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Authors: *James Biggs and Saul Cross*

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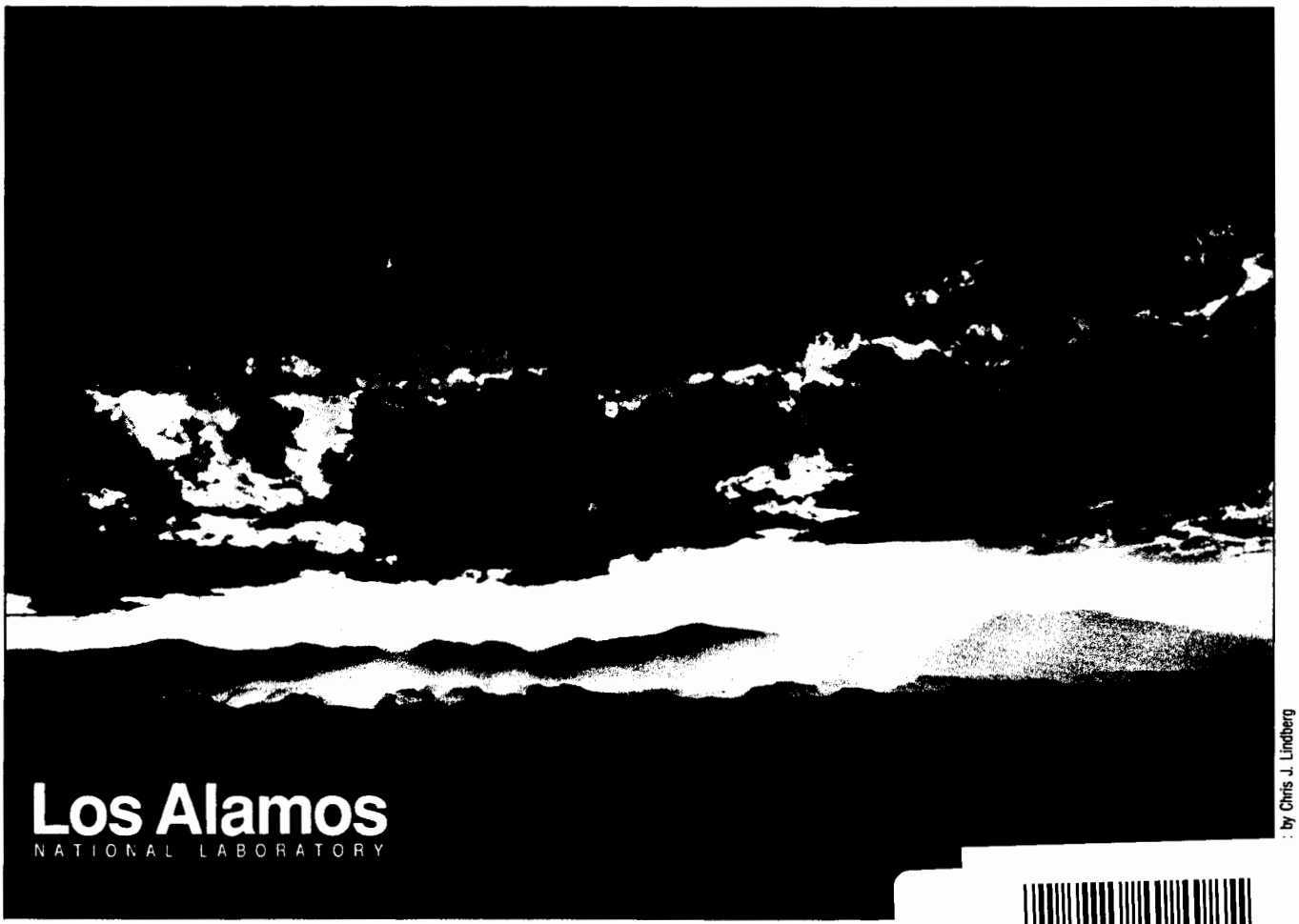

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Biological and Floodplain/Wetland Assessment for Environmental Restoration Program; Operable Unit 1140; TA-46

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EXECUTIVE SUMMARY

The Environmental Restoration Program of Los Alamos National Laboratory (LANL) proposes to conduct site characterization studies in Operable Unit (OU) 1140 at LANL. These studies consist primarily of soil sampling to determine the nature and extent of hazardous waste releases from OU 1140 solid waste management units (SWMUs), subsequently known as potential release sites (PRSs). Before proceeding, LANL's Ecological Studies Team (EST) of ESH-20 conducted ecological field surveys for OU 1140, Technical Area (TA) 46, in 1992.

This report summarizes the results of several surveys that EST conducted in TA-46. The purposes of the surveys were (1) to determine if state or federally threatened, endangered, or sensitive plant or animal species or critical habitat exist within the OU boundaries; (2) to identify and characterize sensitive habitats, such as floodplains and wetlands, within sampling areas, and (3) to provide baseline data for defining the habitat types and population characteristics of the biota within the OU. This information will document presampling conditions at the OU, which can be compared to data collected at the same locations in future studies.

EST began its study by searching an established database containing habitat requirements for state and federally listed threatened, endangered, and sensitive (TES) plant and animal species known to occur within or near LANL. Next, EST used a combination of line transects, circular plots, and Daubenmire plots to gather data on vegetative cover, density, and frequency of understory and overstory components of the plant community. We then compared the habitat information gathered during the field surveys with the habitat requirements for each species of concern identified in the database search. If the habitats identified did not meet the requirements of a species of concern, EST eliminated the species from further consideration. If identified habitats could support a TES species, EST conducted specific surveys for the species of concern in accordance with pre-established survey protocols.

The database search and consultation with state and federal agencies revealed that several species of concern could occur within or near this OU: the northern goshawk (*Accipiter gentilis*), the Mexican spotted owl (*Strix occidentalls lucida*), and the spotted bat (*Euderma maculatum*). However, habitat evaluation studies and previous research indicate that there is a low potential for any of these species to occur in the area. Most habitat elements that these species require are not present in OU 1140.

EST does not expect that any sensitive species will occur within OU 1140, and the proposed sampling would not affect TES species. EST must be notified of proposed disturbances other than soil sampling and these proposed activities must be assessed for potential impacts to biological resources of the area. If any sampling activities are scheduled to occur near outfall discharges or areas of pooled water, a EST biologist

must inspect the area for wood lilies (*Lilium philadelphicum* var. *andium*) and checker lilies (*Fritillaria atropurpurea*)before sampling can proceed. If wood lilies or checker lilies are found, sampling must be planned to avoid any impacts to these state-listed species.

In each sample location, EST noted wetlands and floodplains to ensure that sampling would not occur in these areas. EST first consulted National Wetland Inventory Maps produced by the US Fish and Wildlife Service and then conducted field surveys. We searched for wetlands, floodplains, and riparian areas using the criteria outlined in the "Federal Manual for Delineating Jurisdictional Wetlands" (Dunke et al. 1989). The Team found no wetlands in the OU but did locate several small ponds maintained by a semipermanent source of water in upper Cañada del Buey. This canyon also contains a floodplain. Precautions must be taken to reduce impacts and to minimize disturbance to the canyon and the ponds.

If surface sampling is conducted in OU 1140 in accordance with the mitigations contained in this document, it should not cause any adverse impacts to the biological resources of the area.

1 INTRODUCTION

1.1 Project Description

Since the inception of Los Alamos National Laboratory (LANL), research activities throughout the facility have generated a variety of hazardous and radioactive wastes. The Laboratory defines a Solid Waste Management Unit (SWMU) 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). The Laboratory's Environmental Restoration (ER) Group develops and implements cleanup or containment of SWMUs at LANL, following a four-phase corrective action process: (1) site assessment, (2) site characterization, (3) development of proposed corrective actions, and (4) selection and performance of corrective actions (IT 1990).

This report is a biological assessment for the site characterization or "sampling phase" of the corrective action process for Operable Unit (OU) 1140; Technical Area (TA) 46. The ER Program proposes to sample numerous sites within OU 1140 to characterize hazardous waste releases from SWMUs. Personnel would remove soil samples with hand-held auger drills or with auger-mounted heavy machinery. The Ecological Studies Team (EST) of LANL conducted this biological assessment to identify threatened, endangered, and sensitive (TES) species and floodplains and wetlands in the project area and to assess possible impacts of the site characterization. In addition, this assessment provides baseline information that can be used for long-term monitoring of plant and animal communities. This assessment also describes mitigation measures that must be followed to minimize impacts to non-TES species.

1.2 Purpose and Scope

EST prepared this assessment to evaluate the impact of site characterization activities at OU 1140 in accordance with the following regulations and orders:

- the 1973 Federal Endangered Species Act (ESA),
- the New Mexico Wildlife Conservation Act (WCA),
- the New Mexico Endangered Plant Species Act (EPSA),
- Federal Floodplain/Wetland Executive Orders (EOs) 11990 and 11988,
- Department of Energy (DOE) Order 5400.1 (Environmental Compliance),
- Code of Federal Regulation 10 CFR 1022, and
- the National Environmental Policy Act (NEPA).

1.2.1 Threatened, Endangered, and Sensitive Species

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

There are three possible outcomes of a TES species assessment. It can find that

1). There are no TES species using the habitat within the proposed project area;

2). There are TES species using the habitat within the proposed project area, but there are no expected adverse impacts to the species; or

3). There are TES species habitats in the proposed project area, and adverse impacts to the species are expected to occur as a result of the proposed project.

If no adverse impacts are expected, the biological evaluation is reviewed by the appropriate state or federal agency for concurrence. If a proposed project is expected to jeopardize a listed species, EST initiates consultation with the appropriate state or federal agency. Consultation may result in project modifications, alternative programs, or complete abandonment of the proposed project.

1.2.2 Floodplains and Wetlands

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

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

Additionally, under Section 404 of the Clean Water Act, the degradation of wetlands and floodplains must be controlled by limiting the discharge of fill into them. Depending on the size of the floodplain or wetland, two types of discharge permits may be issued by the Corp of Engineers:

Nationwide permits — if the impact is confined to less than 4 ha. (10 ac) and

Individual permits — if the impact will affect an area larger than 4 ha (10 ac).

1.2.3 DOE Orders

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

1.2.4 SWMUs and Proposed Sampling

SWMUs are located throughout OU 1140 (Fig. 1) and are associated with the following:

- sulfuric acid and nitric acid storage tanks
- a sanitary lagoon and sand filter
- septic systems
- sumps, drains, and outfalls
- sanitary lagoons (former solar ponds)
- operational releases
- a cesium treatment ditch
- inactive drum storage areas
- canyon-side disposal sites
- active waste storage areas

In addition, 12 waste water outfalls from TA-46 flow into Cañada del Buey (Table 1, Fig. 2). Sampling of the SWMUs and sites downgradient will determine the type, quantity, and extent of possible environmental contamination. ER personnel will sample drainages leading to Cañada del Buey and in the canyon. They will remove surface samples from depths of less than 25 cm (10 in.). Subsurface sampling will occur at depths to 61 m (200 ft).

TABLE 1. LANL Outfalls in Cañada del Buey, September 1990

OUTFALL CATEGORY	NPDES ID	TA	AVG. FLOW (gpm)
03A	042	46	0.6
03A	043	46	0.1
03A	124	46	<0.1
03A	136	46	<0.1

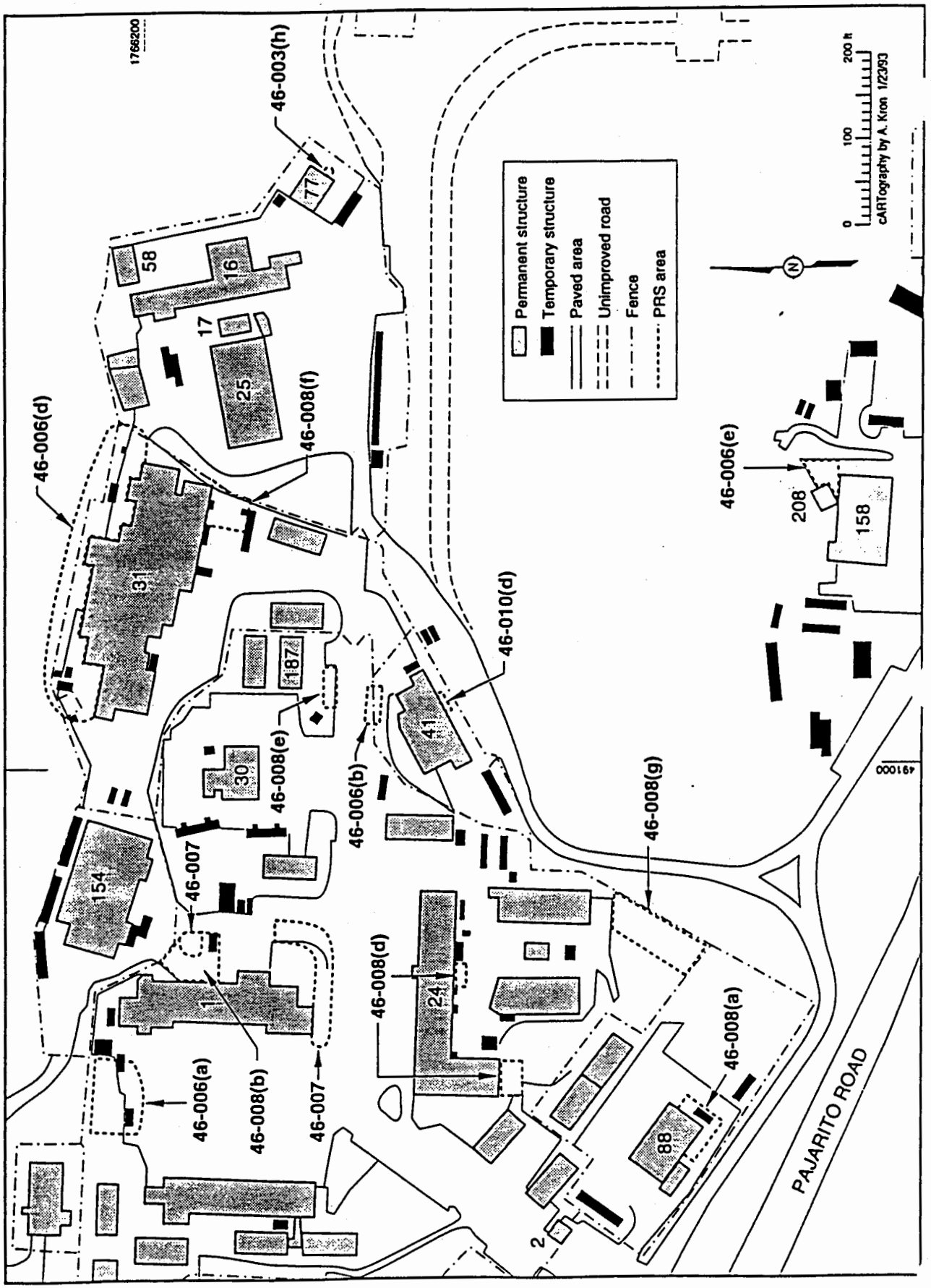


Figure 1. SWMUs of OU 1140.

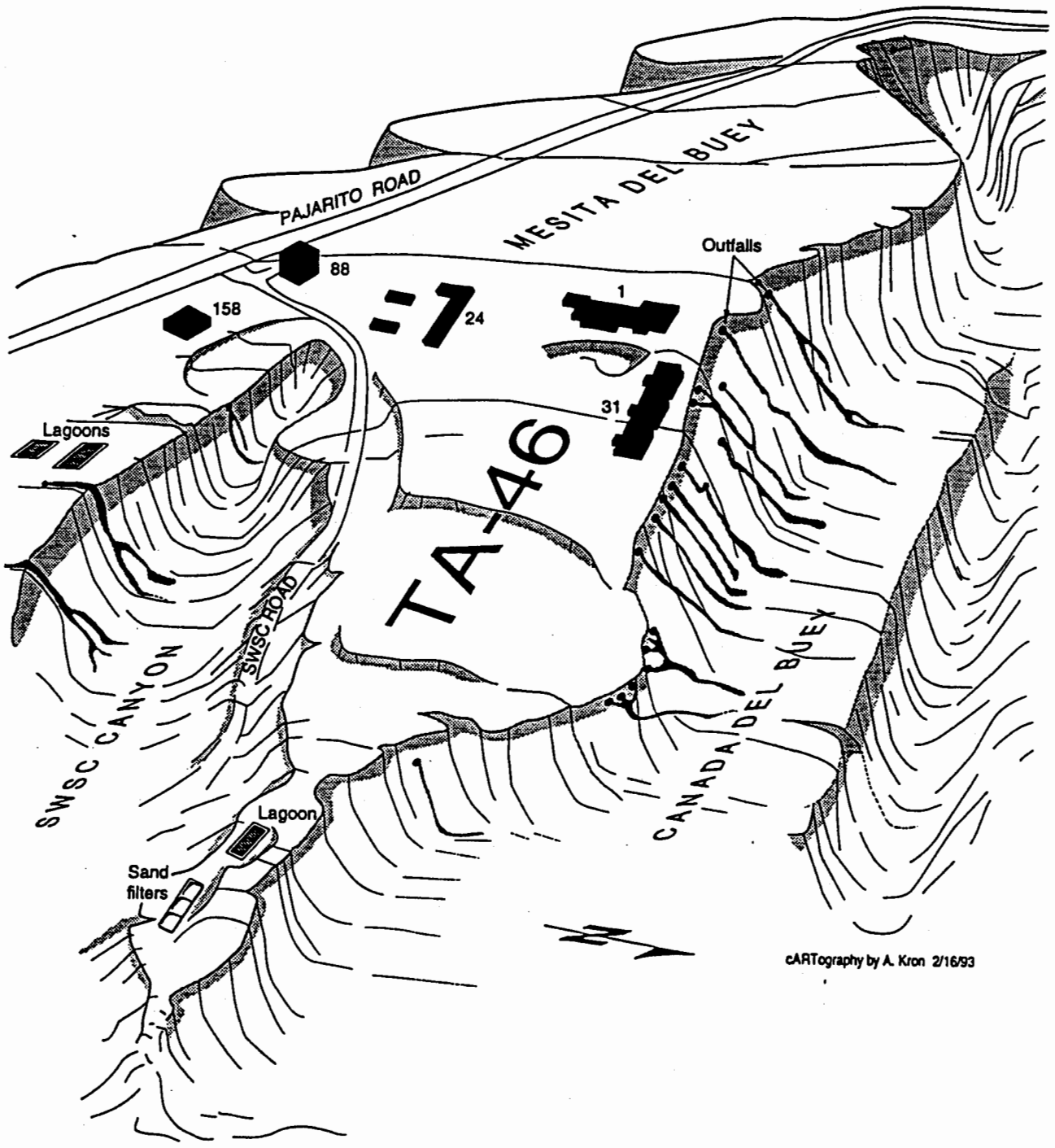


Figure 2. Topographical Features and Outfalls of TA-46.

TABLE 1 (cont.). LANL Outfalls in Cañada del Buey, September 1990			
OUTFALL CATEGORY	NPDES ID	TA	AVG. FLOW (gpm)
04A	013	46	<0.1
04A	014	46	6.9
04A	018	46	0.3
04A	117	46	0.2
04A	118	46	2.2
07S		46	1.2
12S		46	<0.1
13S		46	280

2 ENVIRONMENTAL SETTING

2.1 General Setting

OU 1140 lies within the boundaries of LANL in Los Alamos, New Mexico. The Laboratory is located in north-central New Mexico approximately 105 km (65 mi) north of Albuquerque and 48 km (30 mi) northwest of Santa Fe (Fig. 3).

The dominant physical feature in the LANL area is the Pajarito Plateau, an apron of volcanic rock stretching 32 – 40 km (20 – 25 mi) north-south and 8 – 16 km (5 – 10 mi) east-west. The 2380 m (7800 ft) high plateau slopes gently eastward toward the Rio Grande from the edge of the Jemez Mountains. At 1890 m (6200 ft), the plateau has been cut into a series of cliffs extending to the Rio Grande River at 1646 m (5400 ft). Intermittent streams flowing southeastward dissect the plateau into a number of finger-like, narrow mesas separated by deep canyons.

The plateau bedrock is of Bandelier Tuff, a formation deposited during volcanic eruptions in the Jemez Mountains approximately 1.1 to 1.4 million years ago. The tuff overlays other volcanic materials that are underlain by the conglomerate of the Puye Formation. This conglomerate intermixes with Chino Mesa basalts along the Rio Grande.

The area has a semiarid, temperate, montane climate. Summer temperatures typically range from 10°C – 27°C (50°F – 80°F) during a 24-hour period (Bowen 1990). Winter temperatures generally range from about -9 – 10°C (15 – 50°F) during a 24-hour period. The annual precipitation in the vicinity ranges from 33 – 46 cm (13 – 18 in.), much of it falling during summer rain showers in July and August. Meteorological conditions during the 1992 field season are summarized in Fig. 4.

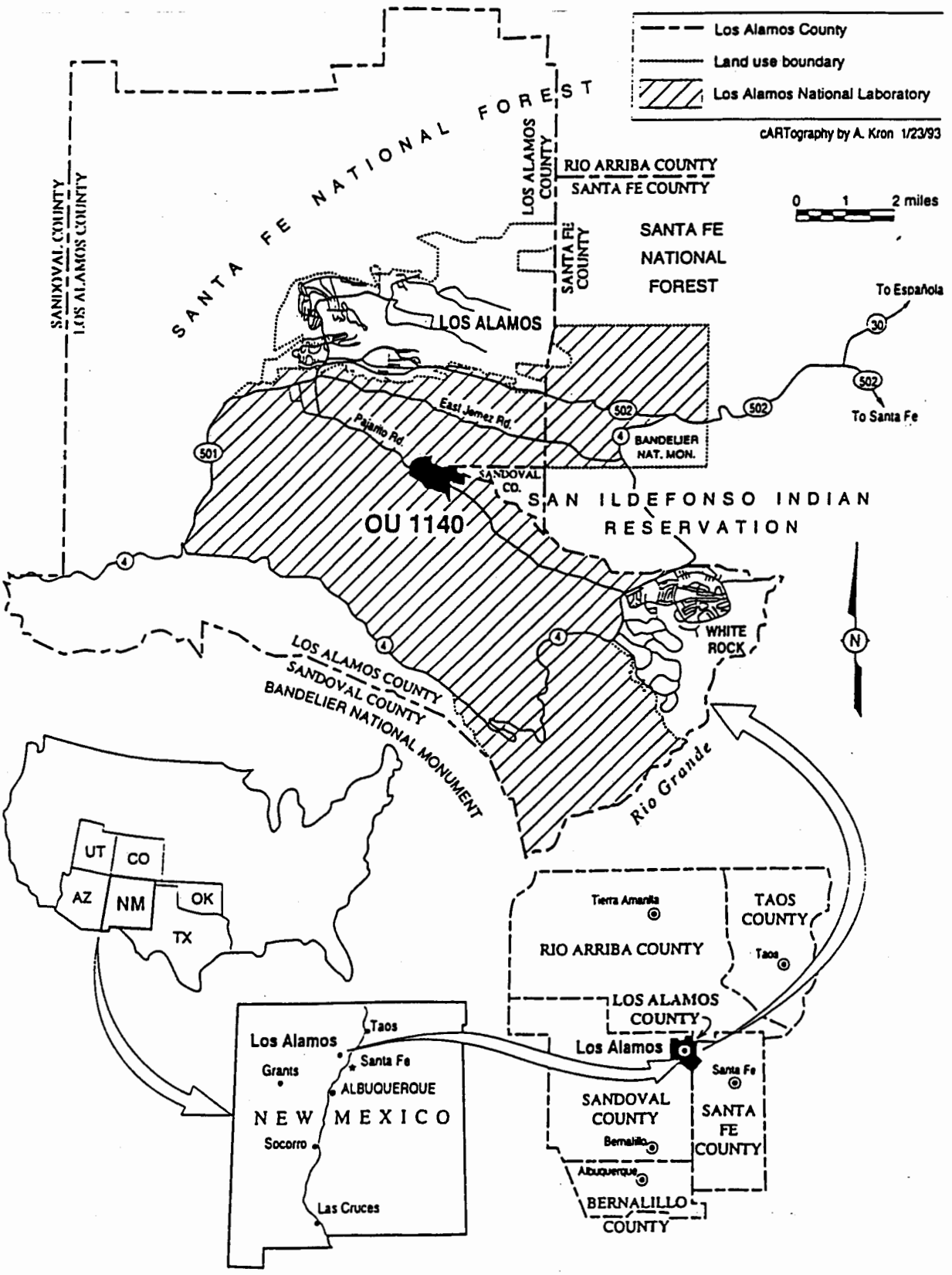


Figure 3. Locations of Los Alamos County and OU 1140.

1992 WEATHER SUMMARY, LOS ALAMOS, NM (EL. 7425 ft)

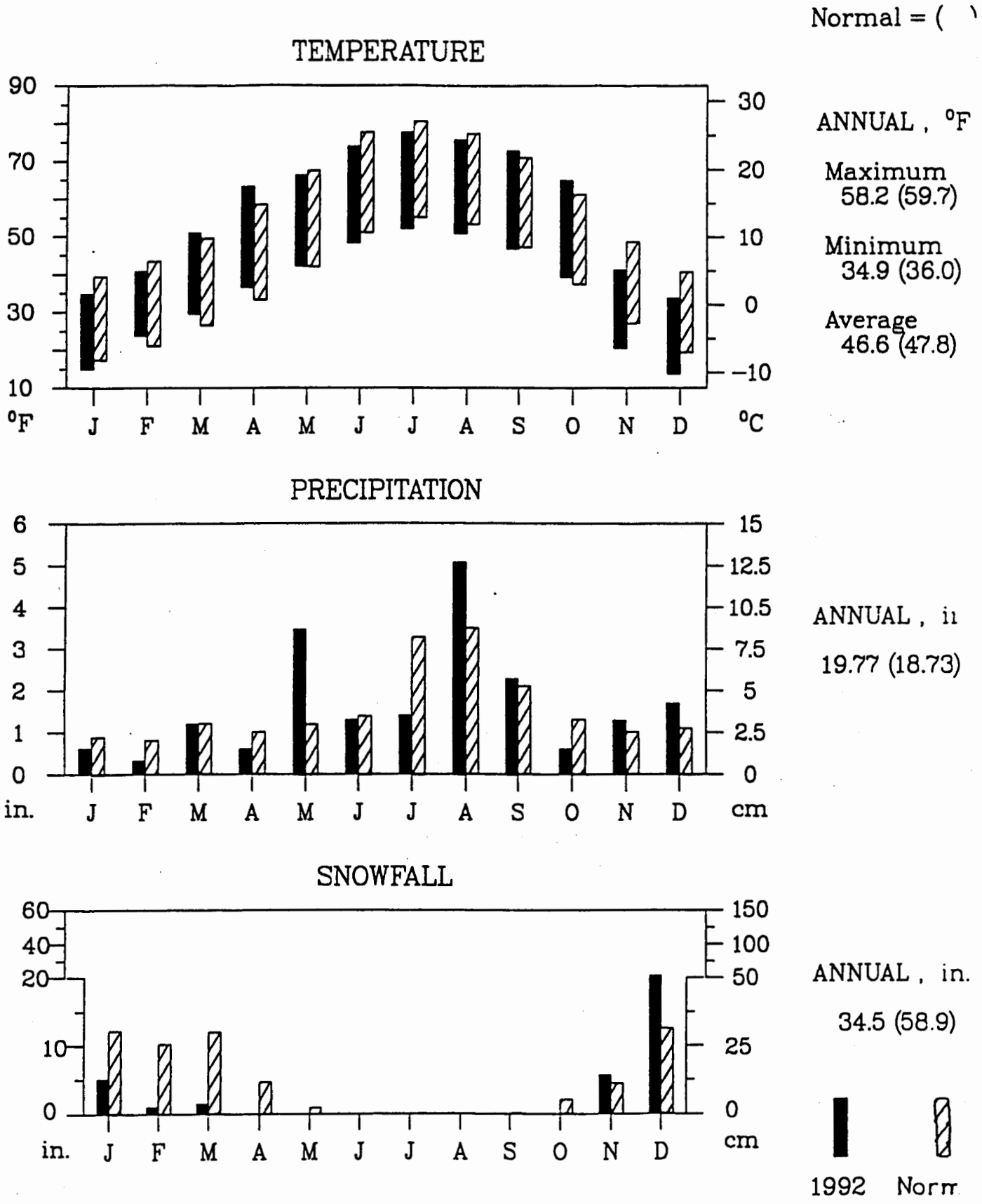


Figure 4. Meterological Conditions for 1992.

2.2 Description of OU 1140

OU 1140 is located in the central portion of the Laboratory. The OU is located in Township 19 North, Range 6 East, Sections 23, 26, and 27. The Universal Transverse Mercator coordinates (UTMs) for the area are given for each corner of the OU.

Zone	Easting	Northing
13	385480	3968880
13	385000	3967835
13	383620	3968710
13	384330	3968940

The OU includes only one technical area, TA-46, and consists primarily of one canyon (Cañada del Buey) and an adjacent mesa (Mesa del Buey) (Fig. 2). Structures are located on Mesita del Buey, which is bounded by Cañada del Buey to the north and Pajarito Canyon to the south. Elevations in TA-46 range from 2079 – 2176 m (6820 – 7140 ft). The topography varies from steep canyon walls to gently sloping mesa tops. Our field surveys were concentrated within canyon bottoms and along the north- and south-facing walls of Cañada del Buey. Information from previous surveys conducted in other portions of the general area is also included in this report.

3 PREVIOUS STUDIES

Prior to the surveys initiated for this study, several biological studies had been conducted within or near to the project area.

3.1 Vegetation Studies

Vegetation surveys conducted in Cañada del Buey, on Mesita del Buey, and on other mesa tops adjacent to the canyon are listed in Table 2. All identified plant species are listed in Appendix A.

TABLE 2 Previous Vegetation Studies Conducted within OU 1140

PROJECT	DATE	AUTHORS/SURVEYORS
Vegetation Survey – Middle Cañada del Buey	1988	Foxx et al.
Biological Surveys – Sewer Consolidation Line	1988	Soholt and Foxx
Vegetation Surveys – Upper Cañada del Buey/Sanitary Landfill	1985-86	Foxx and Tierney

3.2 Wildlife Studies

EST conducted several studies and surveys on the fauna within or adjacent to the OU. These studies are listed in Table 3. Identified species are listed in Appendix B-F.

TABLE 3 Previous Wildlife Studies Conducted within OU 1140

PROJECT	DATE	AUTHORS
The Amphibians and Reptiles of Los Alamos Research Park	1986	Bogart
Breeding Bird Atlas	1984-1988	Travis, et al.
Small Mammal Surveys	1986	Kent
The Ants of Los Alamos County (Hymenoptera: Formicidae)	1986	MacKay
Biotic Survey of Liquid Effluent Areas	1977	Miera, et al.
Small Mammal Surveys	1990	Morrison
Summary of Small Mammal Trapping	1980	Felthauser
Bird Surveys	1990	Morrison

3.2.1 Insects

An insect study by MacKay (1986) conducted in Mortandad Canyon and in Bandelier National Monument may apply to this OU due to similar habitats. Appendix B lists species found in Mortandad Canyon and in habitats similar to those within OU 1140.

3.2.2 Reptiles and Amphibians

Bogart has conducted Laboratory-wide amphibian and reptile surveys since 1978. Appendix C lists the species he found in Cañada del Buey and species that may inhabit Cañada del Buey.

3.2.3 Birds

Surveys were conducted throughout the Laboratory to identify breeding birds of Los Alamos County from 1984 to 1988. An atlas providing information on study methodology, breeding birds, breeding dates, breeding behaviors, species distribution, and species-habitat relationships was prepared by Travis (1992). Species found during more recent surveys are listed in Appendix D.

Researchers conducted surveys in Cañada del Buey which occurred partially in OU 1140 using the following methodology. In July 1990, Morrison used a point-count transect to determine composition of the avifauna in Cañada del Buey. Every 200 m (660 ft), the observer remained stationery for 6 minutes (a point), counting all the birds observed or heard until 30 points had been surveyed. The observer began

walking the transect at dawn just below TA-46, in mixed conifer habitat. The transect continued throughout the length of the Cañada del Buey canyon bottom, finishing just above State Route 4. Counts were recorded as observations made or vocalizations heard within the appropriate distance category: 25 ft or less; or greater than 25 ft. Using counts of each species in each distance category, densities of the most common species can be estimated.

In 1991 and 1992, L. Willis and D. Novoroske also conducted bird surveys in the same area as Morrison utilizing similar methodology. However, Willis and Novoroske conducted surveys during spring, summer, fall, and winter to determine species composition and habitat use for each of the four seasons. The transects were walked in May, July, September, and December of 1991, and March and May of 1992. Data collected in 1992 was pooled with the spring data of 1991. Data collected in July represented a summer survey and data collected in September and December represented fall and winter surveys, respectively.

3.2.4 Small Mammals

A study was conducted by Joan Morrison during the summer of 1990 to evaluate existing diurnal small mammal communities in Cañada del Buey and on the adjacent mesa top.

In 1986, Jim Kent conducted small mammal trapping in Cañada del Buey and on Mesita del Buey, in association with the University of New Mexico.

In 1980, Mark Felthauser conducted small mammal surveys at Los Alamos solid radioactive waste burial sites using mark-recapture methods. Felthauser caught three species of rodents within Area G: deer mouse, piñon mouse, and harvest mouse.

Capture-recapture trapping of small mammals was carried out on June 30-July 2, 1992 and September 1-3, 1992 (Biggs 1992, Appendix E). A 12 x 12 grid of 144 traps spaced 10 m apart was located within Cañada del Buey extending from the south-facing slope to the north-facing slope. The grid extended from approximately 1/2 way up the south-facing slope to about 2/3 the way up the north-facing slope, crossing the canyon bottom. A Sherman live-trap was baited with sweet feed (a molasses coated horse feed) and placed within 2 m of each trap station. Trapping took place over 3 consecutive nights during two trapping sessions for a total of 432 trap nights for each session. Analysis of data included total capture rates for each species, total capture rates for each slope and the canyon bottom, and the percent species composition for the entire grid and for each slope and canyon bottom.

Habitat utilization by large and medium size mammals in Cañada del Buey was assessed using permanent circular pellet/scat plots and permanent well-defined rectangular transects or plots (Raskevitz 1992). Thirteen 2-m (6.5 ft) wide north-south transects were established starting down canyon from the proposed SWSC release point and continuing at intervals for approximately two miles down the canyon. Forty-nine circular 0.01 acre (0.004 ha) pellet plots were placed at 20-m intervals, covering a total area of 0.198 ha. The plots and transects were walked approximately once per month in each canyon and all pellet groups and scat were recorded and cleared.

3.2.5 Bats

Mist-netting for bats occurred over open water between June 30 and July 5, 1992. Open water does not occur in Cañada del Buey. However, due to potentially suitable roosting habitat present in the project area, many of the bat species captured during the study could occur in the vicinity of Cañada del Buey. A total of 94 bats representing 13 species were captured in 16 net nights (Appendix F). A more detailed account of the study and results can be found in Tyrell and Brack (1992).

3.3 Threatened, Endangered, and Sensitive Species

3.3.1 Plants

Several vegetation surveys have occurred in or near OU 1140 (Table 2). During these surveys, plant species were inventoried and no TES plants were found.

3.3.2 Wildlife

In previous studies conducted along and near Cañada del Buey (Table 3), no TES wildlife species were found.

4 METHODOLOGY

EST conducted three levels of surveys within OU 1140. The primary purpose of these surveys was to determine the presence or absence of any species of concern, sensitive habitats, or wetlands or floodplains that could be affected by the site-characterization sampling.

4.1 Level 1 (Reconnaissance) Surveys

The Level 1 survey is a walk-through of the project area to note general habitats and site features. It is the initial survey of the project area and is designed to determine placement of line transects, presence or absence of water sources and floodplains, and evidence of previous disturbance. This survey identified several general vegetation types present in OU 1140, which were used as search criteria in the EST TES

database. The database contains the latest TES species information for Los Alamos County and surrounding counties from the New Mexico Department of Game and Fish (1988 and 1990); New Mexico Native Plant Protection Advisory Committee (1984); and the US Fish and Wildlife Service (1989).

TABLE 4. Definitions for the Hierarchical Vegetation Classification

Vegetation Type: Refers to the vegetation established under the existing climate and includes upland and wetland.

Formation Type: Refers to the 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	Forest
Scrubland	Swamp scrub
Grassland	Marshland
Desertland	Strand
Non-vascular	Submergent

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

Biotic Community: Refers to 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: Refers to principal plant and animal communities within each biotic community based on distinct climax plant dominants.

Habitat Type: Based on occurrence of a particular dominant species that is distributed locally or regionally.

Phase: Based on detailed data collection to determine codominants, understory species, and other species information.

4.2 Level 2 (Habitat Evaluation) Surveys

Based on the general descriptions from Level 1 surveys, Level 2 (habitat evaluation) surveys were designed to define habitat quantitatively. EST used the habitat descriptions to determine if any potential

TES habitat was present. For this assessment, standard ecological techniques were used to analyze cover, density, and frequency of species in overstory and understory vegetation. Information obtained from the vegetation studies was categorized into a hierarchical system of vegetation types for mapping into our Geographic Information System, ARC-INFO (Table 4 provides a definition for each element of the hierarchical vegetation classification). EST then compared the vegetation types with specific habitat requirements for TES species. If the habitat requirements of a particular TES species were not met, the site was considered unsuitable habitat and no further studies for that species were conducted. If any of the habitat could be used by TES species, Level 3 surveys were initiated.

4.2.1 Overstory Evaluation

EST characterized the overstory in coniferous forests of OU 1140 with the line intercept method (Lindsey 1955; Woodin and Lindsey 1954). Transects were established and data were collected within a 6-m (20-ft) wide strip centered on the 213-m (700-ft) transect line (Fig. 5a). Within the strip, EST measured the diameter at breast height (DBH) of all single-stemmed trees and counted all shrub stems taller than 0.9 m (3 ft). EST measured overstory overlap along the transect to determine foliar cover (Fig. 5b).

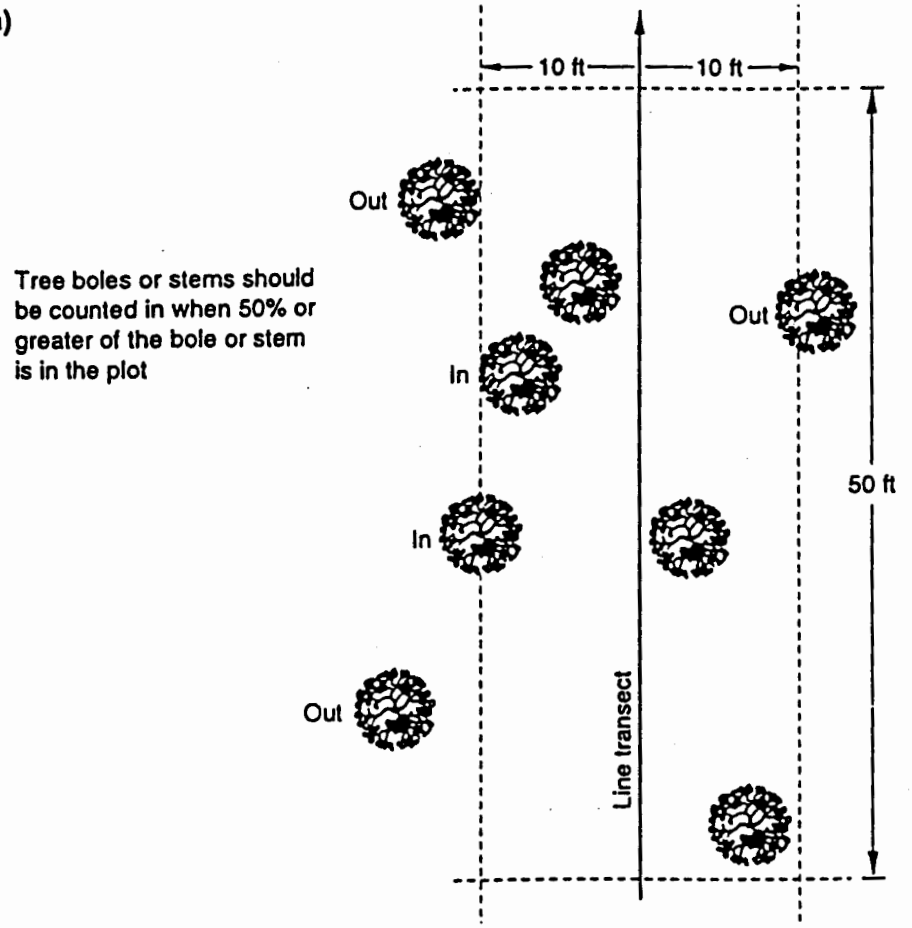
EST measured the overstory components in riparian zones and piñon/juniper woodlands with a circular plot technique. Circular plots were established every 30.5 m (100 ft) along a transect line within the habitat to be evaluated. From a center point on the transect line, EST measured the basal diameter of all multi-stemmed trees and the DBH of all single-stemmed trees within a 9.1-m (30-ft) radius (Fig. 6). EST also counted shrub stems and estimated overstory cover within each quarter of the circular plot.

We used standard ecological techniques in the habitat evaluation to measure cover, density, and frequency of the vegetative component and to calculate importance indices for each overstory and understory species. The Importance Indices for tree and shrub species are calculated by averaging the relative cover, density, and frequency of each species encountered in the line transects. The Importance Index for understory species is calculated by averaging the relative cover and frequency.

4.2.2 Understory Evaluation

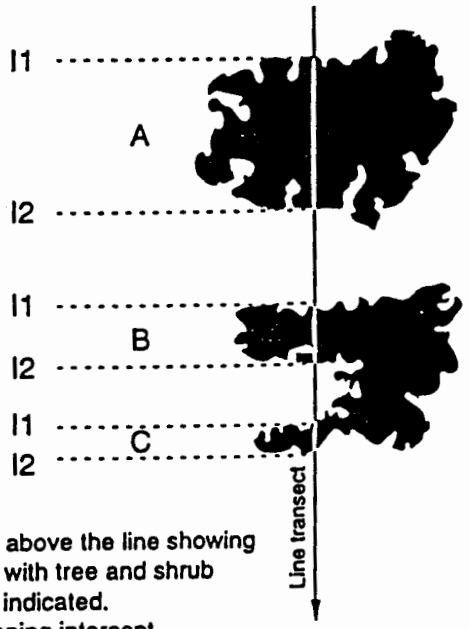
EST measured percent cover of cryptogamic and herbaceous plants, bare soil, litter, and shrubs less than 0.9 m (3 ft) tall with a 20 x 50 cm (7.9 x 19.7 in.) Daubenmire plot (Daubenmire 1959). We placed quadrats every 3 m (10 ft) along the same transect line used for the overstory evaluation (Fig. 7) for a

(a)

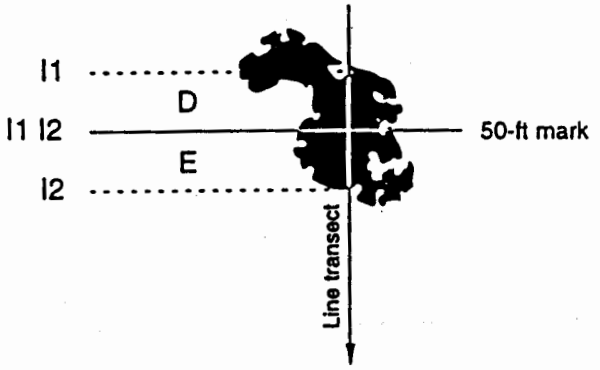


Tree boles or stems should be counted in when 50% or greater of the bole or stem is in the plot

(b)



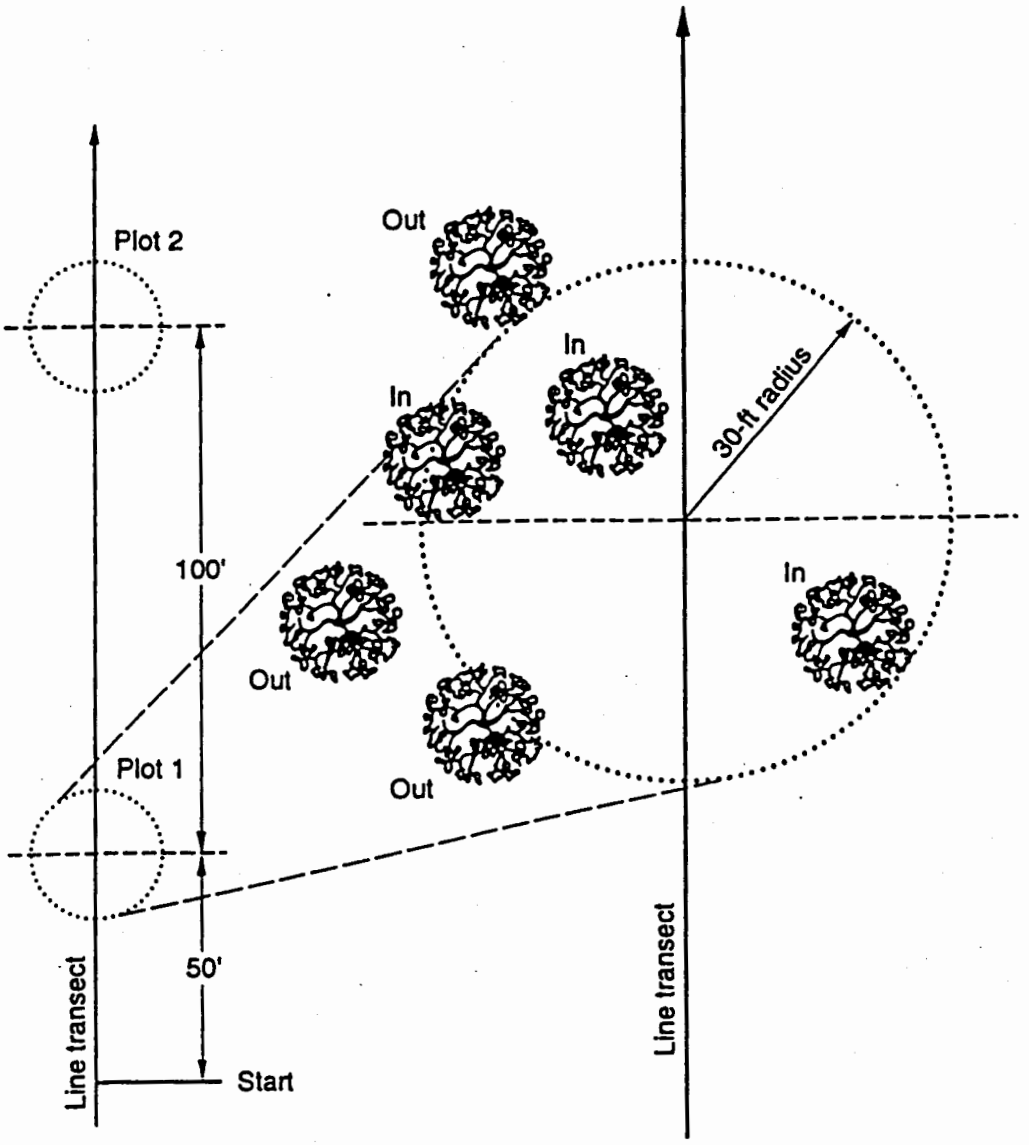
View from above the line showing a transect with tree and shrub intercepts indicated.
I1 = beginning intercept
I2 = ending



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

Figure 5a Line Intercept Method of Overstory Evaluation.

Figure 5b Foliar Intercept Readings for Line Intercept.



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

Figure 6 Circular Plot Method of Overstory Evaluation.

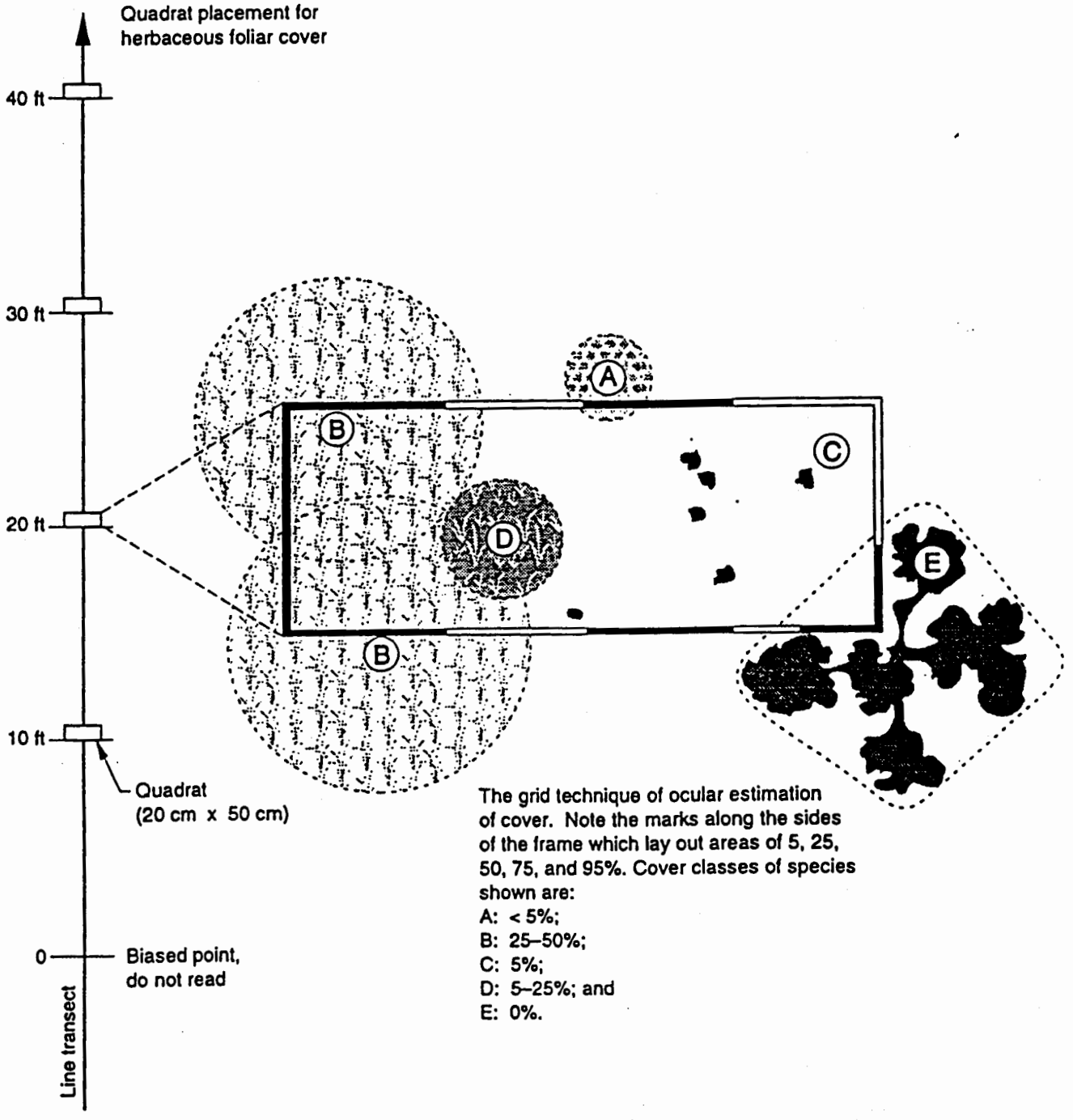


Figure 7 Quadrat Placement for Understory Herbaceous Foliar Cover and Estimation of Understory Cover.

minimum of 213 m (700 ft) or until the number of species within several successive plots had not increased.

We identified all plants with standard reference books including Martin and Hutchins (1980) and Foxx and Hoard (1984). When necessary, voucher specimens were collected and archived in the EM-8 herbarium. Questionable identifications were confirmed at the University of New Mexico herbarium.

4.3 Level 3 (Species Specific) Surveys

Based on the results of the Level 1 and Level 2 surveys and on consultation with experts, Level 3 surveys for TES species were deemed unnecessary. However, continuing studies will determine if unique or sensitive habitats exist within the canyon system.

4.4 Wetlands and Floodplains

Under the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Act Part B Permit, the Environmental Protection Agency (EPA) requires a delineation of all wetlands within watersheds on DOE property. The USFWS in accordance with the National Wetlands Inventory (NWI) mapped and characterized LANL wetlands in 1990. The NWI includes all wetlands and deepwater habitats throughout the United States.

The NWI maps are broad in scope and are intended to provide guidance, but not proprietary jurisdiction. The NWI aerial maps typically reflect conditions during the specific year and season they were taken. A detailed on-the-ground and historical analysis of single sites is currently being undertaken for each OU.

The Federal Manual for Identifying and Delineating Wetlands has three mandatory technical criteria for wetland identification:

- hydrophytic vegetation,
- hydric soils, and
- hydrology.

Hydrophytic vegetation are plants adapted to inundation or periodic saturation, which can withstand anaerobic soil conditions. Vegetation can be classified in 5 different categories: obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). Hydrophytic vegetation is indicated under normal circumstance when 1) more than 50% of the composition of the dominant species from all strata (trees, shrubs, herbs) are OBL, FACW, and/or facultative species; or 2) a frequency analysis of all species within the community yields a prevalence

index of less than 3 (where OBL=1, FACW=2, FAC=3, FACU=4, and UPL=5) ("National List of Plant Species that Occur in Wetlands: Southwest, Region 7").

Hydric soils are formed when prolonged inundation causes anaerobic soil conditions. This results in a change in the iron oxides and manganese oxides affecting solubility, movement, and aggregation of the oxides. This becomes reflected in soil color and physical characteristics. These changes in color and physical characteristics indicate inundation and is used as a field indicator of wetlands.

An area is considered to have wetland hydrology when during the growing season there is permanent or periodic inundation or soil saturation for a significant period (usually a week or more); a water table less than 0.5-1.5 feet from the surface for one week or more; or an area is inundated through ponding or flooding for one week or more.

The base floodplain is defined as the 100-year floodplain, and maps indicating LANL base floodplains have been generated. The critical action floodplain is defined as the 500-year floodplain. Floodplains are protected from disturbance by EO 11990. EST did not delineate wetland boundaries during this survey because delineations are good for only two years due to the fluctuating nature of wetlands. If wetlands could be affected by sampling activities, EST will map them prior to the commencement of sampling.

5 RESULTS

5.1 Level 1 (Reconnaissance) Surveys

During the Level 1 survey, EST established sampling locations, determined the best access routes, and recorded observations of wildlife, terrain, and site disturbance. In addition, these reconnaissance surveys identified four general plant communities to use as search criteria in EST's TES database:

- Mixed conifer
- Piñon pine/Juniper
- Ponderosa pine/Piñon pine
- Ponderosa pine

5.1.1 Plants

Federally Listed Species: The database search did not identify habitat in the project area that would be suitable for any federally listed endangered or threatened plant species. However, habitat in the project area may be suitable for the following three candidate species:

Wright fishhook cactus	*Mammillaria wrightii*
Santa Fe cholla	*Opuntia viridiflora*
Grama grass cactus	*Toumeya papyracantha*

State Listed Species: Four state-listed threatened or endangered plant species met the search criteria (NM Natural Heritage Program 1991).

Wright fishhook cactus	*Mammillaria wrightii*
Santa Fe cholla	*Opuntia viridiflora*
Grama grass cactus	*Toumeya papyracantha*
Wood lily	*Lilium philadelphicum* var. *andium*

Sensitive Species: Under the Federal ESA and New Mexico State statutes, only plant species that are listed or are candidates for listing are protected. New Mexico also has listed species occurring within the state that are considered rare because of restricted distribution or low numerical density. Rare plants are sensitive to long-term or cumulative land-use impacts and are vulnerable to disruptive biological or climatic events. The state monitors these species to determine if they should be elevated to endangered status. The following species are listed as state sensitive:

Sessile-flowered false carrot	*Aletes sessiliflorus*
Threadleaf horsebrush	*Tetradymia filifolia*
Plank's catchfly	*Silene plankii*
Santa Fe milkvetch	*Astragalus feensis*
Mathew's woolly milkvetch	*Astragalus mollissimus*
Taos milkvetch	*Astragalus puniceus*
Cyanic milkvetch	*Astragalus cyaneus*
Tufted sand verbena	*Abronia bigelovii*
Pagosa phlox	*Phlox caryophylla*
Checker lily	*Fritillaria atropurpurea*
Sandia alumroot	*Heuchera pulchella*

5.1.2 Wildlife

Federally Listed Species: One endangered, one threatened, and two candidate wildlife species met the database search criteria:

Endangered Species:

Peregrine falcon	*Falco peregrinus*

Threatened Species:

Mexican spotted owl	*Strix occidentalis lucida*

Candidate Species:

Spotted bat	*Euderma maculatum*
Northern goshawk	*Accipiter gentilis*

***State Listed Species*:** The following wildlife species listed as endangered or threatened in New Mexico met the search criteria:

Endangered Species:

Peregrine falcon	*Falco peregrinus*
Spotted bat	*Euderma maculatum*

5.2 Level 2 (Habitat Evaluation) Surveys

We established vegetation transects within Cañada del Buey and along the canyon slopes to evaluate the understory and overstory components of the following locations and habitats:

South-facing slope	Piñon/Juniper
North-facing slope	Ponderosa pine/Douglas-fir
Canyon bottom	Ponderosa pine/Juniper

Differences in vegetation characteristics (dominant species, relative density, cover, etc.) were not only observed between the varying elevational gradients, but also between the terrain features (north-facing slope, south-facing slope, and canyon bottoms).

5.2.1 Circular Plots

Circular plots were established along a south-facing slope cliff face of Cañada del Buey and along the canyon bottom below the SWSC treatment plant. On the south-facing slope, one-seed juniper and piñon pine are co-dominant overstory species. The relative cover of ponderosa pine is greater than juniper, but ponderosa pine occurred in only half as many plots as juniper and its relative density is only one-fourth that of juniper. Oak and mountain mahogany are the dominant shrub species along the south-facing slope.

Along the canyon bottom of Cañada del Buey below the SWSC plant, ponderosa pine is the dominant overstory species. Juniper is also common, but piñon pine was not present in the transect. The dominant shrub in the area is chokecherry with lesser amounts of oak, skunkbush sumac, currant, and barberry.

5.2.2 Line Intercept

In Cañada del Buey, line intercept transects were established along north-facing slopes, the canyon bottom, and at the base of south-facing slopes. Ponderosa pine is the dominant overstory species along the north-facing slope of upper Cañada del Buey . One-seed juniper had a high relative frequency value (41%), but its overall importance index was much lower. Piñon pine was the only other species recorded. Mountain mahogany is the dominant shrub species along the north-facing slope with common occurrences of Gambel oak.

Ponderosa pine is the dominant overstory species within the canyon bottom below the SWCS plant. Skunkbush sumac is the dominant shrub species in the canyon bottom with common occurrences of Gambel oak and mountain mahogany. Currant is also found along the canyon bottom but in low quantities.

Ponderosa pine is also the most common overstory species at the base of the south-facing slope. Piñon pine and juniper are also found along the base of the slope with moderate relative frequency values but lower overall importance indices. Mountain mahogany is the dominant shrub species with lesser occurrences of oak and skunkbush sumac.

5.2.3 Understory

Mountain muhly is the dominant understory species along the north-facing slopes of Cañada del Buey. It was particularly common below the SWCS plant. Sedge was relatively common along with mountain muhly in upper Cañada del Buey. Blue grama occurs in small amounts on north-facing slopes but is the dominant understory species on the south-facing slope of Cañada del Buey.

We established five transects to measure understory characteristics along the upper Cañada del Buey canyon bottom. In most of these transects, mutton grass is the dominant species. Additional common species include mountain muhly, western virgin's bower, horseweed, and redtop. Meadow rue and sedge were the dominant understory species in one transect.

Little bluestem, wolftail, and nodding brome were the most common understory species within the transect below the SWCS plant with lesser amounts of lupine, mutton grass, and wormwood present.

However, the amount of data collected for this area was limited. A more complete presentation of vegetation information for this portion of Cañada del Buey is given in Banar (1993).

5.2.4 Plant Communities of OU 1140

The classification breakdown for both upland and wetland vegetation types for the Pajarito Plateau is given in Appendix D. This listing includes known and potential habitat types and phases based on Brown (1982), Moir and Ludwig (1979), and the US Forest Service (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 "potential" and further studies are necessary to make a complete and accurate determination. The vegetation surveys indicated there are primarily two vegetation communities within or adjacent to OU 1140: the Rocky Mountain Montane Conifer Forest community and the Great Basin Conifer Woodland community. These communities can be further separated into series and, more specifically, habitat types.

Rocky Mountain Montane Conifer Forest

This community consists of primarily one vegetation series, the ponderosa pine, with minor characteristics of a Douglas fir series in some locations. This conifer forest community is found throughout the entire OU and is most prevalent in the canyon bottom and north-facing slopes. The major series in this community is the ponderosa pine which can be further divided into several habitat types based on location within the OU.

A ponderosa pine/juniper habitat type is most prevalent in the canyon bottom of Cañada del Buey. Slight differences are evident between the upper canyon where mutton grass is common understory and the area below the SWCS plant where little bluestem is the most common understory. Transects in both the upper canyon and below the SWCS plant include chokecherry and New Mexico olive, shrub species usually found in moister habitats.

A ponderosa pine/juniper/mountain mahogany habitat type is found on the north-facing slopes of Cañada del Buey and can be further delimited as a mountain muhly phase.

Great Basin Conifer Woodland Community

The Great Basin Conifer Woodland Community is found primarily along the south-facing slopes and on the adjacent mesa tops. The piñon/juniper series is prevalent and can be further broken down into an oak/mountain mahogany/blue grama habitat type.

5.3 Level 3 (Species Specific) Surveys

5.3.1 Threatened, Endangered, and Sensitive Species

We compared habitat information from the Levels 1 and 2 field surveys with that in EST's TES database and for known threats to the taxon. Based upon these comparisons, we either dismissed species from further consideration or conducted additional Level 3 surveys to confirm the presence or absence of the species within that habitat.

5.3.2 Species Dismissed from Further Consideration

Based on the information gained from the Levels 1 and 2 field surveys and on previous data, we concluded that the following species are not present in OU 1140 and, if they are present, are not expected to be affected by the proposed project.

PLANTS

EST dismissed the following species from further consideration because they have a low potential for occurrence in OU 1140, have not been recorded in OU 1140, and are not expected to be impacted by the proposed project:

- Wright's fishhook cactus (*Mammalaria wrightii*) occurs on gravelly or sandy hills or plains, desert grasslands, and piñon/juniper zones. Although this habitat is present within the OU, Wright's fishhook cactus has not been found in Los Alamos County and it was not found during these or previous field surveys.

- The Santa Fe cholla (*Opuntia viridiflora*) has only been found in an urban area of Santa Fe County. These plants appear to be strongly associated with south- and west-facing slopes in piñon/juniper woodlands at about 7,200 ft (New Mexico Native Plants Protection Advisory Committee, 1984). No Santa Fe cholla were found within the OU during surveys. This species should not be affected by the proposed project.

- Although habitat for the grama grass cactus (*Toumeya papyracanthus*) is present, the cactus has not been previously recorded in this OU and it was not found during Level 2 habitat surveys. The project should not affect this species.

- The sessile-flowered false carrot (*Aletes sessiliflorus*) inhabits rocky canyons and slopes usually in basaltic or sandstone areas. This species was not found during the surveys, it has not yet been recorded for Los Alamos County, and potential habitat is lacking in the project area.

- The threadleaf horsebrush (*Tetradymia filifolia*) lives on limestone or highly gypsous soils. This species was not found during the surveys nor has it been recorded for Los Alamos County.

- Plank's catchfly (*Silene plankii*) is found in piñon/juniper habitat within the mountains along the Rio Grande. It occurs in crevices and pockets in protected cliff faces of igneous rock. This species has not previously been found in Los Alamos County and was not found during the surveys. It is also not expected to occur in the project area due to lack of habitat.

- The Santa Fe milkvetch (*Astragalus feensis*) occurs on dry slopes of piñon/juniper woodlands. It has not yet been found in Los Alamos County nor was it found during the surveys. The project is not expected to impact potential habitat of this species.

- Mathew's woolly milkvetch (*Astragalus mollissimus*) occurs on open slopes and ridges and occasionally in canyons. It has not been recorded for Los Alamos County nor was it found during the surveys.

- The Taos milkvetch (*Astragalus puniceus*) inhabits loose soil in open areas of piñon pine and juniper. This species has not been recorded for Los Alamos County nor was it found during the surveys. The project area contains a limited amount of piñon/juniper woodland.

- The cyanic milkvetch (*Astragalus cyaneus*) occurs on sandy or gravelly hillsides between 1665 – 1970 m (5,500 – 6,500 ft). It has not been found in Los Alamos County and was not found during the surveys.

- The tufted sand verbena (*Abronia bigelovii*) is restricted to Todilto gypsum or its derivatives in piñon/juniper habitats. It has not been found in Los Alamos County and was not found during the surveys.

- The Pagosa phlox (*Phlox caryophylla*) is found on open slopes in mountain woodlands and forests. It has not been recorded for Los Alamos County and was not found during the Level 1 or Level 2 surveys.

- Sandia alumroot (*Heuchera pulchella*) inhabits moist rock faces 2425 – 3635 m (8,000 – 12,000 ft) in elevation. This species has not been recorded for Los Alamos County nor was it found during the field surveys. Potential habitat is lacking within the OU.

WILDLIFE

- Biologists documented peregrine falcon (*Falco peregrinus*) sightings in Los Alamos County approximately 2 miles northeast of the project area. However, this species has not been seen in or adjacent to Cañada del Buey. More suitable habitat occurs outside of the OU, and Cañada del Buey is not considered to be potential habitat for this species (Johnson 1992).

- Mexican spotted owls (*Strix occidentalis lucida*) inhabit forested mountains and canyons with primarily uneven-aged stands and closed canopies. Most of the habitat for this species in OU 1140 is limited to the canyon bottom and north-facing slope, but most of the overstory canopy here is open. Higher-quality habitat is located outside of OU 1140 in the southwestern portion of the Laboratory and along the Jemez Mountians. The Mexican spotted owl has not been sighted and is not expected to nest in the OU, but it may forage in the area (Travis 1992). However, the proposed project should not impact this species.

- The spotted bat (*Euderma maculatum*) lives near pools of standing water in riparian, piñon/juniper, ponderosa pine, and spruce/fir areas and roosts in cliffs or rock crevices. There are several small pools of standing water along upper Cañada del Buey, but these are very small. Mist-netting conducted in the southwest portion of the Laboratory in higher-quality habitat has not captured any spotted bats. This species may roost nearby, but it is not expected to forage in this OU.

5.3.3 Species Which Merit Level 3 Surveys

- The checker lilly (*Fritillaria atropurpurea*) is found in moist areas within ponderosa pine and mixed conifer at 1820 – 3030 m (6,000 – 10,000 ft). This species has been found within the Laboratory in upper Pajarito, Water, and Frijoles canyons. Although the checker lily was not found during surveys, potential habitat for this species exists in OU 1140.

- The wood lily (*Lilium philadelphicum* var. *andium*) occurs in moist areas in ponderosa pine and mixed conifer at 1820 – 3030 m (6,000 – 10,000 ft). This species has been found in upper Pajarito, Water, and Frijoles Canyon in the southern portion of the Laboratory. Although the wood lily was not found during the Level 2 field surveys, potential habitat for this species exists in OU 1140.

- The northern goshawk (*Accipiter gentilis*) has been found on Laboratory property, but not within the project area. In the southwest, goshawks primarily nest in ponderosa pine, mixed conifer, and

spruce/fir forests. Although better nesting habitat is located to the southwest of OU 1140, upper Cañada del Buey may provide some foraging habitat.

5.4 Wetlands and Floodplains

The NWI map did not identify any wetlands within Cañada del Buey. The stream channel through the proposed treatment plant is normally dry, and the regional water table is approximately 300 m (1,000 ft) below the surface of the site. Although the site has no seeps, springs, or wetlands at the site, outfalls within the canyon have produced several small pools that possess hydrophytic vegetation. In addition, LANL's 100-year floodplain map indicates that Cañada del Buey is located within a floodplain.

6 IMPACTS

6.1 Plants

- Removal or excessive disturbance to vegetative cover may result in, initiate, or increase erosion or drainage patterns, both within the canyon bottom (including stream channel) and along the canyon slopes.
- Disturbance or damage to vegetation around the ponds may result in partial or complete loss of the ponds and loss of the associated riparian vegetation.

6.2 Wildlife

The habitat within and along Cañada del Buey is suitable habitat for nesting, foraging, and perching for a variety of bird species. Several raptors have been observed in the area. During field activities in Cañada del Buey, we observed black bear, elk (cow with calf), deer, bobcat kittens, and denning coyotes. Disturbances in OU 1140 may cause one or more of the following:

- Loss of nesting and perching sites, cover, foraging, denning, and other animal habitat, both along the canyon slopes and within the canyon bottom;
- Nest abandonment by birds, which would result in nest failure;
- Interference with critical periods, such as the breeding or denning period of fur-bearers or calving season of elk utilizing the canyon; and
- Contamination of wildlife water sources (i.e., pools) from fuel spills or leaks from vehicles or other machinery.

6.3 Threatened, Endangered, and Sensitive Species

Sampling within or adjacent to riparian areas or small pools could adversely impact wood lilies and/or checker lilies.

If goshawks forage in the area, sampling with heavy equipment could disturb this species.

6.4 Wetlands and Floodplains

Sampling within OU 1140 may include deep core drilling to a depth of more than 60 m (200 ft). Heavy equipment and coring must remain outside of any wetlands areas. If sampling is to take place within or near the small pools in upper Cañada del Buey or within the floodplain, the following must be avoided:

- Disturbance to the stream channel or smaller drainages leading into the stream channel, which could impact existing ponds;
- Excessive disturbance to the vegetation and the soil surface, which could result in an alteration of the water flow and/or a widening of the channel within Cañada del Buey;
- Disturbance along the drainages and slopes, which could initiate or increase soil erosion; and
- Hazardous fuel spills or leaks from vehicles, which could negatively affect water quality in the riparian zone and threaten riparian vegetation.

7 MITIGATIONS

7.1 Plants

Site sampling and subsequent corrective actions could require mitigation by revegetation if loss of vegetation initiates or increases erosion. Survey results indicate that a mixture of native grasses, forbs, and other herbaceous plants are a few of the species that could be used for revegetation. Consultation with EST and/or state or federal agencies can determine appropriate species. Additional mitigation measures include the following:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during the actual sampling and when traveling to the sampling sites;
- Avoid disturbance to existing ponds, and associated riparian vegetation, and stream channel;
- Avoid removal of vegetation whenever possible along the canyon bottom stream channels; and
- Avoid disturbance to vegetation along canyon slopes and especially to established drainages.

EST must be notified prior to the occurrence of any disturbances beyond those usually incurred in typical site sampling activities. Proposed modifications must be evaluated for potential environmental impacts before they can occur.

7.2 Wildlife

Hand-held auger sampling should cause only insignificant impacts to wildlife species and should result in only temporary avoidance of the sampling sites. However, if heavy machinery is to be used, the following mitigation measure must be followed to reduce the impacts:

- If sampling with heavy equipment is to take place in Cañada del Buey between March 1 and August 1, EST must be notified to initiate a pre-sampling survey. If wildlife are breeding or denning near the sampling area, appropriate mitigations will be developed to minimize disturbances to them. If no wildlife are breeding or denning near the sampling area, sampling can proceed as originally scheduled.

Disturbances to wintering species should be minor, and mitigation provided for wetlands, floodplains, and vegetation will help reduce impacts to wildlife species.

7.3 Threatened, Endangered, and Sensitive Species

If any sampling activities are scheduled to occur near outfall discharges or areas of pooled water, an EST biologist must survey the area for the presence/absence of wood lilies and checker lilies before such sampling can proceed. If wood lilies or checker lilies are found, sampling must be planned to avoid any impacts to this state-listed species.

Although the northern goshawk has not been observed in the project area, it may still use the area. If sampling is to occur in upper Cañada del Buey, an EST biologist must check the area during the breeding season (March – August) before such sampling can proceed. If a goshawk is found during this survey, sampling will be scheduled during the nonbreeding season (from September 1 to March 1) to avoid potential impacts to the species. Even if goshawks are not found during this survey, seasonal restrictions may still apply to upper Cañada del Buey to protect potential goshawk habitat.

7.4 Wetlands and Floodplains

Sampling should be planned to eliminate any impacts to wetlands and floodplains. Wetland boundaries must be delineated prior to the commencement of any activity that may affect wetlands. The delineation is only valid for 2 years and must be redone thereafter. Erosion on the mesa top must be minimized to avoid sedimentation into wetlands areas. If sampling is proposed to occur in or near pools of water, an EST biologist must evaluate the site before such sampling occurs. If such sampling is judged to be detrimental to riparian areas, it will not be allowed to occur.

8 SUMMARY OF PERTINENT REGULATIONS

Executive Order 11990 (Protection of Wetlands) calls for avoiding "to any extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands...[and] 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 humans and the 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 of the Clean Water Act regulates permits for discharge of dredged or fill materials into navigable waters after notice and opportunity for public hearings.

The federal Endangered Species Act declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which those species depend.

The Migratory Bird Treaty Act 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. OU 1140 Plant Species

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
ACERACEAE	*Acer negundo*	ACNE	Boxelder maple
ANACARDIACEAE	*Rhus radicans*	RHRA	Poison ivy
	Rhus trilobata	RHTR	Squawbush
BERBERIDACEAE	*Berberis fendleri*	BEFE	Colorado barberry
BORAGINACEAE	*Cryptantha jamesii*	CRJA	James hiddenflower
	Lappula sp.	LAPX	Stickseed
	Lappula redowskii	LARE	Stickseed
	Lithospermum multiflorum	LIMU	Puccoon
CACTACEAE	*Coryphantha vivipara*	COVI	Pincushion cactuc
	Opuntia spp.	OPUX	Prickly pear cactus
	Opuntia imbricata	OPIM	Walkingstick cactus
	Opuntia polyacantha	OPPO	Prickly pear
CAMPANULACEAE	*Campanula rotundifloia*	CARO	Harebell
CELESTRACEA	*Pachystima myrsinites*	PAMY	Myrtle boxleaf
CHENOPODIACEAE	*Atriplez canesans*	ATCA	Fourwing saltbush
	Chenopodium sp.	CHEX	Lamb's quarters
	Chenopodium album	CHAL	Lamb's quarters
	Kochia scoparia	KOSC	Summer cypress
	Salsola kali	SAKA	Russian thistle
COMPOSITAE	*Antennaria parviflora*	ANPA	Pussytoes
	Ambrosia sp.	AMBX	Ragweed
	Artemisia carruthii	ARCA	Wormwood
	Artemisa dracunculus	ARDR	False tarragon
	Artemisa filifolia	ARFI	Sand sagebrush
	Artemisia ludoviciana	ARLU	Louisiana wormwood
	Artemisia tridentata	ARTR	Big sagbrush
	Aster sp.	ASTX	Aster
	Aster bigelovii	ASBI	Bigelow aster
	Bahia dissecta	BADI	Wild chrysanthemum
	Brickellia sp.	BRIX	Brickelbush
	Chrysopsis villosa	CHVI	Hairy golden aster
	Chrysopsis filiosa	CHFI	Leafy golden aster
	Chrysothamnus nauseosus	CHNA	Chamisa
	Cichorium intybus	CIIN	Chicory
	Circium sp.	CIRX	Thistle
	Conyza canadensis	COCA	Horseweed fleabane
	Cosmos parviflorus	COPA	Cosmos
	Cryptantha jamesii	CRJA	James hiddenflower
	Erigeron divergens	ERDI	Fleabane daisy
	E. flagellaris	ERFL	Trailing fleebane
	Gaillardia pulchella	GAPU	Firewheel
	Grindelia aphanactis	GRAP	Gumweed
	Gutierrezia microcephala	GUMI	Snakeweed
	Gutierrezia sarothrae	GUSA	Snakeweed
	Helianthus petiolaris	HEPE	Praire sunflower
	Hymenopappus filifolius	HYFI	Yellow cut-leaf

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
	Hymenoxys argentea	HYAR	Perky Sue, bitterweed
	Hymenoxys richardsonii	HYRI	Bitterweed
	Iva xanthifolia	IVXA	Marsh-elder
	Kuhnia chlorolepis	KUCH	False boneset
	Senecio sp.	SENX	Groundsel
	Senecio fendleri	SEFE	Groundsel
	Senecio multicapitatus	SEMU	Groundsel
	Solidago sp.	SOLX	Goldenrod
	Taraxacum officinale	TAOF	Common dandelion
	Thelesperma trifidum	THTR	Greenthread
	Townsendia exscapa	TOEX	Easter daisy
	Tragopogon dubius	TRDU	Salisfy, Goatsbeard
	Viguiera multiflora	VIMU	Goldeneye
CRUCIFERAE	*Capsella bursa-pastoris*	CABU	Shepherd's purse
	Descurainia sp.	DESX	Tansey mustard
	Erysimum capitatum	ERCA	Western wallflower
CUPRESSACEAE	*Juniperus monosperma*	JUMO	One-seeded juniper
	Juniperus scropulorum	JUSC	Rocky mountain juniper
CYPERACEAE	*Carex sp.*	CARX	Sedge
	Scripus sp.	SCRX	Rush
ERICACEAE	*Pterospora andromedea*	PTAN	Pinedrops
EUPHORBIACEAE	*Croton texensis*	CRTE	Croton
	Euphorbia dentata	EUDE	Wild poinsetta
FAGACEAE	*Quercus gambelii*	QUGA	Gambel oak
	Quercus undulata	QUUN	Wavyleaf oak
GERANIACEAE	*Geranium caespitosum*	GECA	James geranium
GRAMINEAE	*Agropyron sp.*	AGRX	Wheat grass
	Agropyron smithii	AGSM	Western wheatgrass
	Agrostis alba	AGAL	Redtop
	Andropogon scoparius	ANSC	Little bluestem
	Aristida sp.	ARIX	Three-awn hairy dropseed
	Aristida divaricata	ARDI	Poverty three-awn
	Blepharoneuron tricholepis	BLTR	Pine dropseed
	Bouteloua curtipendula	BOCU	Side-oats grama
	Bouteloua gracilis	BOGR	Blue grama
	Bromus anomalus	BRAN	Nodding brome
	Bromus inermis	BRIN	Smooth brome
	Bromus tectorum	BRTE	Downy chess
	Buchloe dactyloides	BUDA	Buffalograss
	Dactylis glomerata	DAGL	Orchard grass
	Eriogonum alatum	ERAL	Winged wild buckwheat
	Eriogonum cernuum	ERCE	Nodding buckwheat
	Festuca sp.	FESX	Fescue
	Hordeum sp.	HORX	Barley
	Koeleria cristata	KOCR	Junegrass
	Lycurus phleoides	LYPH	Wolftail
	Oryzopsis hymanoides	ORHY	Rice grass
	Lelium perenne	LEPE	Perennial rye
	Muhlenbergia montana	MUMO	Mountain muhly

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
	Muhlenbergia torreyi	MUTO	Ring muhly
	Muhlenbergia wrightii	MUWR	Spike muhly
	Phleum pratense	PHPR	Common timothy
	Poa sp.	POAX	Bluegrass
	Poa fendleriana	POFE	Bluegrass
	Sitanion hystrix	SIHY	Bottlebrush squirreltail
	Stipa sp.	STIX	Needlegrass
	Sporobolus cryptandrus	SPCR	Sand dropseed
LABIATAE	*Monarda menthaefolia*	MOME	Horsemint
	Monarda pectinata	MOPE	Ponymint
LEGUMINOSAE	*Glycyrrhiza lepidota*	GLLE	Licorice
	Lotus wrightii	LOWR	Deervetch
	Lupinus sp.	LUPX	Lupine
	Lupinus caudatus	LUCA	Lupine
	Medicago sativa	MESA	Alfalfa
	Melilotus sp.	MELX	Sweet clover
	Melilotus albus	MEAL	White sweet clover
	Melilotus officialis	MEOF	Yellow Blossom clover
	Robinia neomexicana	RONE	New Mexico locust
	Thermopsis pinetorum	THPI	Big goldenpea
	Trifolium pratense	TRPR	Red clover
	Trifolium repens	TRRE	White clover
	Vicia americana	VIAM	American vetch
LILIACEAE	*Allium cernuum*	ALCE	Nodding onion
	Smilacina racemosa	SMRA	False Solomon's seal
	Yucca angustissima	YUAN	Narrowleaf yucca
	Yucca baccata	YUBA	Banana yucca
LINACEAE	*Linum neomexicanum*	LINE	New Mexico flax
LOASACEAE	*Mentzelia pumila*	MEPU	golden blazing star
MALVACEAE	*Sphaerlacea sp.*	SPHX	Globe mallow
OLEACEAE	*Forestiera neomexicana*	FONE	New Mexico olive
ONAGRACEAE	*Epilobium sp.*	EPIX	Willowweed
	Oenothera sp.	OENX	Evening primrose
	Oenothera coronopifolia	OECO	Evening primrose
	Oenothera hookeri	OEHO	Hooker's evening primrose
PINACEAE	*Abies concolor*	ABCO	White fir
	Pinus edulis	PIED	Pinon pine
	Pinus ponderosa	PIPO	Ponderosa pine
	Pseudotsuga menziesii	PSME	Douglas fir
PLANTAGINACEAE	*Plantago major*	PLMA	Rippleseed plaintain
POLEMONIACEAE	*Ipomopsis aggregata*	IPAG	Scarlet trumpet
	Ipomopsis longiflora	IPLO	Blue gilia
POLYGONACEAE	*Eriogonum jamesii*	ERJA	Antelope sage
	Eriogonum polycladon	ERPO	Sorrel wild buckwheat
	Polygonum convolvulus	POCO	Black bindweed
PRIMULACEAE	*Androsace septentrionalis* var. *subulifera*	ANSE	Western rock jasmine
RANUNCULACEAE	*Clematis legusticifolia*	CLLE	Western virgins bower
	Clematis pseudoalpina	CLPS	Rocky mountain clematis

FAMILY	SCIENTIFIC NAME	CODE	COMMON NAME
	Thalicurum fendleri	THFE	Meadowrue
ROSACEAE	*Cercocarpus montanus*	CEMO	Mountain mahogany
	Fallugia paradoxa	FAPA	Apache plume
	Fragaria americana	FRAM	Wild strawberry
	Potentilla fruticosa	POFR	Cinquefoil
	Prunus virginia var.	PRVI	Western black
	melanocarpa		chokecherry
	Rosa sp.	ROSX	Wild rose
	Rosa woodsii	ROWO	Wild rose
	Rubus strigosus var. arizonicus	RUST	Wild raspberry
RUBIACEAE	*Galium sp.*	GALX	Bedstraw
SALICACEAE	*Populus angustifolia*	POAN	Aspen
SAXIFRAGACEAE	*Jamesia americana*	JAAM	Cliffbush
	Philadelphus microphyllus	PHMI	Mockorange
	Ribes cereum	RICE	Wax current
SCROPHULARIACEAE	*Castilleja integra*	CAIN	Foothills paintbrush
	Penstemon sp.	PENX	Beardtonge
	Penstemon secundifolorus	PESE	Beardtonge
	Verbascum thapsus	VETH	Mullein
UMBELLIFERAE	*Ozmorhiza obtusa*	OZOB	Bluntseed sweet cicely
VITACEAE	*Parthenocissus inserta*	PAIN	Virginia creeper
MOSSES	*Ceratadon purpureus*	CEPU	Purple horned toothed moss
LICHENS	*Cladonia sp.*	CLAX	
	Rhizocarpon sp.	RHIX	Crustose rock lichen
	Usnea sp.	USNX	Old man's beard lichen
	Xanthroparmelia sp.	XANX	Green foliose rock lichen

APPENDIX B Ant Species Potentially Occurring in OU 1140

SUBFAMILY	SCIENTIFIC NAME	HABITAT TYPE*	AUTHORITY
DOLICHODERINAE	*Acanthomyops latipes*	P-R	Walsh
	A. interjectus	PP	Mayr
	A. pogonogynous		
	Brachymyrmex depilis		
	Camponotus laevigatus		
	Camponotus sansabeanus	P-J and PP	Buckley
	C. vicinus	P-J and PP	Mayr
	Formica argentea	Disturbed	Wheeler
	F. ciliata	P-J	Mayr
	F. densiventris	P-J	Viereck
	F. fusca	P-J	Linnaeus
	F. hewitti	PP-grass	Wheeler
	F. lasioides	P-R	Emery
	F. limata	P-J	Wheeler
	F. neogagates	P-J and disturbed	Emery
	F. obscuripes obscuripes	P-J	Forel
	F. obtusopilosa	P-J	Emery
	F. podzolica	P-J and disturbed	Francoeur
	Lasius alienus	Pinon	Foerster
	L. crypticus		
	L. neoniger	P-R	Emery
	L. pallitarsis	PP	Provancher
	L. sitiens	P-J and PP	Wilson
	L. subumbratus	P-R	Viereck
	Myrmecocystus mexicanus	P-J	Wesmael
	Polyergus breviceps	PP	Emery
	Tapinoma sessile	P-J	Mayr
DORYLINAE	*Neivamyrmex nigrescens*	P-J	Cresson
MYRMICINAE	*Crematogaster cerasi*	PP	Fitch
	C. colei	Disturbed	Buren
	Leptothorax crassipilis	P-R	Wheeler
	L. muscorum	PP	Nylander
	L. nitens	Disturbed	Emery
	L. texanus texanus	P-R	Wheeler
	L. tricarinatus	P-R	Emery
	Monomorium minimum	P-J	Buckley
	Myrmecina americana	P-R	Emery
	Myrmica brevispinosa	P-J	Wheeler
	M. emeryana	R-P	Forel
	M. hamulata	P-R	Weber
	Pheidole ceres	PP,disturbed, and	Wheeler
	P. wheelerorum	P-J and disturbed	MacKay
	Pogonomyrmex occidentalis	P-J and PP	Cresson
	Solenopsis molesta	P-J and Disturbed	Say
	Stenamma occidentale	P-R	M.R. Smith

Habitat type	Habitat abbreviation
Ponderosa pine	PP
Ponderosa-riparian	P-R
Riparian-ponderosa pine	R-P
Pinon-juniper	P-J

APPENDIX C OU 1140 Reptiles and Amphibians

	Family	Scientific name	Common name
Amphibian	Bufonidae	*Bufo woodhousei*	Woodhouse toad
Reptile	Scincidae	*Eumeces multivirgatus*	Many-lined skink
Reptile	Iguanidae	*Crotaphytus collaris*	Collared lizard
Reptile	Iguanidae	*Sceloporus undulatus*	Eastern fence lizard
Reptile	Igunaidae	*Phrynosoma douglassii*	Short-horned lizard
Reptile	Teiidae	*Cnemidophorus exsanguis*	Chihuahua whiptail
Reptile	Teiidae	*Cnemidophorus neomexicanus*	New Mexico whiptail
Reptile	Teiidae	*Cnemidophorus velox*	Plateau striped whiptail
Reptile	Colubridae	*Masticophis flagellum*	Coachwhip snake
Reptile	Colubridae	*Masticophis taeniatus*	Striped whipsnake
Reptile	Colubridae	*Pituophis melanoleucus*	Gopher snake
Reptile	Colubridae	*Thamnophis elegans*	Western terrestrial garter snake
Reptile	Viperidae	*Crotalus viridis viridis*	Prairie rattlesnake

APPENDIX D Birds of Cañada del Buey by Season

(from Willis and Novoroske 1992)

SPECIES	NUMBER OBSERVED			
	Spring	Summer	Fall	Winter
Acorn woodpecker	7		2	
American kestrel		3	2	
American robin	18	5	1	2
Ash-throated flycatcher	27			
Bewick's wren	11		3	
Blue-gray gnatcatcher	3	2	1	
Brown-headed cowbird	25			
Black-headed grosbeak	19	3		
Brown creeper	1		1	
Broad-tailed hummingbird	26	6	3	
Bushtit			9	
Canyon tohee			1	
Canyon wren	44	17	7	
Chipping sparrow	34	14	13	
Clark's nutcracker			6	
Cooper's hawk	1			
Common raven	37	8	23	19
Dark-eyed junco	102		4	53
Dusky flycatcher	2	1		
Flycatcher	27	2		
Gray flycatcher	9			
Grace's warbler	14	1		
Green-tailed towhee	1		2	
Hammond's flycatcher	3			
Hairy woodpecker	5		4	1
Hepatic tanager	3	1		
Hermit thrush	2	1	1	
House finch	5		5	
House wren	1	3	11	
Hummingbird	1			
Lark sparrow		1		
Lesser goldfinch	1		3	
Mountain chickadee	43	7	21	22
Mourning dove	13	2	11	
Northern flicker	44	5	9	3
Piñon jay	1		5	
Pine siskin	15			
Plain titmouse	5	1		1
Pygmy nuthatch	74	12	51	64
Ruby-crowned kinglet			1	
Red crossbill	4	1		
Rock wren	3	1	3	
Rufous-sided towhee	158	48	34	18
Red-tailed hawk		1	4	

SPECIES	NUMBER OBSERVED			
Say's phoebe	5			
Scrub jay	33	16	26	7
Solitary vireo	31	6	8	
Steller's jay	20	5	19	1
Townsend's solitaire	28	1	30	24
Turkey vulture	3		2	
Violet-green swallow	44	20		
Virginia's warbler	33		2	
Warbling vireo	13	3		
White-breasted nuthatch	38	19	17	9
Western bluebird	36	1	2	
Western tanager	25	2		
Williamson's sapsucker		1	1	
Wilson's warbler			3	
Western wood-pewee	67	20		
Yellow-rumped warbler	23	1	3	

APPENDIX E Small Mammals Captured in Cañada del Buey

(from Biggs 1992)

CITELLUS VARIEGATUS

Scientific name	Common name
Eutamias sp.	Chipmunk
Peromyscus boyleii	Brush mouse
Peromyscus maniculatus	Deer mouse
Neotoma albigula	Whitethroat woodrat
Neotoma mexicana	Mexican woodrat
Reithrodontomys megalotis	Western harvest mouse
Microtus longicudus	Longtail vole
Citellus variegatus	Rock squirrel

APPENDIX F. Bats Captured during LANL Mist-Netting

(from Tyrell and Brack 1992)

Scientific name	Common name
Eptesicus fuscus	Big brown bat
Antrozous pallidus	Pallid bat
Lasionycteris noctivigans	Silver-haired bat
Lasiurus cinereus	Hoary bat
Myotis californicus	California myotis
Myotis evotis	Long-eared myotis
Myotis leibii	Small-footed myotis
Myotis thysanodes	Fringed myotis
Myotis yumanensis	Yuma myotis
Myotis volans	Long-legged myotis
Pipistrellus hesperus	Western pipistrelle
Plecotus townsendii	Townsend's big-eared bat
Tadarida brasiliensis	Brazilian free-tailed bat

APPENDIX G. Letter of Concurrence

United States Department of the Interior

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

November 28, 1995

Cons. #2-22-96-I-034

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

Dear Mr. Kirkman:

This responds to your letter dated October 18, 1995, requesting our review of the biological assessment (BA) entitled *Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1140 ,TA-46*, prepared by J. Biggs and S. Cross. Research activities at the Los Alamos National Laboratory (Laboratory) have resulted in a large number of releases of potentially hazardous wastes. The nature and extent of the contamination at these release sites (known as solid waste management units or SWMUs) is currently being discerned. The proposed action involves the Site Characterization Phase (soil sampling activities) of the Laboratory's Environmental Restoration Group of Operable Unit (OU) 1140. Soil sampling will be conducted with hand-held auger drills or with auger-mounted heavy machinery. Your geographic area of interest is in Los Alamos County, New Mexico.

Information provided in the original BA was out-of-date and inadequate to concur with a not likely to adversely affect determination. A current list of endangered, threatened, and candidate species for Los Alamos County is provided to update your records. A conference call was conducted on November 27, 1995, between the U.S. Fish and Wildlife Service (Service), Mr. James Biggs, and Ms. Elizabeth Withers, and updated information was provided about the site and the status of the Mexican spotted owl (owl) in the project area. Information included a characterization that the site does not contain suitable nesting or roosting habitat for the owl. Suitable nesting or roosting habitat for the owl occurs at a distance greater than 1 mile from the site. In addition, the canyon has an existing access road used for monitoring wells and ground water quality. Any auger-mounted sampling that is conducted will not increase the level of disturbance and will be conducted under existing mitigation measures.

Given the updated information provided in the conference call, the Service concurs with your determination that the proposed action, with existing mitigation measures, is not likely to adversely affect any endangered or threatened species or critical habitat.

If we can be of further assistance, please call Joel D. Lusk at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

Enclosure

cc (w/enc):
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals and Natural Resources Department, Forestry and Resources Conservation Division, Santa Fe, New Mexico
Ms. Kathryn Bennett, Acting Biological Section Leader, ESH-8, Los Alamos National Laboratories, Los Alamos, New Mexico