON:

BRIEF KEY DESCRIPTION: STEMS ALONG STEM. STEMS TO 2 1/2 FT. LEAVES TO 15 CM, OVAL. SEPALS GREENISH, PETALS PURPLE, LIP MARKED WITH PURPLE LINES.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: FOXX, T.S., 1984

GENERAL MAP LOCATION: SPRING IN WHITE ROCK CANYON

COMMENTS:

REFERENCE: FOXX, T.S. & HOARD, D, 1984, NM DEPART. OF NATURAL RES., 1993

PLANTS

FORB

FAMILY POLEMONIACEAE

SCIENTIFIC NAME: *Phlox caryophylla*, Wherry

COMMON NAME: PAGOSA PHLOX

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Rio Arriba County, New Mexico.

SPECIFIC REQUIREMENTS: Open slopes in open woods in mountains.

HABITAT: PONDEROSA-PINON

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6500

MAXIMUM ELEVATION: 7500

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Erect perennial, leaves narrow, 50 mm long;
flowers in loose clusters, bright pink or purple,
flower parts united in a tube. Flowers from late
May to July.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

PLANTS

FORB

FAMILY SAXIFRAGACEAE

SCIENTIFIC NAME: *Heuchera pulchella*, Woot. and Standl.

COMMON NAME: SANDIA ALUMROOT

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Bernalillo, Sandoval, San Miguel, Sierra, Socorro,
and Torrance Counties, New Mexico.

SPECIFIC REQUIREMENTS: Cliff-loving plant, endemic to the Mountains of
Central New Mexico.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 8000

MAXIMUM ELEVATION: 12000

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Perennial herb with leaves clustered at the base;
leaf blades wide, toothed, upper surface with
hairs; low glandular flowers crowded along one
side. Flowers from July through September.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

APPENDIX K

**Tables of Calculated Parameters for Each Plant Species Found within the
Transects**

Transect TA3-1 Two Mile Canyon									
550ft, Circular plot 9/23/92									
	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
PIPO	29.00	74.36	30.85	6.94	8.78	17.55	1.00	23.08	23.83
PIFL	6.00	15.38	6.38	5.15	8.02	16.03	0.67	15.38	12.60
PSME	39.00	100.00	41.49	4.62	13.15	26.29	0.83	19.23	29.00
ALTE	2.00	5.13	2.13	0.55	2.55	5.10	0.17	3.85	3.69
ACGL	0.00	0.00	0.00	0.00	5.00	9.99	0.17	3.85	4.61
ABCO	11.00	28.21	11.70	3.94	7.53	15.04	0.83	19.23	15.32
QUGAT	7.00	17.95	7.45	4.54	5.00	9.99	0.67	15.38	10.94
TOTAL:	94.00	241.03	100.00	25.73	50.03	100.00	4.33	100.00	100.00
	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index	
Shrubs									
QUGA	167.00	428.21	18.03	21.40	29.94	1.00	11.76	19.91	
COST	71.00	182.05	7.67	17.50	24.48	0.17	1.96	11.37	
RICE	84.00	215.38	9.07	3.53	4.94	4.83	56.86	23.63	
ROWO	24.00	61.54	2.59	1.08	1.51	0.67	7.84	3.98	
RONE	3.00	7.69	0.32	0.10	0.14	0.33	3.92	1.46	
BEFE	66.00	169.23	7.13	1.94	2.71	0.50	5.88	5.24	
JAAM	410.00	1051.28	44.28	9.17	12.82	0.67	7.84	21.65	
RUST	100.00	256.41	10.80	16.67	23.32	0.17	1.96	12.03	
SHRUB1	1.00	2.56	0.11	0.10	0.14	0.17	1.96	0.74	
Total =	926.00	2374.36	100.00	71.48	100.00	8.50	100.00	100.00	

Transect TA3-2
Under bridge

650ft, Circular plot
Stream channel

9/29/92

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index

Trees									
JUMO	2.00	4.40	2.67	0.10	0.55	0.83	0.29	10.53	4.67
ALTE	0.00	0.00	0.00	0.00	5.00	7.56	0.14	5.26	4.28
POAN	31.00	68.13	41.33	5.18	13.13	19.85	0.57	21.05	27.41
ULPU	1.00	2.20	1.33	0.10	1.00	1.51	0.14	5.26	2.70
PIPO	24.00	52.75	32.00	2.61	12.00	18.15	0.43	15.79	21.98
PSME	7.00	15.38	9.33	0.91	3.40	5.14	0.29	10.53	8.33
BEOC	3.00	6.59	4.00	6.86	25.00	37.81	0.43	15.79	19.20
ABCO	7.00	15.38	9.33	0.70	6.04	9.14	0.43	15.79	11.42

TOTAL:	75.00	164.84	100.00	16.46	66.12	100.00	2.71	100.00	100.00

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index

Shrubs								
QUGA	32.00	70.33	9.94	3.78	5.33	0.57	20.00	11.75
RIIN	37.00	81.32	11.49	2.55	3.60	0.29	10.00	8.36
ROWO	86.00	189.01	26.71	6.28	8.85	0.43	15.00	16.85
RONE	67.00	147.25	20.81	10.68	15.07	0.71	25.00	20.29
RUST	10.00	21.98	3.11	0.10	0.14	0.14	5.00	2.75
SAMI	10.00	21.98	3.11	10.00	14.11	0.14	5.00	7.40
SOSC	1.00	2.20	0.31	5.00	7.05	0.14	5.00	4.12
CIRX	30.00	65.93	9.32	20.00	28.22	0.14	5.00	14.18
UNK 2	5.00	10.99	1.55	5.00	7.05	0.14	5.00	4.54
SHRUB1	44.00	96.70	13.66	7.50	10.58	0.14	5.00	9.75

Total =	322.00	707.69	100.00	70.88	100.00	2.86	100.00	100.00

Transect TA3-3
Under bridge

600ft, Line intercept
North-facing slope
9/29/92

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index

Trees									
PIPO	9.00	32.67	15.53	3.76	9.32	38.79	0.33	14.81	23.04
PIFL	8.00	29.04	13.80	2.61	2.65	11.03	0.42	18.52	14.45
PSME	19.00	68.97	32.78	0.99	3.38	14.09	0.67	29.63	25.50
SNAG	1.00	3.63	1.73	12.70	0.00	0.00	0.08	3.70	1.81
ACGL	12.00	43.46	20.66	0.19	2.82	11.73	0.25	11.11	14.50
ABCO	4.00	14.49	6.89	0.55	0.63	2.64	0.25	11.11	6.88
QUGAT	5.00	18.15	8.63	4.92	5.22	21.72	0.25	11.11	13.82

TOTAL:	58.00	210.41	100.00	25.72	24.02	100.00	2.25	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index

Shrubs								
QUGA	279.00	1012.77	15.11	25.32	51.61	0.25	6.52	24.42
SHRUB2	57.00	206.91	3.09	0.00	0.00	0.33	8.70	3.93
SHRUB3	5.00	18.15	0.27	0.00	0.00	0.08	2.17	0.81
RICE	304.00	1103.52	16.47	5.08	10.36	0.75	19.57	15.47
RICE2	13.00	47.19	0.70	0.00	0.00	0.17	4.35	1.68
ROWO	90.00	326.70	4.88	4.08	8.32	0.25	6.52	6.57
RONE	2.00	7.26	0.11	0.00	0.00	0.08	2.17	0.76
PRVI	54.00	196.02	2.93	3.32	6.76	0.33	8.70	6.13
BEFE	56.00	203.28	3.03	1.17	2.38	0.33	8.70	4.70
JAAM	791.00	2871.33	42.85	5.27	10.74	0.67	17.39	23.66
RUST	195.00	707.85	10.56	4.82	9.82	0.58	15.22	11.87

Total =	1846.00	6700.98	100.00	49.05	100.00	3.83	100.00	100.00

Transect TA59-1
Two Mile Canyon

700ft, Line transect
South-facing slope

9/16/92

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees									
PIPOSNAG	1.00	3.11	1.72	10.80	0.00	0.00	0.07	3.45	1.72
PIPO	40.00	124.46	68.97	7.70	30.96	76.06	1.00	48.28	64.44
PIFL	6.00	18.67	10.35	7.67	1.54	3.79	0.36	17.24	10.46
PSME	9.00	28.00	15.52	8.74	8.20	20.15	0.50	24.14	19.93
SNAG	1.00	3.11	1.72	5.10	0.00	0.00	0.07	3.45	1.72
ABCO	1.00	3.10	1.72	8.80	0.00	0.00	0.07	3.45	1.72
TOTAL:	58.00	180.46	100.00	48.81	40.70	100.00	2.07	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
QUGA	28.00	87.12	30.11	1.03	100.00	0.36	50.00	60.04
PRVI	5.00	15.56	5.38	0.00	0.00	0.07	10.00	5.13
JAAM	60.00	186.69	64.52	0.00	0.00	0.29	40.00	34.84
Total =	93.00	289.36	100.00	1.03	100.00	0.71	100.00	100.00

Transect TA59-2
Two Mile Canyon

650ft, Circular plot
Stream channel

9/22/92

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
QUGAT	6.00	13.19	5.17	4.57	5.50	8.50	0.43	12.50	8.72
PIPO	8.00	17.58	6.90	6.04	13.20	20.39	0.57	16.67	14.65
PIFL	7.00	15.38	6.03	8.06	12.20	18.85	0.43	12.50	12.46
PSME	30.00	65.93	25.86	5.72	15.13	23.36	1.00	29.17	26.13
ACGL	30.00	65.93	25.86	0.75	3.60	5.56	0.00	0.00	10.47
ABCO	35.00	76.92	30.17	6.03	15.11	23.34	1.00	29.17	27.56
TOTAL:	116.00	254.95	100.00	31.17	64.74	100.00	3.43	100.00	100

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Shrubs								
UNK1	30.00	65.93	2.75	5.83	7.46	0.57	5.00	5.07
QUGA	77.00	169.23	7.06	12.13	15.51	1.00	8.75	10.44
VILE	17.00	37.36	1.56	0.10	0.13	0.29	2.50	1.40
RHTR	3.00	6.59	0.27	0.10	0.13	0.29	2.50	0.97
RICE	134.00	294.51	12.28	4.73	6.05	5.14	45.00	21.11
SALX	307.00	674.73	28.14	17.34	22.17	1.00	8.75	19.69
ROWO	6.00	13.19	0.55	0.33	0.42	0.43	3.75	1.57
RONE	2.00	4.40	0.18	3.00	3.84	0.14	1.25	1.76
PRVI	71.00	156.04	6.51	3.87	4.95	0.86	7.50	6.32
BEFE	6.00	13.19	0.55	0.10	0.13	0.29	2.50	1.06
JAAM	386.00	848.35	35.38	10.68	13.66	1.00	8.75	19.26
COST	43.00	94.51	3.94	12.50	15.98	0.14	1.25	7.06
AMAL	9.00	19.78	0.82	7.50	9.59	0.29	2.50	4.30
Total =	1091.00	2397.80	100.00	78.21	100.00	11.43	100.00	100.00

Transect TA59-3
Two Mile Canyon

700ft, Line intercept

9/22/92

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees									
PIPO	21.00	65.34	14.40	6.44	9.23	14.09	0.93	27.66	18.71
PIFL	10.00	31.11	6.86	5.86	4.99	7.61	0.43	12.77	9.08
PSME	58.00	180.46	39.76	2.99	21.19	32.34	1.00	29.79	33.96
SNAG	1.00	3.11	0.69	7.60	0.00	0.00	0.07	2.13	0.94
ABCO	56.00	173.84	38.30	5.55	30.11	45.97	0.93	27.66	37.31
TOTAL:	146.00	453.87	100.00	28.44	65.51	100.00	3.36	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
AMAL	2.00	6.22	0.77	0.00	0.00	0.07	2.94	1.24
QUGA	160.00	497.83	61.54	7.47	97.76	1.00	41.18	66.82
RICE	29.00	90.23	11.15	0.11	1.50	0.29	11.76	8.14
CEMO	19.00	59.12	7.31	0.00	0.00	0.43	17.65	8.32
SYMX	1.00	3.11	0.38	0.00	0.00	0.07	2.94	1.11
BEFE	45.00	140.01	17.31	0.06	0.75	0.50	20.59	12.88
JAAM	4.00	12.45	1.54	0.00	0.00	0.07	2.94	1.49
Total =	260.00	808.97	100.00	7.64	100.00	2.43	100.00	100.00

Transect TA59-4
Mortendad Canyon

700ft, Line intercept

9/30/92

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees									
QUGAT	3.00	9.33	10.72	4.83	1.47	17.20	0.07	6.67	11.53
PIPO	13.00	40.45	46.44	3.78	4.07	47.58	0.64	60.00	51.34
PIFL	1.00	3.11	3.57	5.80	1.34	15.69	0.07	6.67	8.64
PSME	3.00	9.33	10.72	3.57	1.67	19.53	0.07	6.67	12.31
QUGASNAG	6.00	18.67	21.43	1.13	0.00	0.00	0.07	6.67	9.37
PIPOSNAG	2.00	6.21	7.13	21.05	0.00	0.00	0.14	13.33	6.82
TOTAL:	28.00	87.11	100.00	40.17	8.56	100.00	1.07	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
QUGA	6.00	18.67	2.14	0.00	0.00	0.14	20.00	7.38
RICE	18.00	56.01	6.41	0.00	0.00	0.07	10.00	5.47
SALX	251.00	780.97	89.32	11.84	100.00	0.43	60.00	83.11
ROWO	6.00	18.67	2.14	0.00	0.00	0.07	10.00	4.05
Total =	281.00	874.31	100.00	11.84	100.00	0.71	100.00	100.00

Transect Sludge1c
TA-60

650ft, Circular plot
End of mesa 7/28/92

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index

Trees									
JUMO	34.00	74.73	44.74	4.56	10.33	26.64	0.86	37.50	36.29
PIED	38.00	83.52	50.00	5.84	17.15	44.22	1.00	43.75	45.99
PIPO	4.00	8.79	5.26	8.08	11.30	29.13	0.43	18.75	17.72

TOTAL:	76.00	167.03	100.00	18.47	38.79	100.00	2.29	100.00	100.00

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index

Shrubs								
QUUN	270.00	593.41	32.41	21.00	40.32	0.71	26.32	33.02
QUGA	184.00	404.40	22.09	15.76	30.25	0.43	15.79	22.71
QUEX	132.00	290.11	15.85	12.86	24.69	0.43	15.79	18.77
RHTR	3.00	6.59	0.36	0.10	0.19	0.29	10.53	3.69
CEMO	244.00	536.26	29.29	2.37	4.55	0.86	31.58	21.81

Total =	833.00	1830.77	100.00	52.08	100.00	2.71	100.00	100.00

Transect Sludge2
Sigma Mesa

650ft,Circular plot

7/28/92

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
JUMO	11.00	24.18	25.00	5.46	5.90	27.32	0.71	29.41	27.25
PIED	8.00	17.58	18.18	1.99	3.01	13.96	0.57	23.53	18.56
PIPO	24.00	52.75	54.55	80.50	12.68	58.71	1.00	41.18	51.48
SNAG	1.00	2.20	2.27	0.36	0.00	0.00	0.14	5.88	2.72
TOTAL:	44.00	96.70	100.00	88.32	21.59	100.00	2.43	100.00	100.00
	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index	
Shrubs									
QUUN	240.00	527.47	14.96	20.13	32.87	0.86	9.09	18.98	
QUGA	461.00	1013.19	28.74	28.58	46.67	1.00	10.61	28.67	
RHTR	31.00	68.13	1.93	1.83	2.99	0.57	6.06	3.66	
RICE	25.00	54.95	1.56	1.01	1.65	5.71	60.61	21.27	
CEMO	829.00	1821.98	51.68	9.13	14.91	1.00	10.61	25.73	
BEFE	18.00	39.56	1.12	0.55	0.90	0.29	3.03	1.68	
Total =	1604.00	3525.27	100.00	61.24	100.00	9.43	100.00	100.00	

Transect Sludge3c
Sigma Mesa

700ft, Line intercept
North canyon slope

7/29/92

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees									
PIED	3.00	9.33	2.26	3.00	0.76	1.47	0.07	3.57	2.43
PIPO	47.00	146.24	35.34	5.02	13.19	25.53	0.93	46.43	35.77
PSME	83.00	258.25	62.41	3.90	37.70	73.00	1.00	50.00	61.80
TOTAL:	133.00	413.82	100.00	11.92	51.64	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	571.00	1776.63	79.09	27.17	98.09	1.00	46.67	74.61
RICE	7.00	21.78	0.97	0.00	0.00	0.07	3.33	1.43
CEMO	64.00	199.13	8.86	0.53	1.91	0.43	20.00	10.26
BEFE	68.00	211.58	9.42	0.00	0.00	0.50	23.33	10.92
JAAM	12.00	37.34	1.66	0.00	0.00	0.14	6.67	2.78
Total =	722.00	2246.45	100.00	27.70	100.00	2.14	100.00	100.00

Transect Sludge4c 650ft, Circular plot 7/29/92
 Mid-Sigma Mesa Pinon-juniper

	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Trees									
JUMO	6.00	13.19	42.86	7.37	6.00	23.53	0.43	42.86	36.41
PIED	2.00	4.40	14.29	6.45	10.50	41.18	0.29	28.57	28.01
PIPO	6.00	13.19	42.86	9.90	9.00	35.29	0.29	28.57	35.57
TOTAL:	14.00	30.77	100.00	23.72	25.50	100.00	1.00	100.00	100.00

	#Shrubs	#Shrubs Per Acre	Rel. Density	%Cover	Rel. Cover	%Freq.	Rel. Freq.	Import Index
Shrubs								
QUGA	10.00	21.98	2.29	10.00	19.66	0.14	3.57	8.51
QUEX	166.00	364.84	37.99	13.13	25.80	0.57	14.29	26.02
FAPA	5.00	10.99	1.14	1.00	1.97	0.14	3.57	2.23
RHTR	5.00	10.99	1.14	1.00	1.97	0.14	3.57	2.23
RICE	51.00	112.09	11.67	7.00	13.76	2.29	57.14	27.52
ROWO	6.00	13.19	1.37	1.00	1.97	0.14	3.57	2.30
CEMO	187.00	410.99	42.79	12.75	25.06	0.43	10.71	26.19
BEFE	7.00	15.38	1.60	5.00	9.83	0.14	3.57	5.00
Total =	437.00	960.44	100.00	50.88	100.00	4.00	100.00	100.00

Transect TA3-1
Behind Wellness Center

650ft, Understory
Two Mile Canyon

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SC	21.83					
ROCK	0.92					
LITTER	47.27					
MOSS/LICHEN		2.31	7.69	0.11	4.27	5.98
RUCR		0.08	0.26	0.02	0.61	0.43
GECA		0.08	0.26	0.02	0.61	0.43
VETH		0.54	1.80	0.05	1.83	1.82
FRAM		0.55	1.84	0.22	8.54	5.19
MEAL		0.70	2.35	0.14	5.49	3.92
CIRX		0.15	0.51	0.02	0.61	0.56
QUGA		1.85	6.16	0.15	6.10	6.13
RICE		0.15	0.51	0.02	0.61	0.56
PHPR		0.15	0.51	0.02	0.61	0.56
CLLI		0.46	1.54	0.03	1.22	1.38
THPI		0.62	2.05	0.03	1.22	1.64
RONE		0.00	0.01	0.02	0.61	0.31
AGRX		0.08	0.26	0.03	1.22	0.74
AGAL		10.31	34.38	0.37	14.63	24.51
LEPX		0.39	1.29	0.03	1.22	1.25
BRAN		1.85	6.16	0.12	4.88	5.52
PLMA		0.08	0.26	0.03	1.22	0.74
ACLA		0.23	0.77	0.03	1.22	0.99
ARLU		0.08	0.26	0.03	1.22	0.74
RUST		0.62	2.06	0.05	1.83	1.94
PENX		0.70	2.32	0.09	3.66	2.99
ERIX		0.08	0.26	0.03	1.22	0.74
POAX		2.54	8.49	0.18	7.32	7.90
ERFL		0.23	0.77	0.03	1.22	0.99
ANPA		0.08	0.26	0.02	0.61	0.43
TRAX		0.08	0.26	0.03	1.22	0.74
TRRE		0.00	0.01	0.02	0.61	0.31
BRGR		0.08	0.26	0.02	0.61	0.43
VICA		1.08	3.60	0.15	6.10	4.85
MACX		0.23	0.77	0.02	0.61	0.69
POAR		0.08	0.26	0.02	0.61	0.43
COST		0.85	2.83	0.05	1.83	2.33
BEFE		0.23	0.77	0.03	1.22	1.00
PSME		0.23	0.77	0.03	1.22	1.00
ROWO		0.08	0.26	0.02	0.61	0.43
PAMY		0.54	1.80	0.08	3.05	2.42
GAAP		0.31	1.03	0.03	1.22	1.13

AMRE	0.00	0.00	0.00	0.00	0.00	
MUMO	0.31	1.03	0.03	1.22	1.12	
ANSC	0.08	0.26	0.02	0.61	0.43	
KOCR	0.31	1.03	0.03	1.22	1.12	
PIPO	0.08	0.26	0.02	0.61	0.43	
MOME	0.15	0.51	0.03	1.22	0.87	
SIHY	0.08	0.26	0.02	0.61	0.43	
SPCR	0.15	0.51	0.02	0.61	0.56	
CARX	0.15	0.51	0.03	1.22	0.87	
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Total =	70.02	29.98	100.00	2.52	100.0	100.0

Transect TA3-2
LA Canyon under bridge

700ft, Understory
9/29/92

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	25.97					
ROCK	10.93					
LITTER	22.08					
MOSS/LICHEN	0.07					
SOIL CRUST	0.07					
WATER	1.43					
CAREX		1.36	3.43	0.09	5.00	4.22
ELCA		0.79	1.99	0.09	5.00	3.49
PAIN		0.29	0.72	0.03	1.67	1.19
RUST		0.36	0.90	0.01	0.83	0.87
AGAL		22.86	57.73	0.63	36.67	47.20
POFE		3.93	9.92	0.20	11.67	10.79
VETH		0.29	0.73	0.06	3.33	2.03
MELX		1.50	3.79	0.06	3.33	3.56
MEOF		0.57	1.44	0.04	2.50	1.97
FRAC		0.07	0.18	0.01	0.83	0.51
COCA		0.22	0.54	0.06	3.33	1.94
AGSM		0.22	0.54	0.03	1.67	1.11
BRIN		0.43	1.08	0.06	3.33	2.21
CLLI		0.07	0.18	0.01	0.83	0.51
FESX		0.36	0.90	0.01	0.83	0.87
JUNX		0.21	0.54	0.01	0.83	0.69
PHPR		0.14	0.36	0.03	1.67	1.01
POAV		0.01	0.04	0.01	0.83	0.43
ARCA		0.21	0.54	0.01	0.83	0.69
ERFL		0.14	0.36	0.01	0.83	0.60
OEHO		1.64	4.15	0.04	2.50	3.32
CLEX		0.14	0.36	0.01	0.83	0.60
TRAC		0.21	0.54	0.03	1.67	1.10
PHFO		0.50	1.26	0.04	2.50	1.88
SOAS		0.29	0.72	0.01	0.83	0.78
BROX		2.57	6.49	0.09	5.00	5.75
BRIN		0.21	0.54	0.01	0.83	0.69
Total =	60.55	39.59	100	1.714	100	100

Transect TA3-3
North-facing slope

600ft, Understory

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SC	17.00					
ROCK	6.90					
LITTER	50.67					
MOSS/LI	4.08					
SOIL CRI	3.50					
RUST		1.25	7.04	0.13	8.16	7.60
CARX		0.17	0.94	0.02	1.02	0.98
KOCR		1.17	6.57	0.07	4.08	5.33
FRAM		2.02	11.36	0.18	11.22	11.29
FERN		0.00	0.00	0.00	0.00	0.00
JAAM		0.18	1.03	0.03	2.04	1.54
GAAP		0.83	4.69	0.05	3.06	3.88
BRGR		0.92	5.16	0.05	3.06	4.11
HEPA		1.33	7.51	0.08	5.10	6.31
PSMO		1.12	6.29	0.08	5.10	5.70
BEFE		0.08	0.47	0.02	1.02	0.74
POAX		1.17	6.57	0.05	3.06	4.82
ANPA		0.17	0.94	0.03	2.04	1.49
ERIGX		0.17	0.94	0.02	1.02	0.98
AMLU		0.08	0.47	0.02	1.02	0.74
QUGA		0.58	3.29	0.02	1.02	2.15
VACA		0.58	3.29	0.05	3.06	3.17
RICE		0.58	3.29	0.07	4.08	3.68
ACLA		0.08	0.47	0.02	1.02	0.74
THFE		0.08	0.47	0.02	1.02	0.74
ROWO		0.08	0.47	0.02	1.02	0.74
HEPA		0.68	3.85	0.10	6.12	4.99
ARLU		0.17	0.94	0.02	1.02	0.98
RIIN		0.08	0.47	0.02	1.02	0.74
PENX		1.17	6.57	0.07	4.08	5.33
POFE		1.08	6.10	0.05	3.06	4.58
VICA		0.17	0.94	0.02	1.02	0.98
PAIN		0.35	1.97	0.08	5.10	3.54
ELCA		0.43	2.44	0.07	4.08	3.26
ARDR		0.28	1.60	0.07	4.08	2.84
BRAN		0.25	1.41	0.03	2.04	1.72
CLLI		0.02	0.09	0.02	1.02	0.56
IPAG		0.17	0.94	0.03	2.04	1.49
ERFL		0.08	0.47	0.02	1.02	0.74
TRDU		0.08	0.47	0.02	1.02	0.74
AGCR		0.08	0.47	0.02	1.02	0.74
Total =	82.15	17.75	100	1.63	100	100

Transect TA59-1
Behind south-facing slope

700ft, Understory
Two Mile Canyon

9/16/92

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	7.07					
ROCK	18.64					
LITTER	69.14					
MOSS LICHEN	1.00					
ARUV		0.50	12.07	0.04	6.67	9.37
MUMO		1.57	37.93	0.26	40.00	38.97
ANSC		1.29	31.03	0.19	28.89	29.96
SOLX		0.14	3.45	0.03	4.44	3.95
RHRA		0.14	3.45	0.03	4.44	3.95
IPLO		0.07	1.72	0.01	2.22	1.97
GECA		0.07	1.72	0.01	2.22	1.97
ARLU		0.07	1.72	0.01	2.22	1.97
PAMY		0.14	3.45	0.03	4.44	3.95
QUGA		0.07	1.72	0.01	2.22	1.97
CARX		0.07	1.72	0.01	2.22	1.97
TOTAL:	95.86	4.14	100	0.64	100	100

Transect TA59-2u
Stream channel

700ft, Understory
Two Mile Canyon

9/22/92

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	25.70					
ROCK	8.21					
LITTER	49.66					
MOSS/LICHEN	2.50					
THFE		1.15	8.26	0.16	8.73	8.49
PAMY		0.79	5.66	0.14	7.94	6.80
BEFE		0.14	1.04	0.04	2.38	1.71
QUGA		0.29	2.05	0.03	1.59	1.82
ACLA		0.14	1.03	0.03	1.59	1.31
GAAP		0.01	0.06	0.09	4.76	2.41
AGAL		2.07	14.89	0.20	11.11	13.00
BROX		3.50	25.14	0.14	7.94	16.54
FRAM		0.08	0.55	0.07	3.97	2.26
ANSC		0.00	0.01	0.01	0.79	0.40
CARX		0.01	0.04	0.06	3.17	1.61
UNKNOWN1		0.36	2.56	0.01	0.79	1.68
PAIN		0.29	2.08	0.06	3.17	2.63
UNKNOWN2		0.72	5.14	0.10	5.56	5.35
RIIN		0.00	0.02	0.03	1.59	0.80
PRVI		0.00	0.02	0.03	1.59	0.80
PSME		0.00	0.02	0.03	1.59	0.80
TRRE		0.15	1.06	0.07	3.97	2.51
JAAM		0.21	1.54	0.03	1.59	1.56
UNK GRASS1		1.43	10.30	0.14	7.94	9.12
BRAN		0.14	1.03	0.01	0.79	0.91
RHRA		0.22	1.55	0.04	2.38	1.96
ERIX		0.07	0.53	0.04	2.38	1.46
BRIN		0.79	5.64	0.01	0.79	3.22
GABO		0.07	0.51	0.01	0.79	0.65
JUNX		0.14	1.03	0.01	0.79	0.91
ANPA		0.14	1.03	0.01	0.79	0.91
POA		0.29	2.07	0.07	3.97	3.02
ROWO		0.00	0.01	0.01	0.79	0.40
RUST		0.57	4.10	0.06	3.17	3.64
TARX		0.07	0.51	0.01	0.79	0.65
COST		0.07	0.51	0.01	0.79	0.65
Total =	86.07	13.93	100	1.8	100	100

Transect TA59-3
North-facing slope

700ft, Understory
9/22/92

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	16.13					
ROCK	5.07					
LITTER	64.39					
MOSS/LICHEN	4.29					
ANSC		0.79	7.77	0.03	1.94	4.85
MUMO		0.94	9.28	0.24	16.50	12.89
BLTR		0.36	3.53	0.03	1.94	2.74
PENX		0.08	0.76	0.07	4.85	2.81
FAGR		0.29	2.85	0.07	4.85	3.85
QUGA		1.86	18.38	0.16	10.68	14.53
CEMO		0.21	2.12	0.01	0.97	1.54
CARX		0.72	7.09	0.14	9.71	8.40
ACLA		0.22	2.13	0.06	3.88	3.01
ANPA		0.72	7.12	0.11	7.77	7.44
ARUV		1.29	12.71	0.09	5.83	9.27
PSME		0.22	2.13	0.04	2.91	2.52
PAMY		0.58	5.69	0.13	8.74	7.21
BEFE		0.15	1.44	0.06	3.88	2.66
GABO		0.00	0.01	0.01	0.97	0.49
GAAP		0.00	0.01	0.01	0.97	0.49
RICE		1.14	11.31	0.09	5.83	8.57
PIFL		0.14	1.41	0.01	0.97	1.19
BADI		0.07	0.71	0.01	0.97	0.84
BRAN		0.00	0.03	0.03	1.94	0.98
THFE		0.14	1.41	0.01	0.97	1.19
ABCO		0.07	0.71	0.01	0.97	0.84
VICA		0.14	1.41	0.03	1.94	1.68
Total =	89.88	10.12	100.0	1.47	100.0	100.0

Transect TA59-4u
Upper Mortendad Canyon

700ft, Understory
9/30/92

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SOIL	25.14					
ROCK	2.57					
LITTER	16.64					
SOIL CRUST	0.07					
WATER	3.93					
AGSM		1.71	3.32	0.14	6.25	4.78
ELCA		0.50	0.97	0.03	1.25	1.11
MELX		0.64	1.24	0.07	3.13	2.18
AGAL		13.57	26.28	0.71	31.25	28.76
POFE		0.43	0.83	0.06	2.50	1.66
BRIN		4.64	8.99	0.27	11.88	10.43
FEOC		0.29	0.55	0.01	0.63	0.59
UNK FORB		0.14	0.28	0.03	1.25	0.76
MUMO		0.07	0.14	0.01	0.63	0.38
AGTR		2.36	4.56	0.17	7.50	6.03
CARX		23.43	45.37	0.57	25.00	35.18
FEOC		0.29	0.56	0.07	3.13	1.84
ROWO		0.07	0.14	0.01	0.63	0.38
TRPR		0.14	0.28	0.01	0.63	0.45
SAEX		3.36	6.50	0.10	4.38	5.44
Total =	48.36	51.64	100	2.29	100	100

Transect Sludge1
TA-60, End of mesa

700ft
Pinon-juniper

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SC	37.50					
ROCK	13.12					
LITTER	34.81					
BOGR		6.66	45.73	0.59	39.42	42.58
ARLU		0.14	0.98	0.03	1.92	1.45
CHFO		0.01	0.10	0.01	0.96	0.53
OPPO		0.30	2.06	0.03	1.92	1.99
HYAR		0.72	4.92	0.16	10.58	7.75
GUSA		0.80	5.49	0.06	3.85	4.67
KOCR		0.07	0.49	0.01	0.96	0.73
BOCU		1.59	10.89	0.13	8.65	9.77
ARLO		0.57	3.92	0.04	2.88	3.40
MUMO		2.32	15.90	0.17	11.54	13.72
HYRI		0.37	2.56	0.10	6.73	4.65
POAX		0.29	1.96	0.03	1.92	1.94
CARX		0.43	2.94	0.06	3.85	3.39
TRDU		0.07	0.49	0.01	0.96	0.73
ALCE		0.01	0.10	0.01	0.96	0.53
QUEX		0.07	0.49	0.01	0.96	0.73
ANSE		0.14	0.98	0.03	1.92	1.45
Total =	85.43	14.57	100.0	1.49	100.0	100.0

Transect Sludge2u
Sigma Mesa, east end

700 ft

Species	Cover	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
BARE SC	6.93					
ROCK	12.28					
LITTER	69.33					
ANSC		0.72	6.21	0.06	3.48	4.85
ARCA		0.00	0.01	0.01	0.87	0.44
ARLU		0.43	3.74	0.11	6.96	5.35
BOGR		0.07	0.63	0.03	1.74	1.19
BROX		0.22	1.87	0.03	1.74	1.80
CARX		1.08	9.33	0.19	11.30	10.32
CEMO		0.00	0.02	0.03	1.74	0.88
ERDI		0.00	0.04	0.04	2.61	1.32
ERFL		0.07	0.62	0.01	0.87	0.74
ERJA		0.29	2.49	0.07	4.35	3.42
FAPA		0.00	0.01	0.01	0.87	0.44
THTR		0.01	0.05	0.06	3.48	1.76
HYRI		0.07	0.62	0.01	0.87	0.74
MUMO		6.29	54.49	0.63	38.26	46.38
OPUX		0.00	0.01	0.01	0.87	0.44
POAX		0.72	6.21	0.13	7.83	7.02
QUGA		1.36	11.76	0.13	7.83	9.79
SIHY		0.07	0.64	0.04	2.61	1.63
YUAN		0.14	1.24	0.03	1.74	1.49
Total =	88.54	11.54	100.0	1.64	100.0	100.0

Transect
Sludge3
Sigma Mesa

700ft

Species	Cover	North canyon slope		Plant Freq.	Rel. Freq.	Importance Index
		Plant Cover	Plant Cover			
BARE SOIL	14.85					
ROCK	2.86					
LITTER	73.12					
MUMO		0.71	7.79	0.09	6.59	7.19
QUGA		3.57	38.97	0.33	25.27	32.12
BEFE		0.93	10.13	0.09	6.59	8.36
POAX		1.01	11.02	0.29	21.98	16.50
CARX		0.07	0.78	0.01	1.10	0.94
BROX		0.57	6.26	0.13	9.89	8.08
ARLU		0.07	0.78	0.01	1.10	0.94
IPAG		0.00	0.02	0.01	1.10	0.56
HYRI		0.00	0.03	0.03	2.20	1.11
ANPA		1.50	16.39	0.19	14.29	15.34
EUHE		0.07	0.79	0.03	2.20	1.50
PONX		0.07	0.78	0.01	1.10	0.94
CLPS		0.36	3.90	0.04	3.30	3.60
ERSP		0.07	0.78	0.01	1.10	0.94
PENX		0.00	0.02	0.01	1.10	0.56
THPI		0.14	1.56	0.01	1.10	1.33
Total =	90.83	9.17	100.0	1.30	100.0	100.0

Transect Sludge4

700ft, Understory

Species	Cover	Plant Cover	Plant Cover	Freq.	Rel. Freq.	Importar Index
BARE SOIL	31.11					
ROCK	2.14					
LITTER	49.84					
HYRI		1.15	6.81	0.24	11.33	9.07
ARCA		0.94	5.54	0.24	11.33	8.44
CAIN		0.00	0.02	0.03	1.33	0.68
PENX		0.15	0.86	0.06	2.67	1.76
THTR		0.14	0.85	0.04	2.00	1.43
ERDI		0.15	0.91	0.14	6.67	3.79
ERJA		0.00	0.01	0.01	0.67	0.34
KOCA		0.36	2.12	0.06	2.67	2.39
BOGR		4.22	24.94	0.37	17.33	21.14
MUMO		5.50	32.53	0.36	16.67	24.60
ORTX		0.07	0.44	0.04	2.00	1.22
SIHY		1.07	6.34	0.13	6.00	6.17
YUAG		0.36	2.11	0.04	2.00	2.06
QUGA		0.21	1.27	0.04	2.00	1.63
CARX		0.50	2.97	0.09	4.00	3.48
BEFE		1.14	6.76	0.09	4.00	5.38
ALCE		0.08	0.45	0.07	3.33	1.89
POAX		0.86	5.07	0.07	3.33	4.20
PLPU		0.00	0.01	0.01	0.67	0.34
Total =	83.09	16.91	100.0	2.14	100.0	100.0

APPENDIX L

SPECIES CAPTURED IN OU 1114 DURING IN THE 1992 BRET SMALL MAMMAL TRAPPING PROGRAM

Common name	Scientific name	Sites captured
Long-tailed vole	<i>Microtus longicaudus</i>	1, 2, 3, 4
Mountain vole	<i>Microtus montanus</i>	1, 4
Vole	<i>Microtus</i> sp.	1
White-throated woodrat	<i>Neotoma albigula</i>	3
Mexican woodrat	<i>Neotoma mexicana</i>	2, 3
Woodrat	<i>Neotoma</i> sp.	3
Brush mouse	<i>Peromyscus boylii</i>	1, 2, 3
Deer mouse	<i>Peromyscus maniculatus</i>	1, 2, 3, 4
Deer mouse	<i>Peromyscus</i> sp.	1
Western harvest mouse	<i>Reithrodontomys megalotis</i>	1, 4
Vagrant shrew	<i>Sorex vagrans</i>	1, 4

Trap sites:	Capture totals
1. Upper Los Alamos Canyon	37
2. Upper Mortandad Canyon, effluent 03A-081	22
3. Upper Mortandad Canyon, effluent 051-051	16
4. Upper Sandia Canyon	77

APPENDIX M

BATS OF LOS ALAMOS NATIONAL LABORATORY AND BANDELIER
(3/D Environmental Services, summer 1992)

SCIENTIFIC NAME	COMMON NAME	FEMALE NR	FEMALE RF	MALE	JU V	UNK	TOTAL
<i>Antrozous pallidus</i>	Pallid bat	0	4	4	0	2	10
<i>Eptesicus fuscus</i>	Big brown bat	1	2	7	0	0	10
<i>Lasionycteris noctivagans</i>	Silver-haired bat	0	0	15	0	0	15
<i>Lasiurus cinereus</i>	Hoary bat	0	0	11	0	0	11
<i>Myotis californicus</i>	California myotis	0	2	2	0	0	4
<i>Myotis evotis</i>	Long-eared myotis	2	2	2	0	1	7
<i>Myotis leibii</i>	Small-footed myotis	0	0	5	0	0	5
<i>Myotis thysanodes</i>	Fringed myotis	1	6	4	2	0	13
<i>Myotis volans</i>	Long-legged myotis	1	1	4	1	0	7
<i>Myotis yumanensis</i>	Yuma myotis	0	4	1	0	0	5
<i>Pipistrellus herperus</i>	Western pipistrelle	0	0	1	0	0	1
<i>Plecotus townsendii</i>	Townsend's big-eared bat	0	0	1	0	0	1
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	0	1	3	0	1	5

Explanation of Appendix M Categories:

NR = nonreproductive adult female

RF = reproductive adult female

MALE = adult male

JUV = juvenile (male or female)

UNK = age/sex unknown (escaped from net prior to handling)

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545