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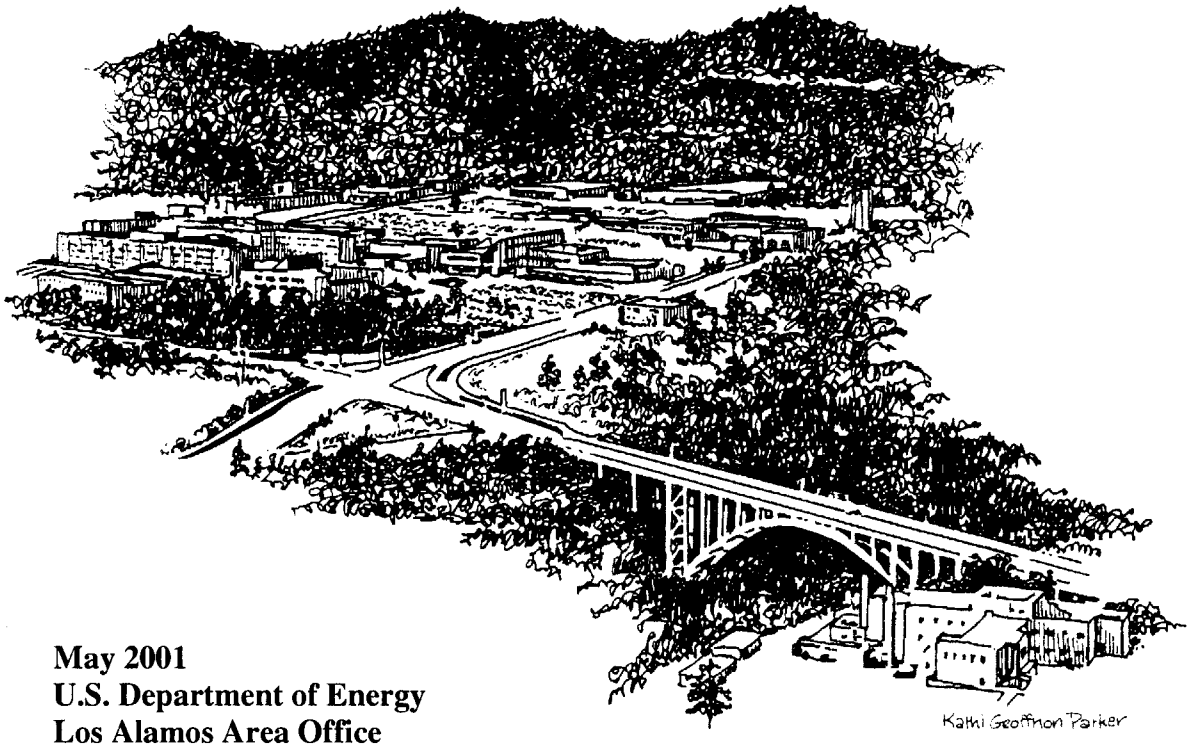
Integrated Cultural and Natural Resources Management Plan for Los Alamos National Laboratory

Preliminary Draft



May 2001
U.S. Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico

ENTERED

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

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Dear Interested Party:

Enclosed is a copy of the Preliminary Draft, *Integrated Cultural and Natural Resources Management Plan for Los Alamos National Laboratory* (Integrated Resource Management Plan or IRMP). The Department of Energy, National Nuclear Security Administration (NNSA), with the cooperation of University of California, Los Alamos National Laboratory (UC/LANL) staff, prepared the IRMP in partial fulfillment of actions required by the Mitigation Action Plan for the *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory* (DOE/EIS-0238). This IRMP is in the earliest stages of development, presenting a vision of and justification for integration of resource-specific management plans at LANL. It will be the vehicle for NNSA to establish resource management policy and institutional goals and to provide guidance to UC/LANL on that policy. UC/LANL will then be responsible for implementing that policy and developing an implementation strategy. NNSA will monitor progress on implementation.

You are invited by NNSA to comment on the Preliminary Draft IRMP document. Written comments should be addressed to: Elizabeth Withers, Department of Energy, National Nuclear Security Administration, Los Alamos Area Office, 528 35th Street, Los Alamos, NM 87544, or submit them to the Mail Room at the above address between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. Written comments may also be sent electronically to: ewithers@doeal.gov or by facsimile to (505) 667-9998. After the public comment period, which ends July 31, 2001, NNSA will consider the comments received, revise the Preliminary Draft IRMP, and issue a Final IRMP. The Final IRMP will then become a living document, revised as needed.

We appreciate your interest in this process. If you have any questions, please contact Ms. Withers of my staff at (505) 667-8690.

Sincerely,

David A. Gurulé, P.E.
Area Manager
Los Alamos Area Office

LAAME:3EW-612

Enclosure

Issue date: May 2001

Integrated Cultural and Natural Resources Management Plan for Los Alamos National Laboratory

as required by the Mitigation Action Plan for the Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory

Preliminary Draft

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Executive Summary

In 1997, the Department of Energy (DOE) and Los Alamos National Laboratory (LANL) began an effort to develop a Natural Resources Management Plan to integrate management of ground water, surface water, biological resources, threatened and endangered species, fire, soil and geologic resources, and air quality. In 1999, the DOE issued a Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory, a Record of Decision (ROD), and a Mitigation Action Plan (MAP). The MAP included a discussion of existing programs, plans, and controls built into operations at LANL that function as mitigation measures, and a commitment by DOE to undertake additional measures to further mitigate impacts of continuing operations of LANL at the levels outlined in the ROD. Preparation of an Integrated Cultural and Natural Resources Management Plan (referred to as IRMP in this document), described as an enhancement of existing programs, was included as a mitigation measure.

This IRMP will be the vehicle for DOE to establish resource management policy and institutional goals and to provide guidance to University of California/LANL on that policy. LANL will then be responsible for implementing that policy and developing an implementation strategy. DOE will monitor progress on implementation.

This IRMP is in the earliest stages of development, presenting a vision of and justification for integration of resource-specific plans. A number of plans for specific resource areas, in particular biological resources, are still in process. As these underlying plans develop, so will the IRMP. The current draft is at a high level, setting the stage for integration and outlining an overall approach. One of the major contributions of the current draft is identification of operational plans and resource plans for Los Alamos National Laboratory (LANL) that either exist or are in development. This compilation sets the stage for integration. Subsequent versions of the plan will provide more detail on an integration process and on facility-specific plans. The facility plans will provide an approach for the development of implementing actions that avoid conflict, maximize achievement of goals and objectives at the facility level, and maintain adherence to institutional goals and objectives.

LANL has been in operation since its founding as the Manhattan Project in 1942. Currently, LANL consists of approximately 2,000 structures on 43 square miles of land on the Pajarito Plateau in north-central New Mexico. The plateau consists of a series of fingerlike mesas separated by deep east-to-west oriented canyons, cut by intermittent streams. Most developments are confined to mesa tops. Mesa tops range in elevation from approximately 7,800 feet to 6,200 feet. LANL is divided into technical areas that are used for building sites, experimental areas, waste disposal locations, and other infrastructure elements. However, less than 25 percent of the land is developed. Development is limited by steep slopes and by the need for security and safety buffers because of the work performed.

A number of institutional operational plans have been prepared by and for LANL. These include the Annual Institutional Plan; the 1999 Strategic Plan (covers 1999–2004); the 1996 Tactical Plan (last updated in 1998); the Comprehensive Site Plan (presents conceptual planning for development); and the Installation Work Plan (covers the Environmental Restoration Project).

Institutional resource management plans are in various stages of development at LANL. The air quality program is compliance-oriented. A draft watershed management plan was issued in 1999 and is in revision. A ground water protection management plan was issued in 1996 and provides direction to an enhanced monitoring program. There is no institutional soils management plan and it is not clear that one is needed, since soils are implicitly addressed in other plans. A biological resource management plan is in the early stages of development. It will include such elements as erosion and contaminant transport, ecological risk management, forest/wildlife management, and human/wildfire interfaces. A Threatened and Endangered Species Habitat Management Plan was issued in 1998. A wildfire hazard reduction plan and an integrated cultural resource management plan are also in preparation. Each of these plans has a geographically defined management unit for organization.

The IRMP will use LANL's facility management unit (FMU) structure as the organizing principle. An FMU is a group of structures related by function and/or located contiguously and serving a particular purpose, capability, or mission need. There are currently 17 FMUs, with three responsible for the majority of the area of LANL. The utilities organization at LANL is the facility manager for the area that essentially is undeveloped except for power lines, water lines, roads, and other infrastructure elements. The high explosive testing and processing divisions are responsible for substantial land that is retained as buffer for this type of experimental activity. The remaining FMUs are primarily buildings and support structures without significant open space.

Goals and objectives are important elements of a resource management plan. However, the IRMP is a plan still in the earliest stages of development. A number of the plans for specific resource areas, in particular biological resources, are still in process. Goals and objectives will be part of these underlying resource-specific plans; if they are expected to affect the majority of LANL, they may be incorporated into the goals and objectives of the IRMP. In addition, the IRMP will need to develop several processes for reviewing implementing actions and identifying and resolving or avoiding conflicts, such that the overall goals and objectives can be achieved as much as possible.

In the MAP, DOE identified four specific measures intended to further minimize the impacts of operating LANL. DOE's initial goals for LANL's IRMP will be those measures:

- Electrical Power Consumption –manage electric power demands to prevent periods of brownouts by adjusting to the limitations of available power until a solution for long-term increase in the power supply is in place.
- Water Supply and Demand –manage water demand to prevent exceedances of DOE water rights. Water conservation goals are to be developed and implemented by October 2001.
- Waste Management –reduce waste generation. Percentage reductions for different waste types are to be achieved by December 2005.
- Wildfire –reduce the threat of a major wildfire impacting facilities, operations, and the environment.

Integrated Cultural and Natural Resources Management Plan for Los Alamos National Laboratory

The Integrated Cultural and Natural Resources Management Plan (referred to as IRMP in this document) is a plan in the earliest stages of development, presenting a vision of and justification for integration of resource-specific plans. A number of plans for specific resource areas, in particular biological resources, are still in process. As these underlying plans develop, so will the IRMP. The current draft is at a high level, setting the stage for integration and outlining an overall approach. One of the major contributions of the current draft is identification of operational plans and resource plans for Los Alamos National Laboratory (LANL) that either exist or are in development, setting the stage for integration. Subsequent versions of the plan will provide more detail on the integration process and on facility-specific plans. The facility plans will provide a mechanism to develop implementing actions that avoid conflict, maximize achievement of goals and objectives at the facility level, and maintain adherence to institutional goals and objectives.

This IRMP will become the vehicle for establishing institutional strategic objectives for stewardship of natural and cultural resources. Integrated Safety Management (ISM) will be the system used for promulgation and implementation of institutional strategic objectives (LANL 1998a). ISM is the Department of Energy (DOE) and University of California/Los Alamos National Laboratory (UC/LANL) approach to integrating environment, safety and health (ES&H) protection into the operations of LANL. The institutional expectations and the supporting goals, objectives, targets and decisions will be applicable at both the institutional and facility level.

The IRMP is not meant to encompass all resources at LANL since it does not include such resources as people, equipment, or infrastructure. Its focus is on maintaining or enhancing operations while minimizing environmental impacts. The underlying premise of the IRMP is that LANL has mission assignments, mission assignments take precedence, and mission assignments will be accomplished in the most feasible and environmentally sound manner. As the IRMP develops, it will establish the process for achieving that reality.

This IRMP will be the vehicle for DOE to establish resource management policy and institutional goals and to provide guidance to UC/LANL on that policy. LANL will then be responsible for implementing that policy and developing an implementation strategy. DOE will monitor progress on implementation.

1.0 Introduction

Historically, major resources at LANL were treated separately without consideration for integrated effects. Over time, changing regulations and requirements resulted in a series of natural and cultural resource specific studies that identified what changes were taking place, activities that lead to change, and steps to be taken to protect existing resources. Although LANL was meeting regulatory requirements, the existing project-by-project assessments and policy development did not necessarily lead to setting priorities among resources or improvements to

resource management plans. As the IRMP develops, LANL implementation will need to address this problem.

In 1996, DOE requested LANL management (DOE 1996) to establish and implement biological/natural resource management plans and other measures to fulfill DOE's natural resource stewardship responsibilities. DOE's Land and Facility Use Planning Policy (DOE 1994) states:

"It is the Department of Energy policy to manage all of its land and facilities as valuable national resources. Our stewardship will be based on the principles of ecosystem management and sustainable development. We will integrate mission, economic, ecologic, social, and cultural factors in a comprehensive plan for each site that will guide land and facility use decisions. Each comprehensive plan for each site will consider the site's larger regional context and be developed with stakeholder participation. This policy will result in land and facility uses which support the Department's critical missions, stimulate the economy, and protect the environment."

In 1997, DOE and LANL began an effort to develop a Natural Resources Management Plan (NRMP) to integrate management of ground water, surface water, biological resources, threatened and endangered species, fire, soil and geologic resources, and air quality with the intent to assist operations managers at LANL. Each resource has its own set of regulations and requirements including cultural (historic and archaeological) resources. Data gaps in understanding these resources and inter-relationships between resources were identified, new issues were brought to bear, and various solution paths were presented.

In 1999, DOE issued a Site-Wide Environmental Impact Statement (SWEIS) for the Continued Operation of Los Alamos National Laboratory, a Record of Decision (ROD), and a Mitigation Action Plan (MAP). The MAP is a DOE management document that identifies the potential environmental impacts of operating LANL at the level decided on in the ROD, the Expanded Operations Alternative, and the commitments made in the ROD to mitigate those potential impacts. The MAP establishes planned actions and schedules to carry out each commitment.

The SWEIS included a discussion of existing programs, plans, and controls built into operations at LANL that are mitigating influences. These programs and controls include operating within applicable regulations, DOE orders, contractual requirements, and approved policies and procedures. The DOE committed to additional measures to further mitigate impacts of continuing operations of LANL at the levels outlined in the ROD. The mitigation measures included enhancements of existing programs that would improve operational efficiency and minimize future potential impacts from LANL operations. Among the enhancements was the preparation of an Integrated Cultural Resources Management Plan (ICRMP) that included Traditional Cultural Properties (TCPs) and the NRMP. The NRMP included natural resource-specific plans, such as biological, threatened and endangered species, forest, ground water, wildfire, and air quality. The MAP acknowledged that individual natural resource-specific plans were in various stages of development; the NRMP was viewed as augmenting and integrating these other efforts.

The objective of the ICRMP was to manage, preserve, and protect cultural resources and TCPs using an integrated approach. The objective of the NRMP was to manage natural resources in a

fashion that directly supports DOE's Land and Facility Use Planning Policy by integrating mission, economic, ecological, social, and cultural factors in a comprehensive process for guiding land and facility use decisions at LANL. As these plans were being developed, DOE determined that combining the ICRMP and the NRMP (and the supporting resource-specific plans) into an IRMP was appropriate.

DOE's MAP for the SWEIS contains the following major milestones for completion of the IRMP:

- LANL to submit a Preliminary Draft IRMP to the Planning, Management, and Review Team (PMRT) – December 2000 (This milestone was delayed four months until April 2001 due to the Cerro Grande Fire).
- LANL to submit Final IRMP to the PRMT, including the implementation strategy – April 2002.
- LANL to begin implementation of the IRMP – October 2002.

This draft IRMP is divided into seven sections. A parallelism between discussions of operations undertaken to implement missions and discussions of resources potentially affected by those operations is maintained throughout the document. The first four sections introduce the IRMP and present its philosophy and purpose as well as the context in which it will be implemented. Section 2 outlines the purpose of the IRMP. Section 3 summarizes the geographic location of LANL and the history of operations. Section 4 presents an overview of the regional ecosystem and the resources expected to be integrated in the IRMP. Section 5 identifies existing operational plans and resource management plans that will be integrated into the IRMP. Section 6 presents the organizations involved in the IRMP planning development.

Section 7 discusses early concepts of implementation, including an identification of the resources and major missions for each management unit and presents preliminary institutional goals, based on the MAP. This section will be expanded in future drafts of the IRMP to describe processes for integrating the management of identified resources and achieving ongoing mission assignments as well as resolving possible conflicts between implementing actions. Finally, Section 7 presents a possible process by which the IRMP will be updated and revised in accordance with operational, regulatory, and/or environmental needs.

2.0 Purpose of IRMP

This IRMP is a comprehensive planning document designed to facilitate DOE's mission at LANL by building on existing programs and efforts. The IRMP will be the vehicle for DOE to establish resource management policy and institutional goals for LANL. LANL will then be responsible for implementing that policy. The goals will provide direction as to how various resources and their uses are to be managed consistent with mission assignments. The IRMP is a dynamic resource management approach that accommodates new or revised management needs, advanced resource information, and operational change as circumstances dictate.

The IRMP will become the institutional framework for managing mission needs and activities that may affect the environment while considering regional economic and social needs and accomplishing these tasks with minimal impact to the local environment. Based on a philosophy of mission accomplishment coupled with resource conservation, the IRMP will present an approach for assessing form, function, and significance of resources that may affect, or be affected by, implementation of program-specific activities, regulatory compliance, and effective resource stewardship as part of DOE's mission. Finally, as the IRMP evolves, an integrated basis for developing and improving institutional resource management policy that minimizes risk to both DOE's mission and local and regional resources will be provided.

The IRMP will improve

- institutional planning and the project implementation process (i.e., operational efficiency),
- regulatory review and the negotiation process (compliance),
- DOE and LANL's relationship (trust) with regulators, stakeholders, and the public,
- scientific understanding and management of DOE and LANL's natural and cultural resources, and
- DOE and LANL's understanding and management not only of impacts but of institutional and environmental risk factors.

By recognizing LANL as a component of a regional ecosystem, the IRMP contributes to regional resources management. It recognizes that LANL occupies only a part of the Pajarito Plateau ecosystem complex and that actions taken at LANL may affect regional ecosystem dynamics. The IRMP recognizes DOE's landholder responsibilities and it incorporates agreements reached through consultation with regional land managing agencies and owners. These include Bandelier National Monument, Santa Fe National Forest, Native American Pueblos, New Mexico State Agencies, the U. S. Fish and Wildlife Service, and the County of Los Alamos. The IRMP is intended to be compatible with resource management plans of contiguous land managing agencies and owners, insofar as compatibility is appropriate for the missions of different agencies.

3.0 LANL Operations

The following section discusses the geographic location of LANL and the history of operations. Information is drawn from the SWEIS for LANL and supporting documents (DOE 1999; LANL 1997).

3.1 Geographic Setting

LANL and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure 3.1). The 43-square-mile LANL site is situated on the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep east-to-west-oriented canyons cut by intermittent streams. Mesa tops range in elevation from approximately 7,800 feet on the flanks of the Jemez Mountains to about 6,200 feet at their eastern termination above White Rock Canyon and the Rio Grande. Plant communities on these mesas range from ponderosa pine forests on the flanks of the Jemez Mountains to piñon-juniper woodlands near the Rio Grande. The climate is moderate with relatively mild winters and summers.

Most LANL and community developments are confined to mesa tops. The surrounding land is largely undeveloped, and large tracts of land north, west, and south of LANL are administered by the Santa Fe National Forest, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County. The Pueblo of San Ildefonso borders LANL to the east (Figure 3.1).

LANL is divided into technical areas (TAs) that are used for building sites, experimental areas, waste disposal locations, etc. (Figure 3.2). However, these uses account for only a small part of the total land area. Over one-half of the total acreage has slopes whose grade exceeds 20 percent, making development very difficult. In addition, much of the area that could be developed is needed for security and safety buffers because of the work being performed. Therefore, of the 43 square miles, less than 25 percent is developed. Development is limited by steep slopes and by the need for security and safety buffers because of the work performed.

The DOE administers the area occupied by LANL and has the option to completely restrict public access. However, the public is currently allowed limited access to certain areas of LANL

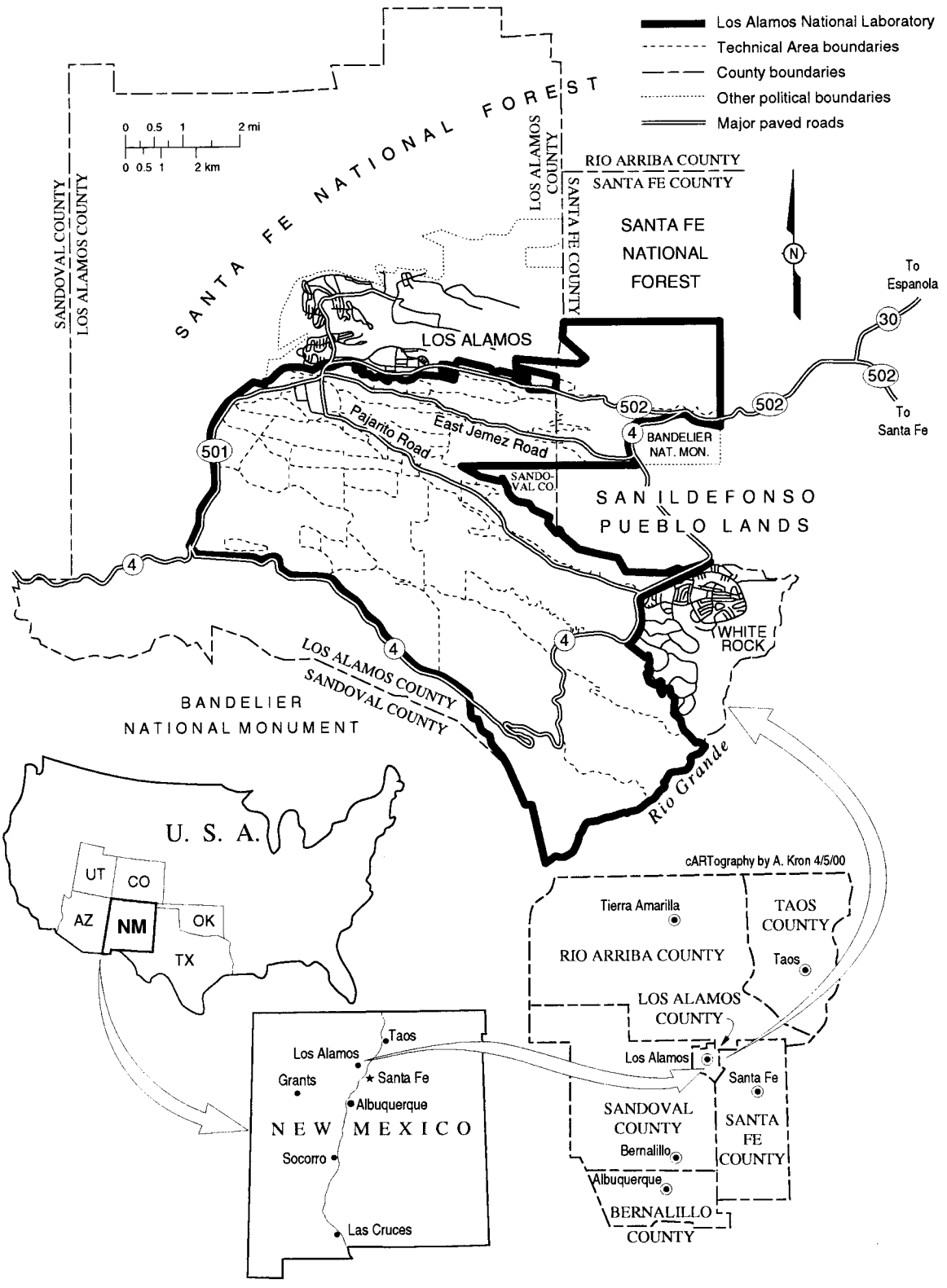

Figure 3.1 Location of LANL.

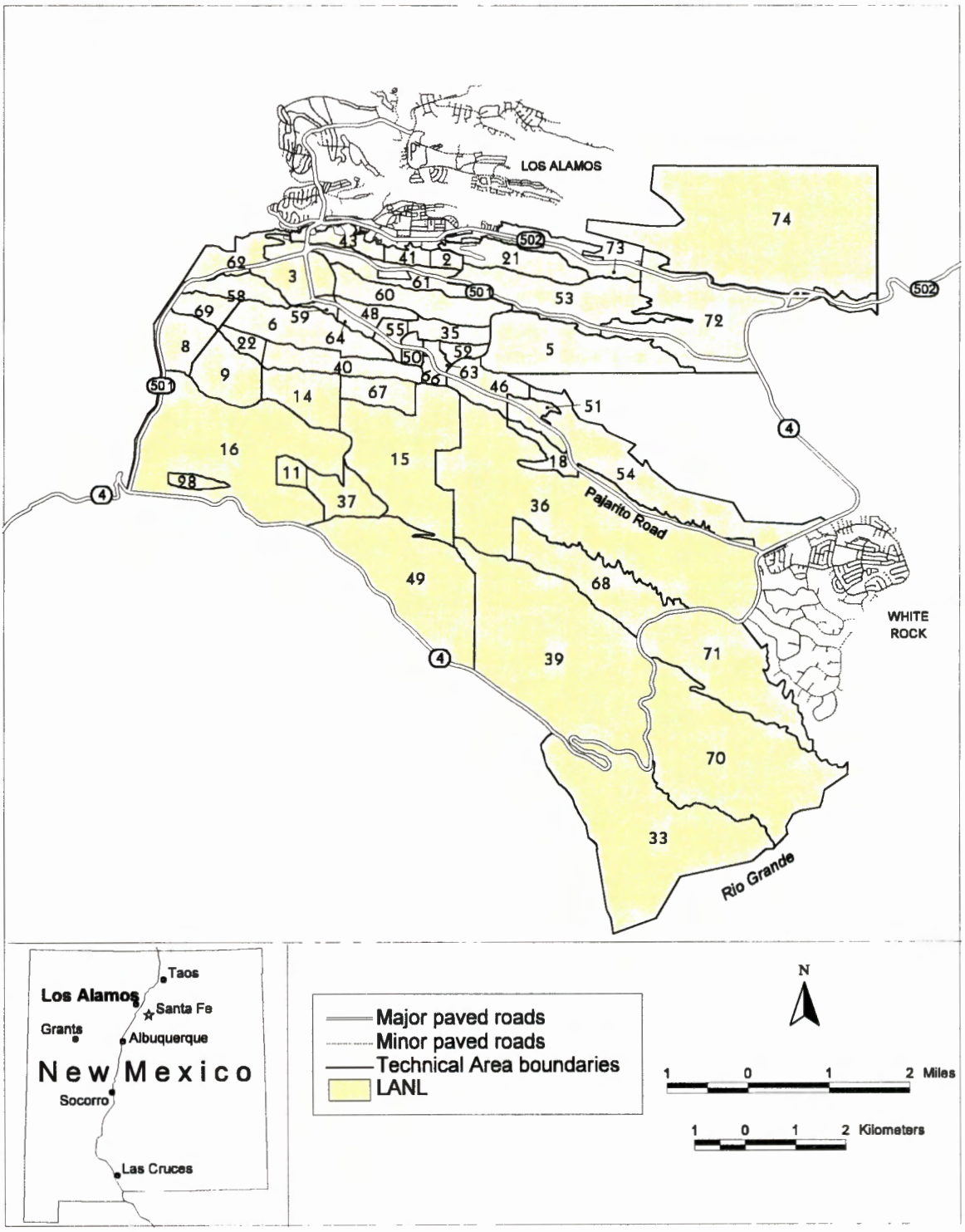

Figure 3.2 LANL technical areas.

3.2. Historic and Current Operations

3.2.1 The War Years (1942–1946)

During World War II, the main technical area (TA-1) of the Manhattan Project Site consisted of technical, administrative, and warehousing facilities and was constructed on about 25 acres around Ashley Pond and along the south side of the present Trinity Drive out to the edge of Los Alamos Canyon. By 1945, approximately 100 structures were in use. TA-1 was a large complex that combined features of both experimental research laboratories with industrial operations. Between 1943 and 1945, much of the theoretical, experimental, and production work involving the development of the atomic bomb took place in TA-1.

Some work was considered too dangerous to perform at TA-1 and was undertaken at remote locations. For example, the Omega Site (TA-2) was built to house experiments on integral assemblies. This work involved experiments to determine critical masses of fissionable material. In 1946, this work moved to TA-18. Alpha Site at TA-4, abandoned in the late 1940s, was used as a firing site to test high explosives (HE). Beta Site at TA-5 was used extensively in 1945 as a firing site for the pin or electric method of studying implosions. S-Site at TA-16 was developed for production of HE to be used in the various tests.

Many other sites developed during the war were used for a variety of purposes. Within LANL boundaries, many experiments were conducted that released or had the potential to release contaminants to the environment. LANL compiled detailed information on these sites under the auspices of the Environmental Restoration (ER) Project and is in the process of cleaning them up. Information regarding these sites can be found in "Comprehensive Environmental Assessment and Response Program, Phase 1: Installation Assessment, Los Alamos National Laboratory" (DOE 1986) and the subsequent "Installation Work Plan for Environmental Restoration" (LANL 1992).

Work at TA-1 involved a variety of radioactive and hazardous materials that required appropriate disposal. Radioactive materials handled included tritium, curium, uranium, phosphorus, polonium, thorium, radium, cesium, strontium, and americium. Hazardous materials handled included lithium hydride, beryllium, mercury, iodine, trisodium phosphate, ammonium sulfate, various acids (such as hydrochloric, nitric, perchloric, hydrofluoride, and orthophosphoric), and various types of organic compounds. In addition, regular office activities, routine nonhazardous waste operations, and the townsite generated nonhazardous waste.

Two major disposal areas were established to accept these wastes. Nonhazardous waste was disposed in an area located adjacent to and under portions of the existing airport. This dump consisted of a burning area and landfill. Hazardous and radioactive wastes were disposed in separate disposal areas at or adjacent to TA-21.

Other waste areas were established adjacent to remotely located facilities. In addition, testing conventional ammunitions resulted in impact areas that contained unexploded ordnance. These areas, which contain what is termed "legacy" contamination, are now being evaluated for potential risk to human health and the environment, and, when appropriate, are being cleaned up

and restored by the ER Project under the oversight of the Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED).

3.2.2 Postwar Development (1947–1960)

As originally planned, the sole purpose of the Manhattan Project Site was to develop the atomic bomb, and the War Department planned to dismantle the site upon completion of this project. However, at the end of the war, distrust of the Soviet Union and the US government's need for developing and maintaining a nuclear arsenal resulted in the establishment of a permanent nuclear weapons research and design entity at Los Alamos. The facility was soon designated as Los Alamos Scientific Laboratory, a name that lasted until the early 1980s, when it was changed to Los Alamos National Laboratory (LANL) upon being designated as one of several multipurpose national laboratories. Immediately following World War II, work concentrated on refining the design of fission weapons.

During the late 1940s and early 1950s, operations in TA-1 were slowly moved to South Mesa across Los Alamos Canyon. TA-3, the new home for most of these operations, became one of the largest and most complex technical areas in LANL. Easy access to TA-3 was provided in late 1951 by the open-spandrel, steel-arch bridge that spans Los Alamos Canyon.

The first new facility built at TA-3 was the Van de Graaff Laboratory complex, which included a vertical machine for accelerating particles (and later a horizontal machine), followed by construction of the Chemistry and Metallurgical Research (CMR) Building. The CMR Building was designed to be the major laboratory for investigating plutonium chemistry and metallurgy and the properties of other materials, such as uranium, tritium, and other radionuclides. The next facilities built were warehouses. Thereafter, a flurry of building activity occurred during which the administration building, the cryogenics complex, the shops/fabrication building, and the Physics Building were constructed. By the mid-1950s, construction started on the Sigma Complex, and most operations had been moved from TA-1 to TA-3. TA-1, however, lingered on for a number of years as operations continued in some of the buildings—in some cases, into the early 1960s.

In 1957, Area G (TA-54) was opened to replace the trenches used at TA-21 for radioactive waste disposal. Burial and storage units at Area G include pits, shafts, trenches, and pads of varying dimensions. Area G remains in operation today. Also located at TA-54 are Area H, built between 1959 and 1963 for disposal of uncontaminated classified material; Area J, used for disposal of equipment wastes that require administrative control (i.e., may have minute quantities of HE contamination); and Area L, used for chemical disposal from 1964 to 1975.

During the spring and summer of 1945, construction started on TA-21 and structures were built for chemical and metallurgical work. This site, as developed and used over the years, is informally divided into two main sections: DP West and DP East. DP West was built to replace D Building at TA-1. D Building could not safely handle large quantities of plutonium. DP East was built to process polonium and to produce initiators. Plutonium work continued at TA-21 until late 1977 or early 1978, when these operations moved to TA-55. TA-21 was one of the few technical areas that was not moved south of Los Alamos Canyon during the 1950s and 1960s.

3.2.3 Modern Configuration (1961–Present)

LANL continued to evolve as an active research and development institution; however, construction of new facilities started to decline in 1961, and most new construction was confined to remodeling existing structures to accommodate new applications. A major exception was the construction of a new technical area, TA-55, during the 1970s and creation of a consolidated "plutonium corridor" in the central portion of LANL along Pajarito Road. Other new buildings of interest include the Plutonium Processing Facility at TA-55, the accelerator physics building at TA-53, the Weapons Engineering Test Facility at TA-16, the Materials Science Laboratory at TA-3, and the Strategic Computing Center at TA-3 (currently under construction).

Because LANL's mission assignments have continued to expand into areas other than nuclear weapons research, by the late 1980s, considerable thought was being given to land use planning. By 1990, LANL had developed a planning model that proposed building on and strengthening existing development patterns to achieve effective functional working relationships between major programs, taking into account compatibility of land uses. In this planning model, TA-3 and its immediate environs remain the administrative and functional center of LANL. Emanating from this area are three main development corridors, each with its own major programmatic emphasis: East Jemez Corridor, Pajarito Corridor, and West Jemez Corridor.

The East Jemez Corridor consists of the Los Alamos Meson Physics Facility—now the Los Alamos Neutron Scattering Center (LANSCE)—Sigma Mesa, and East Jemez Road. LANSCE is devoted primarily to accelerator-related experimental science; Sigma Mesa is proposed for administrative, technical, and physical support functions; and East Jemez Road is reserved for physical support functions and primary access to LANL. The Pajarito Corridor is used primarily for nuclear materials research and development, fusion and laser research and development, waste management, and other multipurpose experimental science. The West Jemez Corridor is used for weapons engineering and dynamic testing.

Satellite support and service areas for LANL administrative and technical support functions were planned for each of the three main development corridors. Satellite sites might also be used for physical support functions. Facilities providing cafeterias, wellness centers, and other employee services might also be located in these areas. All such satellites require expansion areas to permit the phased, planned growth of facilities as funding permits.

In 1999, DOE revised the requirements for a Comprehensive Site Plan (CSP), adding an environmental planning element. The 2000 edition of the CSP split the three planning areas noted above into 10 planning units, but the approach remained largely the same (LANL 2000).

LANL currently consists of approximately 2,043 structures. Of these, 1,835 are buildings, which contain about 7.3 million square feet. The other structures consist of meteorological towers, water tanks, manholes, small storage sheds, electrical transformers, etc.

4.0 LANL Resources

The following section discusses the regional ecosystem encompassing LANL and resources specifically at LANL. Information is drawn from the SWEIS for LANL and supporting documentation (DOE 1999; LANL 1997; LANL 1998b; LANL 1999).

4.1 Regional Ecosystem

Administrative boundaries do not necessarily coincide with ecological boundaries. LANL facilities, infrastructure, operations, and impacts (positive, negative, and undetermined) are immersed in the patterns and processes of a complex regional landscape making up the Pajarito Plateau. Major habitat types and canyon systems are continuous across this plateau, which encompasses jurisdictional boundaries of LANL, Bandelier National Monument, Santa Fe National Forest, Native American Pueblos, and other land management stewards. Seasonal migration routes for elk and deer and foraging or hunting ranges of black bears and mountain lions cross these jurisdictional boundaries.

Because of this ecological continuity and "interconnectedness" of patterns of vegetation and wildlife populations, along with ecological processes that shape and sustain them, the "site" to be managed by this IRMP must be considered in its context as part of a larger regional ecosystem. Two landscape-based organizational themes may be used to place this larger regional ecosystem into perspective: watershed units and major vegetation zones.

4.1.1 Watersheds

The regional LANL ecosystem has been defined to include eight major watersheds as shown in Table 4.1, each of which has significant tributaries. Guaje Canyon bounds this regional ecosystem on the north, Frijoles Canyon on the south, the crest of the Jemez Mountains on the west, and the Rio Grande on the east. Because of their downstream hydrologic connection to LANL and the functional boundary of Cochiti Dam, the White Rock Canyon stretch of the Rio Grande and Cochiti Lake are also included in this regional ecosystem.

Watersheds draining the Jemez Mountains and Pajarito Plateau are tributaries of the Rio Grande, which is the fifth largest watershed in North America. Approximately 11 miles of LANL's eastern boundary borders on the rim of White Rock Canyon or descends to the Rio Grande. The riverine, lake, and canyon environment of the Rio Grande as it flows through White Rock Canyon makes a major contribution to the biological resources and significantly influences ecological processes of the LANL region.

Table 4.1 Watersheds and Main Tributaries

Watersheds[a]	Major Tributaries to the Watershed[b]
Los Alamos	Los Alamos
	Pueblo
	Barrancas
	Bayo
	Rendija
	DP
	Guaje
Mortandad	Ten-Site
	Mortandad
	Cañada del Buey
	Cedro
Water	Cañon de Valle
	S-Site (Martin)
	Potrillo
	Fence
	Indio
Sandia	Sandia
Pajarito	Pajarito
	Threemile
	Starmer
	Twomile
Ancho	North Ancho
	South Ancho
Chaquehui	Chaquehui
Frijoles	Frijoles

[a] These watersheds drain the Pajarito Plateau, some portion of DOE property, and discharge to the Rio Grande.
[b] Many of these tributaries receive surface flow from other, lesser, named and unnamed, tributaries.

4.1.1.1 Canyons

From their narrow, thickly forested beginnings on the flanks of the Jemez Mountains, to their confluence with the Rio Grande, major canyons are associated with the eight major watersheds. The plateau canyons range in depth from about 200 to 600 feet. The steeply sloping, north-facing canyon walls and canyon bottoms are shadier and cooler and have higher levels of humidity and soil moisture than the often nearly vertical, south-facing canyon walls, which are sunnier, hotter, and more arid. These differences in slope, aspect, sunlight, temperature, and moisture cause a dramatic localized shift in major vegetation zones on canyon walls and in canyon bottoms beyond their typical range of elevation. This "canyon-effect" is responsible for fingers of coniferous forest extending down regional canyons.

Surface water flow occurs in canyon bottoms seasonally, or intermittently, as a result of spring snowmelt and summer rain. A few short sections of riparian vegetation of cottonwood and willow and other water-loving plants are present in scattered locations on LANL as well as along the Rio Grande in White Rock Canyon. The relatively abundant moisture concentrated between the temperature moderating canyon walls allows a diverse array of plant and animal species to

exist in these canyons at elevations that exceed the normal upper and lower elevation limits for these species.

Wildlife is abundant and diverse in the canyons. The canyons contain a more complex mix of habitats than the adjacent mesa tops and provide nest and den sites, food, water, and travel corridors. Mammals and birds are especially evident in these environments.

4.1.1.2 Wetlands

The majority of the wetlands in the LANL region are associated with canyon stream channels or are present on mountains or mesas as isolated meadows containing ponds or marshes, often in association with springs or seeps.

A 1990 survey (based on interpretation of aerial photographs) identified a total of 39 acres of wetlands within LANL boundaries. A 1996 field survey by LANL personnel identified an estimated 50 acres of wetlands within LANL boundaries, based on presence of wetland vegetation (hydrophytes). The LANL survey determined that more than 95 percent of identified wetlands are located in the Sandia, Mortandad, Pajarito, and Water Canyon watersheds.

Currently, about 13 acres of wetlands within LANL boundaries are caused or enhanced by process effluent wastewater from National Pollutant Discharge Elimination Systems (NPDES)-permitted outfalls. In 1999, the effluent from NPDES outfalls, both storm water and process water, was estimated to have contributed 317 million gallons to wetlands within LANL boundaries. Nearly half of the NPDES outfalls at LANL are probable sources of drinking water for large mammals. Effluents are being reduced through a program of outfall reductions. It is expected that some wetlands will shrink and perhaps disappear entirely over time.

4.1.2 Major Vegetation Zones

While watersheds traverse all or part of the elevational gradient, major vegetation zones are organized into elevation- and aspect-defined bands across this gradient. Increasing temperature and decreasing moisture along the 12-mile wide and 5,000-foot elevational gradient from peaks of the Jemez Mountains to the Rio Grande result in formation of six vegetative zones. The six vegetation zones that characterize this regional ecosystem are montane grasslands, spruce-fir forest, mixed-conifer forest (with aspen forest), ponderosa pine forest, piñon-juniper woodland, and juniper savannah.

The montane grassland, spruce-fir, and mixed conifer vegetation zones are located primarily west of LANL with little representation on LANL proper. The vegetation zones and associated ecotones provide habitat, including breeding and foraging territory, and migration routes for a diversity of permanent and seasonal wildlife.

4.2 Resources for Integration

The resources included here are those that have high potential to be affected by LANL's operations and facilities or those that have high potential to affect LANL's operations and facilities. In each case, the potential impacts are discussed. Resources that have a lower potential to be affected by LANL's operations, such as geology, are not included in this draft of the IRMP.

4.2.1 Air

The quality of ambient air is defined by federal and state regulations. EPA has set National Ambient Air Quality Standards for pollutants of nationwide concern. These pollutants, known as criteria pollutants, are carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, and particulate matter. The area around LANL is classified as an attainment area for all six criteria pollutants.

The State of New Mexico has also established ambient air quality standards. DOE and LANL operations meet all state standards.

4.2.1.1 Radiological Air Quality

Individuals are continuously exposed to airborne radioactive materials. These materials come primarily from natural sources such as radium and its daughters, including radon. However, some LANL operations result in release of radioactive materials to air from point sources such as stacks and vents or from non-point (or area) sources such as dispersed radioactive contamination in soils. The concentration of radionuclides in point-source releases is continuously sampled or estimated based on knowledge of materials used and activities performed. Radionuclide emissions from LANL point and non-point sources include several radioisotopes such as tritium, uranium, strontium-90, and plutonium.

The largest contributors to LANL radiological point-source emissions are LANSCE and the tritium operations (TA-21 and TA-16). LANL non-point sources of radiological emissions include fugitive emissions from the LANSCE, the PHERMEX facility at TA-15, the dynamic testing facility at TA-36, and low-level radioactive waste disposal at Material Disposal Area G located at TA-54.

4.2.1.2 Non-Radiological Air Quality

LANL operations can result in release of non-radiological air pollutants that may affect the air quality of the surrounding region. Construction activities and other operations will continue to release small amounts of criteria pollutants and other regulated substances to the atmosphere. These are not expected to exceed ambient air quality standards nor approach levels that could affect human health. Operations will also release small quantities of toxic pollutants, including carcinogenic pollutants, to the atmosphere.

Criteria pollutants released from LANL operations are emitted primarily from combustion sources such as boilers, emergency generators, and motor vehicles. Toxic air pollutant emissions from LANL activities are released primarily from laboratory, maintenance, and waste management operations. Unlike a production facility with well-defined operational processes and schedules, LANL is a research and development facility with great fluctuations in both types of chemicals emitted and emission rates.

DOE has a program to review all new operations for potential to emit toxic air pollutants. Because reviews demonstrate that LANL's toxic air pollutant emissions are below the state's permitting threshold limits, DOE is not required to monitor LANL's toxic air pollutant emissions.

4.2.2 Water

Water is a limited resource in the semiarid climate of northern New Mexico. Canyon-bottom streams within LANL boundaries are mostly dry and only portions of some streams contain water year-round. Flash floods can occur following thunderstorms. Sediments moved by storm water events from upstream locations, hillsides, or mesa tops occur along the bottom of most LANL canyons, and flash floods move these sediments from the canyon bottoms into the Rio Grande.

4.2.2.1 Surface Water

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but volume is generally insufficient to maintain surface flows across the LANL site before they are depleted by evaporation, transpiration, and infiltration. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages. Effluents from sanitary sewage, industrial water treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances. Surface water within LANL boundaries is not a source of municipal, industrial, or irrigation water, but is used by wildlife that live within, or migrate through, the region.

Storm water and associated sediment transport are the major mechanisms by which contaminants are transported within and beyond LANL boundaries. Therefore, management efforts to reduce contaminant migration in the canyons at LANL have historically focused on these transport mechanisms.

4.2.2.2 Ground Water

LANL and the surrounding communities use ground water for drinking water supplies. Water levels in wells penetrating into the regional aquifer have declined in response to pumping, typically by several feet each year.

Like surface water, the presence of ground water is variable. Bodies of ground water can occur near the ground surface in canyon bottom alluvium, perched or trapped above less-permeable rocks below. They can also occur at deeper levels, perched or trapped above less-permeable rocks, forming ground water bodies referred to as intermediate perched ground water. The size and location of these perched ground water bodies are under investigation and are not fully known.

The main aquifer is the only body of ground water in the region sufficiently saturated and permeable to transmit economic quantities of water to wells for public use. All drinking water for Los Alamos County, LANL, and Bandelier National Monument comes from the main aquifer. Depth to water in the main aquifer, from the ground surface, varies from approximately 1,200 feet along the western boundary of the Pajarito Plateau to approximately 600 feet along the eastern edge of the Pajarito Plateau.

Water in the main aquifer is under artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande. The source of recharge to the aquifer is presently under

investigation. Recent results of a major, multiyear hydrogeologic study have indicated that there is significant ground water recharge along the flank of the Jemez Mountains and there may be more ground water recharge from canyon bottom alluvial ground water than previously believed. LANL contaminants have been found in perched zones above the regional aquifer and in the regional aquifer as a result of characterization wells. Work continues to increase understanding of the hydrogeologic conditions.

4.2.3 Soils

Several distinct soils have developed in and around LANL as a result of interactions between bedrock, topography, and local climate. Soils that formed on mesa tops include the Carjo, Frijoles, Hackroy, Nyjack, Pogna, Prieta, Seaby, and Tocal soil series. All of these soils are well drained and range from very shallow (0 to 10 inches) to moderately deep (20 to 40 inches), with the greatest depth to the underlying Bandelier Tuff being about 40 inches.

Construction activities at LANL can displace these soils, and run-off from parking lots and buildings can cause erosion. In addition, surface contamination can result from open detonations at the firing sites, or from deposition of contaminants released to the atmosphere from building vents and other operations.

4.2.3.1 Soil Monitoring

A soil sampling and analysis program at LANL, as mandated by DOE Orders 5400.1 and 5400.5, provides information on concentration and distribution of radionuclides in soils near LANL. Soil samples are collected from on-site, perimeter, and off-site locations. Additionally, background soil samples are collected from regional stations that are located in three major surface water drainages surrounding LANL (Rio Chama and Embudo, Cochiti and Bernalillo, and Jemez). These background stations are located over nine miles from LANL, which is considered beyond the range of potential influence from normal LANL operations.

Data from these samples show that average concentrations of tritium, strontium-90, cesium-137, plutonium-239, plutonium-240, americium-241, and gross alpha and beta activity in soils collected from perimeter stations were not significantly different than radionuclide concentrations and activity in soil samples collected from regional background locations. In contrast, the average levels of uranium (3.12 micrograms per gram), plutonium-238 (0.015 picocurie per gram), and gross gamma activity (4.1 picocuries per gram) were significantly higher than uranium (1.84 micrograms per gram), plutonium-238 (0.004 picocurie per gram), and gross gamma (3.4 picocuries per gram) in background soils. Although average levels of uranium and gross gamma activity in perimeter soils were significantly higher than background, they were still within the regional statistical reference level (RSRL) of 4.05 micrograms per gram and 7.3 picocuries per gram, respectively. The RSRL is the average background concentration plus twice the standard deviation of the mean from data collected over a 21-year period.

4.2.3.2 Soil Erosion

Soil erosion can have serious consequences to maintenance of biological communities and is also a mechanism for moving contaminants across LANL and off site. Soil erosion rates vary considerably on mesa tops at LANL, with highest rates occurring in drainage channels and areas

of steep slopes and lowest rates occurring on gently sloping portions of the mesa tops away from channels.

A study performed at Bandelier National Monument suggests that erosion rates are high across widespread portions of local piñon-juniper woodlands, which are found on the eastern portion of LANL. Another study found that light summer rain storms in 1993 resulted in erosion of more than 12 tons per acre of soil. The current annual soil erosion rate in Bandelier National Monument is estimated to be 36 tons per acre. Areas where runoff is concentrated by roads and other structures are especially prone to high erosion rates. High erosion rates appear to be relatively recent, most likely resulting from loss of vegetative cover, decreased precipitation, past logging practices, and past livestock grazing.

4.2.4 Biological

Though operations at LANL are not expected to result in significant impacts to biological resources, ecological processes, or biodiversity (including threatened and endangered species), operations will continue to release small quantities of contaminants, disrupt natural migration routes, or otherwise disturb local environs.

The lands within and around LANL have diverse, unique biological communities having complex ecological relationships. Plant communities range from urban landscaping to grasslands, wetlands, shrublands, woodlands, and mountain forest, which provide habitat for a wealth of animal life. This richness of animal life includes elk and deer, bears, mountain lions, coyotes, rodents, bats, reptiles, amphibians, invertebrates, and a myriad of resident, seasonal, and migratory bird life. In addition, threatened and endangered species of concern and other sensitive species use LANL resources. Because of restricted access to LANL lands and management of contiguous Bandelier National Monument for natural biological systems, much of the region provides a refuge for wildlife.

The inter-fingering of deep, steep-sided canyons with narrow mesas that descend the east slopes of the Jemez Mountains and an inversion of normal altitudinal distribution of vegetation communities along the canyon floors result in many transitional overlaps of plant and animal communities and increased biological diversity. This dominant feature of the Pajarito Plateau, in combination with an elevational gradient of about 5,000 feet from mountain ridges to the Rio Grande, has made a major contribution to species richness and diverse ecological relationships that characterize the Pajarito Plateau.

Wetlands, mostly restricted to the bottoms of these canyons, provide habitat for reptiles, amphibians, and invertebrates and potentially contribute to overall habitat requirements of the Mexican spotted owl, southwestern willow flycatcher, and spotted bat, all of which are federal- or state-listed species, or both. Wetlands also provide habitat, food, and water for many common species such as deer, elk, small mammals, and many migratory birds and bats.

4.2.4.1 Wildlife

LANL's lands support a diversity of wildlife ranging from state- and federal-listed threatened and endangered species to large and small game populations. A number of regionally protected and sensitive species of concern have been documented on or near LANL's lands. These consist

of two federal-listed endangered species, two federal-listed threatened species, and 18 species of concern (species that may be of concern to US Fish and Wildlife Service but do not receive protection under the *Endangered Species Act*). Operations at LANL may impact these species by removal of key habitat, disturbing these species during breeding seasons, altering hunting and foraging areas, etc. Conversely, these species may impact operations by requiring certain areas to remain undisturbed and restricting the locations for new facilities.

4.2.4.2 Forest

There are three forest types that occupy the majority of LANL acreage: piñon-juniper woodlands, ponderosa pine, and spruce fir forests. Each of these forest types has it own characteristics; however, they all three show effects of fire suppression over the last hundred years coupled with restrictions in grazing by domestic livestock. The most obvious effects have been an increase in overall tree stand densities, continuity, and fuel loading with a concomitant decrease in understory cover. The heavily forested areas have dense stands of unhealthy trees with excessive amounts of standing and fallen dead tree material.

In the last 50 years, this region has seen five major wildfires: the Water Canyon Fire in 1954, the La Mesa Fire in 1977, the Dome Fire in 1996, the Oso Fire in 1998, and the Cerro Grande Fire in 2000. In each case, fire occurred during the late spring, early summer fire season when fire danger was high or extreme. Weather conditions were hot and dry, fuel moisture content was low, and fuel loads were high. Even after these five fires, overall conditions across the Pajarito Plateau are still conducive to wildfire, and as fuel loads regenerate in the burned areas, the probability of the next fire event increases.

4.2.5 Cultural

Cultural resources are any prehistoric or historic sites, buildings, structures, districts, or other places or objects (including biota of importance) considered to be important to a culture, subculture, or community for scientific, traditional, or religious purposes, or for any other reason. They combine to form the human legacy for a particular place. The cultural resources present within the LANL region are complex because of great cultural diversity in the inhabitants of this region. As structure and physical environment of the Jemez Mountains and Pajarito Plateau changed over time, cultures changed in response, as reflected in settlement patterns and technology that evolved over time.

The cultural resources present within LANL boundaries and the region have been classified into three categories: prehistoric, historic, and TCPs. These three categories of cultural resources are protected variously under state and federal laws, regulations, and executive orders.

4.2.5.1 Prehistoric

Prehistoric cultural resources refer to any material remains and items used or modified by people before establishment of a European presence in the upper Rio Grande Valley in the early seventeenth century. Socio-historical time lines have been developed based on changes in settlement patterns and subsistence strategies as reflected by cultural material remains.

Archeological surveys have been conducted of approximately 75 percent of the land within LANL boundaries (with 60 percent of the area surveyed receiving 100 percent coverage) to identify cultural resources. The majority of these surveys emphasized prehistoric American Indian cultural resources. Information on prehistoric cultural resources is maintained in the LANL cultural resources database, which is a listing of the cultural resources identified through surveys and excavations recorded over the last decade. The database is organized primarily by site type and records 1,295 prehistoric sites. Of the 1,295 prehistoric sites in the LANL database, 1,192 have been assessed for potential nomination to the National Register of Historic Places (NRHP). Of these, 770 sites are eligible, 322 sites are potentially eligible, and 100 sites are ineligible. The remaining 103 sites, which have not been assessed for NRHP eligibility, are assumed to be eligible until a determination has been made.

4.2.5.2 Historic Period

Historic cultural resources include all material remains and any other physical alteration of the landscape that has occurred since the arrival of Europeans in the region. The historic resources present within LANL boundaries and on the Pajarito Plateau can be attributed to three phases: Spanish Colonial, Early U.S. Territorial/Statehood, and the Nuclear Energy Period. Because of the very well-defined changes in the function of LANL, the Nuclear Energy Period is further broken into three periods: World War II/Early Nuclear Weapon Development, Early Cold War, and Late Cold War. A systematic survey of the Historic Period resources present within LANL boundaries is underway.

4.2.5.3 Traditional Cultural Properties

A TCP is a significant place or object associated with historical and cultural practices or beliefs of a living community that is rooted in that community's history and is important in maintaining the continuing cultural identity of the community. TCPs are essential in preserving cultural identity through social, spiritual, political, and economic uses.

An area may have TCP significance depending upon a variety of factors, e.g., the site is remembered in prayers or tribal stories, traditional ritual knowledge of the site is passed on to other members of the community, or traditional customs continue to be practiced by members of a community. TCPs that are considered culturally important by traditional communities include shrines, trails, springs, rivers, acequias, plant and mineral gathering areas (also referred to as ethnobotanical sites), traditional hunting areas, ancestral villages and gravesites, and petroglyphs. However, TCPs are not limited to ethnic minority groups. Americans of every ethnic origin have properties to which they ascribe traditional cultural value.

Within LANL's boundaries, there are ancestral villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas that could be identified by Pueblo and Athabascan communities as TCPs. DOE and LANL have a program in place to manage on-site cultural resources for compliance with the *Native American Graves Protection and Repatriation Act* and *American Indian Religious Freedom Act*. When an undertaking is proposed, DOE and LANL arrange site visits by tribal representatives with San Ildefonso, Santa Clara, Jemez, and Cochiti Pueblos to solicit their concerns and to comply with applicable requirements and agreements. Provisions for coordination among these four Pueblos and DOE is contained in formal agreements called

Accords that were entered into in 1992 for the purpose of improving communication and cooperation among federal and tribal governments. According to the DOE compliance procedure, American Indian tribes may request permission for visits to sacred sites within LANL boundaries for ceremonies.

5.0 Operations and Environmental Resources Management Plans

This section summarizes current operations management plans at LANL and environmental resource management plans. The summary includes identification of purpose and status for each of the plans.

5.1 Operations Plans

All work at LANL is conducted within the framework established by the institutional operations management plans. Table 5.1 identifies the hierarchy of these plans and their relationships and establishes the context in which the IRMP will manage the relationship between operations and the environment.

5.2 Environmental Resources Plans

Environmental operations, like all operations, function within the above framework. LANL has an active environmental monitoring program and publishes an annual environmental surveillance report (ESR). The ESR assesses emissions data from LANL operations and includes major pathways of concern (air, water, food, etc.) to humans and the local environs. LANL has a major environmental restoration effort underway to address historic releases of contaminants to the environment and expects to have all this contamination removed to safe levels within the next decade. LANL also has an environmental protection and regulatory compliance program to ensure operations are staying within federal and state laws, rules, and regulations, and to identify problem areas and determine what corrective actions should be taken.

In support of these programs, several resource management plans have been written and are coupled with the CSP (shown in Table 5.1) for long-term planning for new construction and better utilization of existing facilities. Table 5.2 identifies these resources management plans in context with the five major resources identified in Section 4 requiring integration. These plans are in various stages of development.

Table 5.1 Summary of Institutional Operations Management Plans

Annual Institutional Plan	Notes
Purpose, Scope, and Status	The LANL Institutional Plan is an integrated, single-document summary of LANL's internal plans and their connections to the DOE Agreement with the President, the DOE Strategic Plan of 1997, and various roadmaps of the Department. This document meets the DOE Institutional Planning requirement as well as the Institutional Planning requirements in the contract between DOE and UC for managing LANL. The links among the Department plans and roadmaps, LANL's Strategic Plans, LANL's program plans, and the infrastructure and support plans are more clearly visible because they are summarized in one document.
Relationship to Other Plans	Provides an overview of the various plans used to direct operations at LANL. It has no direct connection to the resource management plans.
Party(ies) Responsible for Implementation	Science and Technology Base Programs Planning Team prepares this document for the Directors Office.
Management Unit	Major LANL Directorates.
Data Gaps/Issues Analyses	Yet to be determined.
Potential Enhancements	Yet to be determined.
Strategic Plan	**Notes**
Purpose, Scope, and Status	The 1999 LANL Strategic Plan (1999–2004) presents the five-year objectives and strategies established to address a wide range of potential futures while meeting near-term programmatic commitments. The Strategic Plan identifies how LANL will accomplish its programmatic requirements in stockpile stewardship, nonproliferation and arms control, environmental restoration, and basic and applied research addressing civilian needs. It also establishes strategies to prepare LANL for unpredictable, emerging challenges by ensuring a strong and diverse science base. Further, the plan sets strategies to strengthen LANL's partnerships with other first-rate science and engineering institutions.
Relationship to Other Plans	The Strategic Plan is supported by six major operational plans: Nuclear Weapons, Threat Reduction, Strategic and Supporting Research, Community Relations, Financial, and Workforce.
Party(ies) Responsible for Implementation	Science and Technology Base Programs Planning Team prepares this document for the Directors Office.
Management Unit	Major LANL Directorates.
Data Gaps/Issues Analyses	This plan was last updated in 1999.
Potential Enhancements	Yet to be determined.
Tactical Plan	**Notes**
Purpose, Scope, and Status	1996 LANL Tactical Plan was prepared to present tactical goals and plans for 11 major areas of concern. This plan was last updated in 1998.
Relationship to Other Plans	The 11 goals and plans addressed by the Tactical Plan are 1. Safety First! 2. Productivity and Strategic Business Development 3. Embrace Diversity 4. Corporate Citizenship 5. Science-Based Stockpile Stewardship and Management 6. The Neutron Laboratory 7. The Plutonium Future 8. Reducing the Threat of Nuclear, Biological, and Chemical Proliferation and Terrorism 9. Integrated Environmental Science 10. Modeling, Simulation, and High-Performance Computing 11. The Genome and Beyond

Table 5.1 (Con't.)

Tactical Plan (Con't.)	Notes
Party(ies) Responsible for Implementation	Science and Technology Base Programs Planning Team prepared this document for the Directors Office.
Management Unit	Major LANL Directorates.
Data Gaps/Issues Analyses	Yet to be determined.
Potential Enhancements	Yet to be determined.
Comprehensive Site Plan	**Notes**
Purpose, Scope, and Status	The CSP presents the institutional vision for the physical system of LANL within a 10-year planning period and identifies improvements essential to achieving progress; issues that may affect progress; and the planning process used to guide progress toward the vision. CSP 2000 was updated in 2000 and is supposed to be updated annually.
Relationship to Other Plans	All proposed new facilities or modifications to existing facilities are reviewed for *National Environmental Policy Act* (NEPA) requirements, but the CSP itself has no specific relationship to any of LANL's resource management plans. The CSP supports LANL's Institutional Plan, which presents the Lab's programmatic structure for accomplishing LANL's mission, and the LANL Strategic Plan. It does so by proposing development actions necessary to meet the requirements of both plans.
Party(ies) Responsible for Implementation	Site Planning and Architecture (PM-1) develops and updates the CSP and implements the planning process. All LANL organizations provide input to planning process.
Management Unit	Ten planning units, including 1. Core (i.e., TA-3) 2. Pajarito Corridor West 3. Pajarito Corridor East 4. LANSCE Mesa 5. Experimental Engineering 6. Dynamic Testing 7. Sigma Mesa 8. Omega West 9. Rio Grande Corridor 10. Land Transfer Area
Data Gaps/Issues Analyses	Yet to be determined.
Potential Enhancements	None.
Installation Work Plan	**Notes**
Purpose, Scope, and Status	The Installation Work Plan (IWP) presents to NMED LANL's human health and ecological risk-based approach to investigating and remediating Potential Release Sites (PRSs), using land use (e.g., industrial, recreational, or residential) as the driver for establishing levels of allowable residual risk. Addresses LANL's 2,124 PRSs. Updated annually. Most recent update was submitted to DOE and NMED in 3/00; next update to be submitted in 3/01.

Table 5.1 (Con't.)

Installation Work Plan (Con't.)	Notes
Relationship to Other Plans	The IWP states that investigations of impacts on the regional aquifer will be conducted in accordance with LANL's Hydrogeologic Work Plan. The IWP was revised in 3/00 to reflect the ER Project's adoption of a watershed/aggregate approach to investigating PRSs. This approach facilitates ecological risk assessment. The watershed/aggregate approach was derived from LANL's Watershed Management Plan (WMP).
Party(ies) Responsible for Implementation	ER Project.
Management Unit	Watersheds and aggregates. Aggregates are subsections of watersheds and are typically individual canyons within a watershed. The boundaries of aggregates are typically defined so that there is a surface water monitoring station at each of the upper and lower boundaries.
Data Gaps/Issues Analyses	None.
Potential Enhancements	None.

Table 5.2 Summary of Institutional Resources Management Plans

Air	
Air-Shed Management Plan	**Notes**
Purpose, Scope, and Status	There is no institutional air-shed management plan. Air Quality (ESH-17) utilizes quality plans to assure that processes are in place to identify and review all proposed new LANL operations, or modifications to existing LANL operations, for their impacts on air quality.
Relationship to Other Plans	None
Party(ies) Responsible for Implementation	Air Quality (ESH-17)
Management Unit	None
Data Gaps/Issues Analyses	None
Potential Enhancements	None
Water	
Watershed Management Plan	**Notes**
Purpose, Scope, and Status	The WMP will establish a framework from which to implement an enhanced surface water-monitoring network, and to focus management attention on aspects of the watershed system that could lead to contaminant transport. The WMP will accomplish its goal by providing a framework for intra-Laboratory communication and coordination; establishing a Laboratory-wide information system where all watershed protection data will be stored and available across LANL; and conducting additional surface water monitoring to reduce data gaps and uncertainties. The draft WMP was issued in 1999; the final WMP is expected to be issued in late 2001.

Table 5.2 (Con't.)

Water (Con't.)	
Watershed Management Plan (Con't.)	**Notes**
Relationship to Other Plans	Data collected under the WMP supports compliance demonstrations by the ER Project, the Environmental Surveillance Program, and the NPDES storm water program.
Party(ies) Responsible for Implementation	The following organizations are all represented on the Watershed Integration Team and have the following responsibilities: Water Quality and Hydrology (ESH-18) – takes the lead in developing and updating the WMP. Implements the WMP. Hazardous and Solid Waste (ESH-19) – provides guidance on development of surface water protection indices. Ecology (ESH-20) – contributes biological and natural resources data for canyons and wetlands. ER Project – integrates ER investigations with the WMP. Earth and Environmental Sciences (EES) Division – contributes data from field investigations. Project Management Division – contributes information on construction projects' design, scope, and schedule.
Management Unit	Watersheds. Of the 14 watersheds making up the regional ecosystem, eight such watersheds traverse LANL lands: LA/Pueblo Sandia Mortandad Pajarito Water/Canon de Valle Ancho Chaquehui Frijoles
Data Gaps/Issues Analyses	Erosion Management – data on effectiveness of large-scale Best Management Practices (e.g., piñon-juniper thinning). Pajarito Plateau Partnership – develop a Pajarito Plateau Watershed Management Plan in collaboration with all partners (by 2001) and collaborate with partners to implement the plan. Database Development – develop database to store all watershed data. Monitoring Station Construction, Operation, and Maintenance – install new monitors where necessary to develop sufficient information to meet data quality objectives.
Potential Enhancements	Yet to be determined.

Table 5.2 (Con't.)

Water (Con't.)	
Ground Water Protection Management Program Plan and Hydrogeologic Work Plan (Con't.)	**Notes**
Purpose, Scope, and Status	The final Ground Water Protection Management Program (GWPMP) Plan and Hydrogeologic Work Plan was issued in 1996 in accordance with DOE Order 5400.1, and its purpose is to assure long-term protection of local and regional ground water resources through enhanced ground water monitoring and program documentation. The Plan describes ground water quality and quantity; presents LANL's management program for ground water protection and remediation, including development of a conceptual model for ground water flow, and surveillance of contamination sources; and presents a plan for integrating ground water-related activities of different LANL environmental programs. The Hydrogeologic Work Plan is the implementing document for the GWPMP Plan. It was issued in 1996, and describes activities to be conducted to characterize the hydrogeologic setting beneath LANL and refine the conceptual model. It also describes activities to be undertaken to enhance LANL's ground water monitoring program. LANL's progress on implementing both the GWPMP Plan and the Hydrogeologic Work Plan is summarized annually in the Ground Water Annual Status Summary Report.
Relationship to Other Plans	The Installation Work Plan, which is the governing document for ER Project activities, states that ground water investigations will be conducted in accordance with the Hydrogeologic Work Plan. The implementation of the WMP, which describes the activities to be conducted to characterize surface water flow and erosion, results in collection of data that will be used to refine LANL's conceptual model for ground water recharge and flow.
Party(ies) Responsible for Implementation	Water Quality and Hydrology (ESH-18) – develop the GWPMP Plan and issue annual reports; conduct surveillance monitoring at the monitoring wells being installed in the regional aquifer. ER Project – install all regional monitoring wells described in the Hydrogeologic Work Plan and collect samples for characterizing the nature and extent of contamination in ground water. LANL Ground Water Integration Team – coordinates activities presented in the Hydrogeologic Work Plan to meet the needs of all LANL programs that work with ground water.
Management Unit	Nine ground water aggregates, including 1. Pueblo, Los Alamos, and Sandia Canyons; Los Alamos and DP Mesas; and Mesita de Los Alamos. 2. Cañada del Buey and Pajarito Canyon; Mesita del Buey. 3. Frijoles Mesa. 4. Ancho and Chaquehui Canyons; the mesa top containing TA-33 and TA-39. 5. Cañon de Valle, Three Mile Mesa, and the mesa top containing TA-16. 6. Potrillo, Fence, and Water Canyons; Three Mile Mesa; and Lower Frijoles Mesa. 7. Mortandad Canyon. 8. Rendija, Guaje, Barrancas, and Bayo Canyons. 9. Regional (i.e., site-wide). These management units are roughly correlated to watersheds used as management units by the WPM and by the IWP.

Table 5.2 (Con't.)

Water (Con't.)	
Ground Water Protection Management Program Plan and Hydrogeologic Work Plan (Con't.)	**Notes**
Data Gaps/Issues Analyses	The conceptual model on recharge and flow of ground water will not be available until all regional aquifer and perched aquifer monitoring wells are installed and monitoring data has been collected for several cycles.
Potential Enhancements	Yet to be determined.
Soils	
Soils Management Plan	**Notes**
Purpose, Status, and Scope	There is no institutional soils management plan. Ecology (ESH-20) uses guidance on soil resource management found in two references (LA-6779-MS, 1978; and LA-10262-M, 1986) to guide activities of the soils monitoring team.
Relationship to Other Plans	None.
Party(ies) Responsible for Implementation	Ecology (ESH-20)
Management Unit	None.
Data Gaps/Issues Analyses	None.
Potential Enhancements	None.
Biological	
Biological Resources Management Plan	**Notes**
Purpose, Scope, and Status	The Biological Resources Management Plan (BRMP) will present management measures to minimize risk to both LANL's mission and regional ecosystems by actively planning and managing natural resources. Some specific ecological/operational problems addressed are erosion and contaminant transport, ecorisk management, forest/wildfire management, vehicle collisions, and other human/wildlife conflicts. The BRMP is in the early stages of development. A data collection and analysis effort has been undertaken to identify and fill data gaps, and a management action plan will be developed, in which management plans will be developed for specific management units. The BRMP is scheduled to be ready for implementation by late 2002.
Relationship to Other Plans	The BRMP will provide high-level guidance for implementation of the Threatened and Endangered Species Habitat Management Plan (HMP) and Wildfire Hazard Reduction Project Plan (WHRPP). It will also interface with the ICRMP; WMP (erosion and contaminant transport); and provide the foundation for the institutional ecological risk approach (ecological risk management).
Party(ies) Responsible for Implementation	Ecology (ESH-20) – develop BRMP; conduct special studies to fill data gaps.
Management Unit	Not defined.
Data Gaps/Issues Analyses	Research is needed in a number of areas to fill data gaps, including quantitative habitat analysis; biocontaminants; wildlife monitoring; forest fuels and vegetation inventory; and habitat manipulation related to soils and contaminant transport.
Potential Enhancements	Yet to be determined.

Table 5.2 (Con't.)

Biological (Con't.)	
Threatened and Endangered Species Habitat Management Plan (Con.t.)	**Notes**
Purpose, Scope, and Status	The HMP provides protection to federal-listed threatened or endangered species residing on or using LANL property, while facilitating implementation of DOE's mission at LANL. HMP issued in 1998. Covers three threatened and four endangered species.
Relationship to Other Plans	The HMP interfaces with the other biological plans such as the WHRPP and is an integral part of the BRMP. It also identifies sensitive species involved with the Institutional Ecological Risk Approach (ecological risk management).
Party(ies) Responsible for Implementation	Ecology (ESH-20) – develop and update HMP; develop and update species-specific Site Plans; develop and execute monitoring plans; conduct *Endangered Species Act* compliance reviews for operational activities with potential for significant threatened and endangered species impacts. Facility Managers – assure that activities within FMU conform to Site Plan requirements.
Management Unit	Species-specific Areas of Environmental Interest for • Mexican spotted owl • southwestern willow flycatcher and • bald eagle.
Data Gaps/Issues Analyses	Based on new maps being generated for vegetative land cover following the Cerro Grand Fire, the HMP and/or Site Plans may need adjustment. Any listings or delistings since 1998 will be addressed.
Potential Enhancements	Yet to be determined.
Wildfire Hazard Reduction Project Plan	**Notes**
Purpose, Scope and Status	The WHRPP will identify tracts of forest at LANL to receive primary treatment during the next three years to reduce the risk of wildfire, and maintenance treatment thereafter. The Plan will describe the tract-specific prescriptions, schedules, and identify environmental constraints. A draft Plan was issued in late January 2000, and the final Plan will be issued in the Spring.
Relationship to Other Plans	The WHRPP will use input from several plans in determining treatment areas and schedules. These include the HMP and ICRMP.
Party(ies) Responsible for Implementation	Ecology (ESH-20) is responsible for developing the Plan, and Facility Managers are responsible for its execution.
Management Unit	FMUs.
Data Gaps/Issues Analyses	Yet to be determined.
Potential Enhancements	Yet to be determined.

Table 5.2 (Con't.)

Cultural	
Integrated Cultural Resources Management Plan	**Notes**
Purpose, Scope, and Status	The ICRMP will provide a set of guidelines for managing and protecting cultural resources, in accordance with requirements of the *National Historic Preservation Act*, the *Archaeological Resources Protection Act*, and the *American Indian Religious Freedom Act*, and in the context of LANL's mission. *Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites* issued in 8/00; this plan presents a framework for collaborating with ethnic groups in identifying TCPs and sacred sites. ICRMP due to be complete in 2004. Will be updated every five years after issuance.
Relationship to Other Plans	HMP, which may limit access to certain cultural resources sites.
Party(ies) Responsible for Implementation	Ecology (ESH-20) – draft strategy for TCP and sacred site consultation. Develop and update ICRMP. Evaluate proposed operational activities for potential impacts to cultural sites. Facility Managers – assure that activities conform to ICRMP requirements.
Management Unit	None. Cultural resources typically occupy small, discrete areas.
Data Gaps/Issues Analyses	ICRMP is in developmental phase and should be issued in 2004.
Potential Enhancements	Yet to be determined.

5.3 Integrated Safety Management System

Integrated safety management (ISM) is the single ES&H management system that sets ES&H policy for all people performing work at LANL. ISM is official LANL policy that is to be followed by the entire workforce. Implementation of ISM is included as a contractual requirement in the current UC/DOE contract. The system is described in the Integrated Safety Management Description Document (LANL 1998a).

ISM is a system for performing work safely and in an environmentally responsible manner. The term "integrated" is used to indicate that the safety and environmental management system is a normal and natural element of the performance of work. ISM is a comprehensive, systematic approach for setting, implementing, and sustaining the execution of safety and environmental expectations for LANL. The IRMP and the supporting individual resource-specific plans (identified above) are mechanisms for implementing ISM and are applicable at the institutional and facility levels. The goals and objectives of the IRMP should become expectations under ISM. In addition, the goals and objectives from the individual supporting plans may also become institutional expectations. Similarly, resource-specific plans that are still under development, such as the BRMP, will be implemented through the ISM system.

LANL's ES&H policy states that "we will never compromise safety or security for operational needs and we are committed to achieving excellence in environment, safety, and security performance." Fundamental to ISM is that all work will be performed safely while meeting the applicable institutional-, facility-, and activity-level requirements. The ISM system, through its requirements (Laboratory Performance Requirements [LPRs] and Laboratory Implementing Requirements [LIRs]), places expectations on the functioning of these facility-level controls. These expectations are derived from the work smart standards (WSS) adopted by LANL and DOE for controlling hazards. The WSS, LPRs, and LIRs also provide expectations for work activities within a facility that do not involve the facility itself. These expectations are met using the safe work practices work-control process, which embeds the five-step process in its work and worker authorization process.

To achieve this integration of the three levels of expectations and controls, LANL has tools that provide the necessary communication between the levels. The ISM requirements system, with its LPRs and LIRs, gives the high-level expectations for the protection of workers, the public, and the environment derived from the WSS set. The Facility Safety Plans communicate the expectations at the facility level. The Hazard Control Plans communicate the expectations at the activity level.

Application of the core functions to the environment requires additional considerations beyond those applied to worker safety. These additional requirements come from a subtle but significant difference between how hazards can directly affect a worker and how hazards may affect the environment. Some activities may generate very minor exposures of the environment to hazardous materials or energy. For any single activity, these exposures cause little or no harm. A modest negative environmental effect by a single activity that does not stress the environment beyond its natural, self-healing capability may not need to be prevented or controlled. However, should many activities cause a similar effect, and should the accumulation of all those activities

overwhelm the environment's self-healing capability or exceed a regulatory or permit limit, then the activities need to be controlled to prevent or mitigate the negative effects. Cost-effective controls or mitigators are to be found and applied in these instances just as for worker protection. In many instances, the cost-effective controls will be institutional in nature, as compared to activity specific (e.g., discharge limits for facilities and waste minimization goals for LANL).

6.0 Development of the IRMP

Although an IRMP had been in development since 1997, the requirement to prepare such a plan in the SWEIS MAP provided a formal structure and a set of calendar milestones for planning. A number of organizations have been involved in the development of this draft IRMP.

6.1 Planning, Management, and Review Team

The MAP called for establishment of a tripartite PMRT representing the Los Alamos Area Office (LAAO), the Albuquerque Operations Office, and LANL. In accordance with the MAP milestone, the PMRT was established by October 1999 and held several meetings to discuss approaches to the IRMP.

As its name implies, the PMRT was established to provide guidance on development of the IRMP and to ensure the IRMP accomplishes its requirements of assisting DOE managers in establishing resource management policy and providing institutional goals and tools to LANL's operations managers who are responsible for implementing that policy.

The MAP included a milestone calling for the preparation of a Work Plan for the development of the IRMP, due to DOE on December 1999. Following guidance from the PMRT, the IRMP Work Plan was submitted as scheduled. The work plan specified how the required IRMP for LANL would be developed. It identified the proposed scope of the IRMP and provided a schedule for completion of the IRMP. It identified those areas where additional information would be needed before completion of the IRMP and provided a roadmap to ensure completion of the IRMP within the timeframe required by the SWEIS MAP. It also recognized that the IRMP would be a living document that will evolve as more information becomes available on the ecosystems within and surrounding LANL.

Following the IRMP Work Plan, the PMRT developed the annotated outline used to develop the IRMP.

6.2 Steering Committee

LANL established a Steering Committee in October 1999 to provide advice, recommendations, and insight from operational, facility planning, and environmental support organizations at LANL. The Steering Committee includes the members of the PRMT. The Steering Committee's purpose is to

- Establish an institutional approach to integrating IRMP components (e.g., air, water, soils, and biological and cultural resources),
- Identify existing weaknesses in the IRMP components and help formulate technical approaches to filling data gaps,
- Improve the decision-making process for resource management while ensuring that Laboratory mission and needs are met, and
- Serve as a communication tool for enhancing information flow between support organizations and operational organizations at LANL.

During FY00, the Steering Committee met and heard presentations on existing and proposed plans, with the following presentations:

- Scope and Status of Plan
  - Identify whether or not the plan exists, and, if not, the anticipated date of completion. If the plan exists, identify its current stage of development and the anticipated date of completion.
  - Outline the major topics addressed by the plan, what the plan is expected to accomplish, and major goals and milestones that will be met to reach that endpoint.
- Relationship to Other Plans
  - Identify how this plan will fit with each of the other plans.
  - Identify the benefits of this approach and how this leads to accomplishment of the integration of resource management.
- Data Gap/Issues Analysis
  - Identify what major concerns still exist, what data are missing, and what other items should be addressed that have not been previously addressed or dismissed.
  - Explain why it is important to collect these data or solve these issues and how this will augment or expand the utility of the approach.
- Recommendations for Enhancement/Issue Resolution
  - Clearly state what needs to be accomplished and why.
  - Make recommendations for sequencing work needs.

The Plans that were reviewed included

- Threatened and Endangered Species Habitat Management Plan (Complete)
- Biological Resources Management Plan (The draft is expected in 2002 and the final in 2003.)
- Ground Water Management Plan (Complete)
- Watershed Management Plan (In Progress)
- Integrated Cultural Resources Management Plan (In Progress)
- Comprehensive Site Plan (Complete)

Air Quality and Soils currently do not have plans. No decisions have been made on whether these plans are necessary.

6.3 Senior Advisory Team

LANL established a Senior Advisory Team to assist in evaluation of selected studies proposed for filling data gaps. The following criteria were used in selection of specialized studies to be accomplished concurrently with the preparation of the IRMP:

- Fill data gaps,
- Address stakeholder concerns and DOE commitments, and
- Assist compliance with regulatory drivers.

6.4 Natural Resources Science Team

LANL established a Natural Resources Science Team in the fall of 2000, with a goal of ensuring process-based understanding and science-based management of natural resources. The team's purpose is to

- ensure integrated science-based stewardship of LANL's natural resources to help protect the vitality of LANL by addressing vulnerabilities related to natural resources management; and
- serve as an advisory group for Integrated Resources Management and its associated natural resource management programs, e.g., biological resources, watershed management, and ground water protection.

6.5 Interagency Organizations

The IRMP relates to the management of resources on DOE/LANL administered land. However, the Plan recognizes that LANL occupies only a part of the Pajarito Plateau ecosystem complex and that actions taken by LANL may affect neighboring lands. These include lands administered by the US Forest Service (Santa Fe National Forest), the Park Service (Bandelier National Monument), and Bureau of Indian Affairs (San Ildefonso and Santa Clara Pueblos).

A number of interagency organizations have been created to foster cooperation. Among these are the following:

The East Jemez Resource Council was established in 1999 with a goal of maintaining and enhancing the natural and cultural resources of the East Jemez Mountains so that they may be sustained and appreciated by current and future generations. DOE/LAAO, Santa Fe National Forest, US Fish and Wildlife Service, and Bandelier National Monument signed the Agreement establishing the Council. Others attending meetings include San Ildefonso, Cochiti, and Santa Clara Pueblos, NMED, New Mexico State Forestry Division, and New Mexico Department of Game and Fish.

In 1999, when the WPM was in development, regional landowners and managers with a common interest in the water quality of the Pajarito Plateau established the Pajarito Plateau Watershed Partnership. The partnership's mission is to protect, improve, and/or restore water quality in this watershed. Toward this end, the partnership is preparing a multi-agency program and plans to identify and resolve the primary regulatory and stakeholder issues affecting water quality. Partnership members include Bandelier National Monument, San Ildefonso Pueblo, Santa Clara Pueblo, Los Alamos County, NMED, Santa Fe National Forest, DOE, and UC/LANL.

The Interagency Wildfire Management Team was formed in 1996 to provide fire control advice and a forum to exchange expertise and information among land stewards in the East Jemez region. The Team was cited with having a significant role in coordinating responses to the Cerro Grande fire, the devastating fire that swept across the Pajarito Plateau and LANL in May 2000. The Team has representatives from LANL, DOE, Los Alamos County Fire Department, the Pueblo of San Ildefonso, the State of New Mexico, and other interested parties.

Cochiti Lake Ecological Resources Team was formed in 1999 with a final Memorandum of Understanding between the US Army Corps of Engineers, Bandelier National Monument, DOE/LAAO, US Geological Survey, US Fish and Wildlife Service, NM Game and Fish, Cochiti Pueblo, US Forest Service, and LANL. The Cochiti Lake Ecological Resources Team assists the US Army Corps of Engineers in mitigating resource impacts along the lands administered by other entities within the area of the reservoir pool. The team serves as an interagency forum for discussing issues pertaining to the status or management of physical, biological, and recreational resources in the vicinity of Cochiti Lake and White Rock Canyon.

7.0 Approach to Implementation

This section discusses early concepts of implementation. The SWEIS analysis presents a baseline of operations and impacts on resources. The IRMP will build on that baseline, using the current FMUs at LANL as the organizing structure. Resources and major missions of each management unit are discussed in this section, and preliminary institutional goals, based on the SWEIS MAP, are presented.

7.1 SWEIS Baseline

The IRMP recognizes the baseline environmental envelope established for LANL through the SWEIS by DOE as the starting point for integration of operations and resources.

The SWEIS evaluated operations at LANL for the preferred alternative (Expanded Operations) and determined that emissions from these operations (at the anticipated levels) did not result in unacceptable impacts to the local environs. The SWEIS specifically addressed major resources of interest to the IRMP (air, water, soil, biological, and cultural) and the effects of each major operation on each specific resource. Thus, as long as emissions and operational parameters stay within the limits evaluated in the SWEIS, by definition, unacceptable impacts to existing resources do not exist.

The SWEIS analysis was limited to existing information and provided a "snap shot" in time. The IRMP will use the SWEIS as a baseline and will augment the SWEIS by gathering information regarding existing and future operational impacts (as well as appropriate mitigation measures) as part of operational implementation. As more information becomes available through the implementation of the IRMP, managing both operations and associated impacts will be improved.

LANL initiated a program to evaluate actual operations against SWEIS projections and publishes this data in an annual SWEIS Yearbook. Each yearbook focuses on operations during one calendar year and specifically addresses the following:

- facility and/or process modifications or additions,
- types and levels of operations during the calendar year,
- operations data for Key Facilities, and
- site-wide effects of operations for the calendar year.

These data are used to demonstrate compliance with or deviations from projections.

Three actions may change the environmental baseline. First, impacts from ongoing operations may exceed projections. Second, impacts from new operations may not fit within existing parameters. Finally, new information from ongoing environmental studies may determine the existence of previously unknown impacts. In all three cases, the appropriate adjustment will be made at the FMU level to maintain uniformity in approach.

A tool being developed for the ongoing NEPA compliance program will greatly assist with problem identification in resource allocation. Laboratory-wide water use and electric power

consumption are two major issues not captured by the existing NEPA process. A forward-looking additive tool is being developed to evaluate anticipated use so that allocations of these (and other) limited resources can be made to proposed projects. This tool will not only assist in resource allocation, but should identify potential resource shortfalls in time to make critical program adjustments.

7.2 Management Units

As with all resource plans at LANL, some concept of subdividing the 43 square miles is needed for implementation. Years ago LANL established a concept of a TA for administrative purposes. TAs were set up to facilitate administration of related functions, enhance security, provide safe distances between dynamic experiments, and isolate various program elements. Much of the land in many of these TAs is undeveloped to provide a buffer for security, safety, and possible expansion.

Some TAs (such as firing sites) required a great deal of space to protect people from shrapnel and other energetic releases. Other TAs (such as locations where nuclear-weapon-like assemblies are made) require isolation from public view for security purposes. Still, other TAs require ready access to neighboring TAs in which related activities are conducted (e.g., to minimize movement of hazardous materials). LANL lands are divided into 47 separate TAs.

The Facility Management program, initiated by LANL in 1996, established a different approach to organizing LANL's 43 square miles. An FMU is defined as a group of structures, systems, and equipment that are related by function or activity or are located contiguously and that serve a particular purpose, capability, or mission need. There are currently 17 FMUs (Figure A-1 in the Appendix). As can be seen from the map, three FMUs (#80-Facility and Waste Operations-Utilities and Infrastructure, #70 – Engineering Science Applications, and #67-Dynamic Testing) contain the majority of open/buffer land. A fourth FMU, #61, is responsible for the mesa on which the LANSCE is located. A fifth FMU, #64-Facility and Waste Operations-Solid Waste Operations, is responsible for solid waste disposal. The remaining 12 FMUs are designated to include only buildings and support structures, without any surrounding open space, and therefore, do not contain wetlands, prehistoric cultural resources, or wildlife habitat of concern.

LANL's divisions "own" facilities, and division management is accountable for maintenance of building operational safety envelopes and for maintenance management. Thus, management units used by the Facility Management program not only capture the LANL entity responsible for open lands, but also the facility owners within any given land unit.

Unique management units, or geographic differentiation of the 43 square miles of LANL, have been designated for many of the different resource management plans that have been prepared for LANL. Plans for natural resources use units that are consistent with the media or resource the plan addresses. For example, water protection plans look at watersheds; air plans would look at airsheds; the HMP looks at areas that contain habitat for specific threatened and endangered species. The program for wildfire risk reduction has selected management units based on FMUs. The CSP uses 10 planning areas as the management unit. There is some consistency of these 10 planning management units with FMUs, but there is not a complete overlap.

At this point in the evolution of the IRMP, the FMUs (as defined above) will be the management unit for this plan. The FMUs represent reasonably consistent missions/programs and are administratively definable. Guidance on managing natural resources within the constraints of mission requirements can be developed in cooperation with a responsible, accountable division. Each FMU will be provided with a specific plan for the resources of that unit. Some FMUs will have little or no resources that need to be managed, while others with significant open space, such as the Dynamic Testing division, will have many resources requiring a far more detailed plan.

7.2.1 Major Missions and Operations per Management Unit

DOE's principal missions are

- National Security – This mission includes the safety and reliability of the nuclear weapons in the stockpile, maintenance of the nuclear weapons stockpile in accordance with executive directives, and stemming the international spread of nuclear weapons materials and technologies.
- Energy Resources – This mission includes research and development for energy efficiency, renewable energy, fossil energy, and nuclear energy.
- Environmental Quality – This mission includes treatment, storage, and disposal of DOE wastes; cleanup of nuclear weapons sites; pollution prevention; storage and disposal of civilian radioactive waste; and development of technologies to reduce risks and reduce cleanup costs for DOE activities.
- Science – This mission includes fundamental research in physics, materials science, chemistry, nuclear medicine, basic energy sciences, computational sciences, environmental sciences, and biological sciences.

Support activities to each of these departmental missions are performed at LANL, with a special focus on national security. DOE assigns mission elements to LANL based on the facilities and expertise of the staff located there.

The existing facilities and areas of expertise at LANL have evolved since its inception in the early 1940s. In particular, LANL has developed facilities and expertise to perform

- Theoretical research, including analysis, mathematical modeling, and high-performance computing,
- Experimental science and engineering, ranging from bench-scale to multi-site multi-technology facilities (including accelerators and radiographic facilities), and
- Advanced and nuclear materials research, development, and applications, including weapons components testing and fabrication and stockpile assurance, replacement, surveillance, and maintenance (including theoretical and experimental activities).

These capabilities allow LANL to conduct research and development activities such as HE processing, chemical research, nuclear physics research, materials science research, systems analysis and engineering, human genome "mapping," biotechnology applications and remote sensing technologies applied to resource exploration and environmental surveillance.

Table 7.1 displays the current FMUs, primary missions, and capabilities.

Table 7.1 FMUs, Primary Missions, and Capabilities

FMU	Division*	Primary Mission	Capability
61	LANSCE	National Security/Science	Linear Accelerator
63	CCS	National Security/Science	Computing
64	FWO	Environmental Quality	Waste Management
65	NMT-CMR	National Security/Science	Chemical Analysis; Actinide Processing
66	C	National Security/Science	Chemistry
67	DX	National Security	HE Testing
70	ESA	National Security	HE Processing
71	ESH	Environmental Quality	ESH expertise
72	B	Science	Biological Research
73	MST	National Security/Science	Materials Fabrication; Materials Science
74	NIS-18	National Security	Criticality Experiments
75	NIS-33/35	National Security/Science	Remote Sensing Experiments
76	NMT-55	National Security/Science	Pit Manufacturing; Actinide R&D
77	P	National Security/Science	Physics Research
80	FWO-UI	All missions	Utilities and Infrastructure
81	FWO-DF	All Missions	Waste Management related
85	FWO-D	All Missions	Decontamination and Decommissioning

*Divisions

LANSCE – Los Alamos Neutron Science Center
CCS – Computer and Computational Sciences
FWO-WFM – Facilities and Waste Operations- Solid and Liquid Waste
NMT-CMR – Nuclear Materials Technology - Chemistry and Metallurgy Lab
C – Chemistry
DX – Dynamic Experiments
ESA – Engineering Science Applications
ESH – Environment, Safety and Health
B – Biology
MST – Materials Science and Technology
NIS – Nonproliferation and International Security
NMT-55 – Nuclear Materials Technology – Plutonium Facility (TA-55)
P – Physics
FWO-UI – Facilities and Waste Operations – Utilities and Infrastructure
FWO-DF – Facilities and Waste Operations – Diversified Facilities (support)
FWO-D – Decontamination and Decommissioning

7.2.2 Resources per Management Unit

Each management unit is intimately linked to a set of resources, and the interface between operations and resources varies depending upon characteristics of each (e.g., resource sensitivity to ongoing operations). In addition, resources also interface with each other adding additional complexity to the overall process of resource management.

This section introduces each resource with a site-wide map showing the distribution of each resource overlain with the FMU boundaries. A brief discussion accompanies each map to explain relevant features of the resource. As the IRMP evolves, additional details of resources for each FMU will be added.

7.2.2.1 Watersheds

There are nine major watersheds crossing LANL property as depicted in Figure A-2. (Section 4 noted that there are eight major watersheds. The watershed in Bayo Canyon crosses LANL and feeds into Los Alamos watershed beyond LANL boundaries. Therefore, for the purpose of describing watersheds that are influenced by LANL operations, Bayo is included here.) These watersheds effectively divide LANL into regions of influence from the standpoint of contaminant transport, and mostly isolate contaminants to a specific drainage system. Though the air pathway between watersheds may transport contaminants, once these contaminants have settled to the land surface, the most common transport mechanism becomes sediment transport via surface water flow. These watersheds also influence the various wetlands, floodplains, and vegetation types found within LANL.

7.2.2.2 Wetlands and Floodplains

Floodplains and wetlands on LANL property are mostly restricted to canyon bottoms as shown in Figures A-3 and A-4. Floodplains are a canyon bottom phenomena at LANL, and are established by the seasonal thundershowers that can result in significant localized rainfall. These storm events may cause flooding in one isolated canyon with neither of the adjacent canyons having storm water flow.

Since LANL is in a desert environment, most of the wetlands are human-caused and depend on NPDES outfall discharges or releases from sewage treatment facilities for water support. Wetlands are mostly restricted to the canyon bottoms, but may occur on mesa tops where sufficient water exists on a yearly basis.

7.2.2.3 Storm Water Gauging Stations

Figure A-5 identifies the locations of all storm water gauging stations at LANL. As would be expected, these stations are located in the canyon bottoms or drainages to canyon bottoms.

7.2.2.4 NPDES Outfalls

LANL has actively eliminated NPDES outfalls. By the end of 1999, only 21 regulated outfalls remained. Total discharge from these outfalls was conservatively estimated at about 317 million gallons of water in 1999. Locations of these outfalls are shown in Figure A-6.

7.2.2.5 Vegetation Types

A variety of vegetation types exist at LANL, mostly defined by piñon-juniper, ponderosa pine, or mixed conifer forests. As shown in Figure A-7, the north-facing walls of the canyon systems at LANL provide sufficient moisture to allow higher elevation vegetation types to extend as long

fingers down these canyon systems. Please note that this map represents vegetation types before the Cerro Grande Fire in 2000. Maps of the post-fire land cover are still in preparation.

7.2.2.6 Fire Roads and Firebreaks

Wildfire is recognized as an important concern of resource management, and the reduction of wildfire hazard is one of the mitigation measures identified by the SWEIS. Figure A-8 identifies what fire roads and firebreaks currently exist. Information on fuel loading (post-Cerro Grande Fire) will be included in this map when it is available.

7.2.2.7 Threatened and Endangered Species

Figure A-9 identifies those locations that contain either critical habitat or buffer zones for identified threatened and endangered species at LANL. Any disturbance of these areas will require interface with the United States Fish and Wildlife Service. The map displays pre-Cerro Grande Fire data; as field surveys provide revised data, the maps will be updated.

7.2.2.8 Migration Corridors (Large Animals)

As large animal populations (elk and deer) increase, there is a concomitant increase in traffic accidents with these animals. This becomes a safety issue for employees and other persons traveling the roadways within LANL boundaries. Figure A-10 identifies known migration corridors, pre-Cerro Grande Fire. These routes will be updated to reflect post-fire data.

7.2.2.9 Utilities (Power Corridors, Major Roads, Etc.)

Figure A-11 displays the existing utility corridors, roads, and support structures on LANL property. This information is important for land use planning purposes in identifying availability of these services to proposed new construction activities.

7.2.2.10 ER Potential Release Sites

Historic contamination is recognized as a problem at LANL. Knowledge of the locations of these PRSs will assist in planning new facilities and in avoiding potential contamination issues with ongoing or new activities. Figure A-12 identifies the locations of known PRS.

7.2.2.11 Cultural Resources

LANL occupies an area that is extremely rich in both prehistoric cultural resources and historic cultural resources. Figure A-13 presents the density of locations of such resources. Any activity within these areas will require special attention to cultural resource issues and constraints imposed by the presence of these resources.

7.3 Goals and Objectives

Goals and objectives are important elements of a resource management plan. However, the IRMP is a plan still in the earliest stages of development. A number of the plans for specific resource areas, in particular biological resources, are still in process. Goals and objectives will

be part of these underlying resource-specific plans; if they are expected to affect the majority of LANL, they may be incorporated into the goals and objectives of this IRMP. In addition, the IRMP will need to develop several processes for reviewing implementing actions and identifying and resolving or avoiding conflicts, such that the overall goals and objectives can be achieved as much as possible.

7.3.1 Underlying Principles

The underlying principles of the IRMP are as follows:

Operate LANL's facilities consistent with LANL's mission assignments and sound ecological principles.

- Improve environmental compliance and protection (both cost and effectiveness) through planned and active management of natural and cultural resources,
- Manage contaminants in soil, air, water, and biota to levels that are protective of human health and the ecosystem, and
- Enhance understanding and appreciation of natural resources stewardship among facility and operations managers responsible for making land use decisions.

Develop new facilities consistent with LANL's mission assignments and sound ecological principles.

- Integrate measures into facilities planning that will foster and promote biodiversity and ecosystem processes, and enhance wetland and floodplain values and
- Minimize cost and schedule risks by facilitating more effective land use and facilities planning through the IRMP process.

Restore and maintain ecosystem viability while accomplishing LANL's mission assignments and operations.

- Provide for regional resources management synergism and increased coordination between regional land managers,
- Use native species and natural regeneration as the preferred method of perpetuating vegetative communities,
- Develop a matrix of ecologically acceptable management activities and guidelines for semi-improved and unimproved areas on LANL lands,
- Conduct periodic interdisciplinary assessments on appropriate spatial scales to identify management practices necessary for maintaining or restoring ecosystem health, and
- Implement monitoring programs to record population dynamics, evaluate management effectiveness, identify negative impacts to biotic resources, and measure the need for and effectiveness of mitigations.

7.3.2 Setting Goals and Objectives

Management goals and objectives delineated by the IRMP are expected to be established at the institutional and FMU level. Based on institutional level expectations, FMU-specific goals and objectives are expected to be developed with operating group and FMU input and approval for

implementation by operations. These goals and objectives will ensure ongoing operations assist LANL in meeting DOE's expectations; help minimize impacts to local environment; and provide a basis for measuring improvements. It should be recognized that this IRMP is a guidance document to LANL, and that implementation of this guidance will be LANL's responsibility. The resource-specific plans and the FMU specific plans will remain under LANL's purview as the method by which LANL implements DOE's guidance and policy contained within this IRMP.

It is currently proposed that implementation will include individual plans for each FMU. Using institutional goals as drivers, each management unit (with its concomitant missions and operations) will be cross-indexed to resources (i.e., air, water, habitat, etc.) to determine which of these resources are most impacted by operations, and the relative level of that impact. This information will enable development of a resource management plan for each management unit. This plan will identify the preferred set of actions for each resource to enhance ongoing operations and define management practices that should be implemented to create and maintain each resource at its desired state (i.e., elimination of erosion, decreased particulate matter in air, reduction of forest fuel loads, etc.) while meeting institutional goals and objectives.

Within this framework, using the ESH-ID process or a similar process, operations managers will be expected to identify and resolve pertinent resource issues for new operations or facilities. Like the NEPA process, integration of operations and resources does not necessarily mean the most environmentally benign solution is chosen; but rather, that potential impacts to resources are considered in making the decision.

Overlaying these management unit specific resource management plans, will be a set of regional management criteria that focus on interagency issues for management of major habitat types, water sheds, air sheds, and other resources of concern that cross land ownership boundaries. These regional issues will not take precedence over LANL concerns; however, they may modify and direct the decision-making process.

Changes in missions and/or operations within a management unit may result in entirely different set of resource impacts and management options. In addition, as management practices alter a given resource, these management practices may be altered and adjusted to focus these changes into the desired outcome. Thus, the IRMP is dynamic and will evolve with changes in operations, resources, resource knowledge, and institutional needs.

7.3.3 Preliminary Institutional Goals

Implementation of the IRMP is based on the premise that the environmental envelope for operations established by the SWEIS avoids unacceptable impacts to the local environs. In general, an evaluation of changes in operations, modification of existing structures, construction of new facilities, etc., showing that the parameters of such changes remain within projections, by definition, demonstrates proper integration between resources and operations. No further action is warranted or required. This conclusion is based on the existence of and compliance with programs, plans and controls that are built into operations at LANL. These programs, plans and controls include operating within applicable regulations, DOE orders, contractual requirements, and approved policies and procedures.

In the MAP, DOE identified four specific measures intended to further minimize the impacts of operating LANL. DOE's initial goals for LANL's IRMP will be those measures as follows:

- Electrical Power Consumption – The stated objective is to manage electric power demands to prevent periods of brownouts by adjusting to the limitations of available power until a solution for long-term increase in the power supply is in place.
- Water Supply and Demand – The stated objective is to manage water demand to prevent exceedances of DOE water rights. Water conservation goals are to be developed and implemented by October 2001.
- Waste Management – The stated objective is to reduce waste generation. Percentage reductions for different waste types are to be achieved by December 2005.
- Wildfire – The stated objective is to reduce the threat of a major wildfire impacting facilities, operations, and the environment.

It is expected that LANL will make these specific goals institutional objectives under the ISM system.

7.4 Monitoring and Updates

To maintain the IRMP and enhance its utility as a resource management framework, DOE working in concert with LANL will develop a set of metrics to monitor and track progress for both short-term and long-term goals and objectives. A lack of progress towards these goals and objectives or a deviation from planned outcomes will result in adjustments to the IRMP and its implementation to effect desired changes.

Each resource being integrated by the IRMP will have its own set of goals and objectives and implementing actions, as defined in resource-specific management plans. Through the IRMP, these goals and objectives and implementing actions will be compared to those of other resources to identify conflicts and establish management priority or modify implementing actions. As a result, the actual management of resources for given management units will be established and implemented.

It is within this framework that the IRMP performance measures will be set. There are three functional categories of measures:

(1) Operational – those measures that determine how well the ongoing mission is supported and maintained by the IRMP;
(2) Environmental – those measures that determine how well LANL's resource management system works on a FMU basis in protecting the environment and managing resources; and
(3) Regional – those measures that evaluate how well LANL's resource management options fit within the overall management of resources of the Pajarito Plateau.

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Appendix

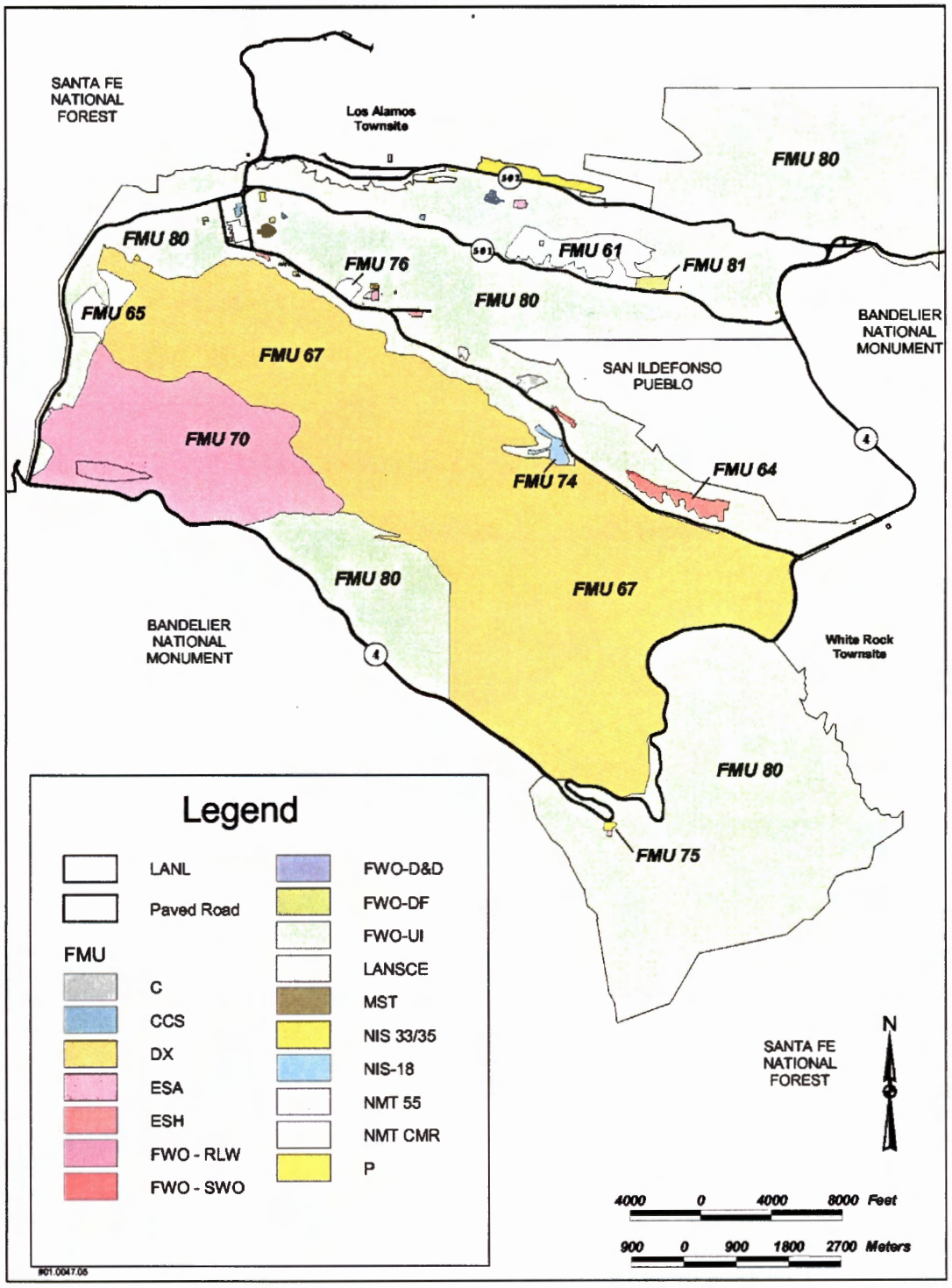

Figure A-1 Facility management units.

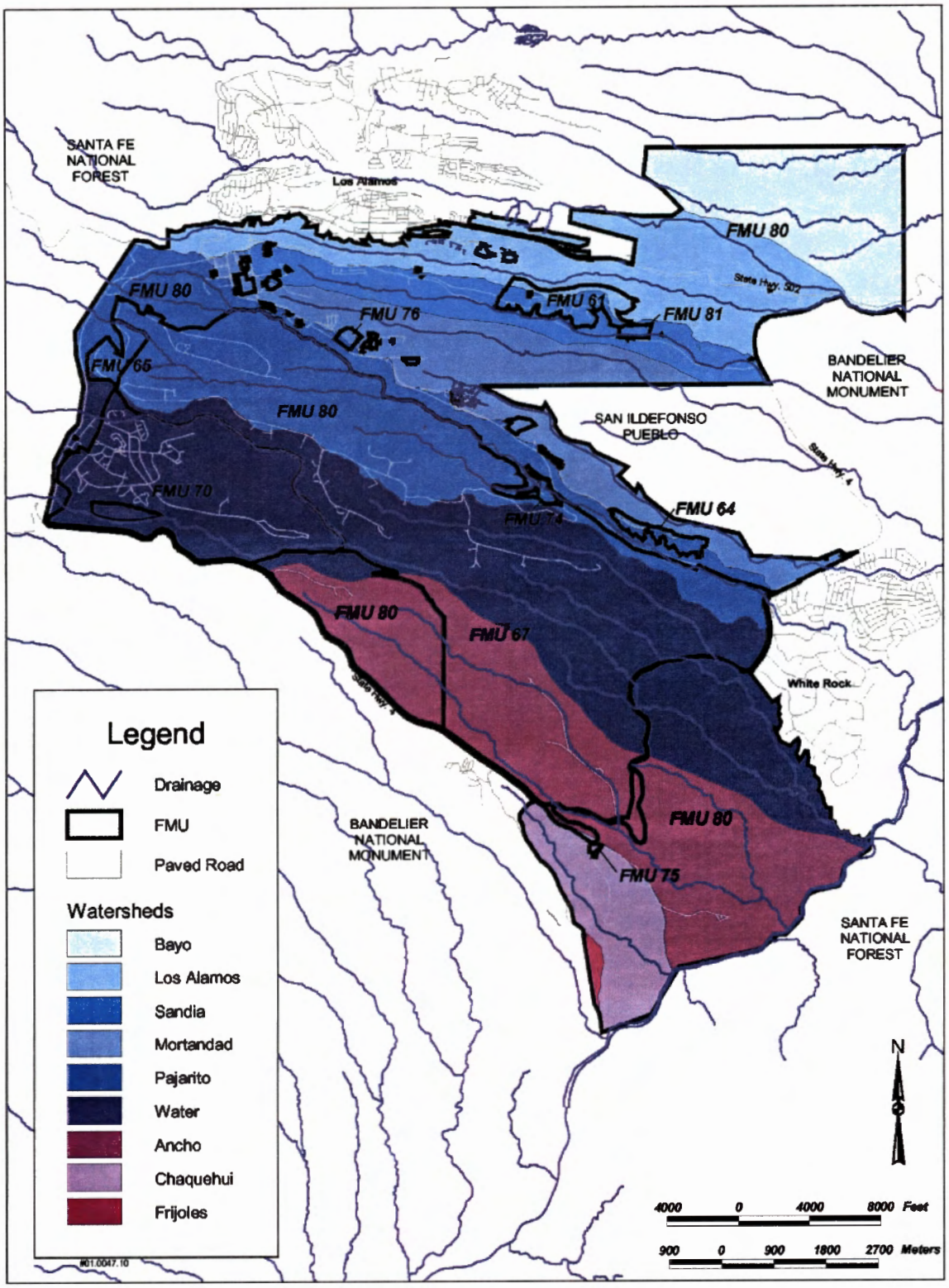

Figure A-2 Watersheds.

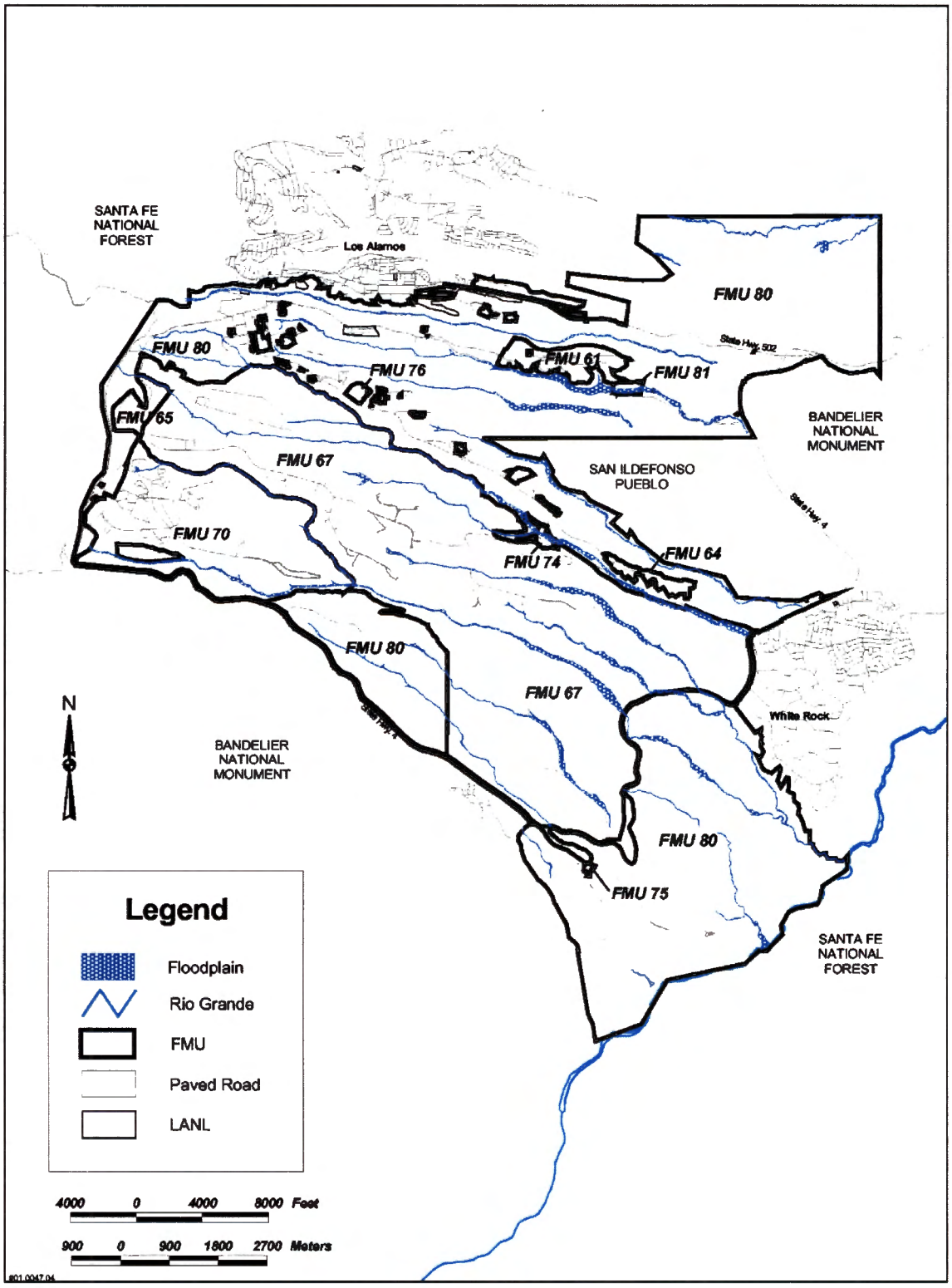

Figure A-3 Floodplains at LANL.

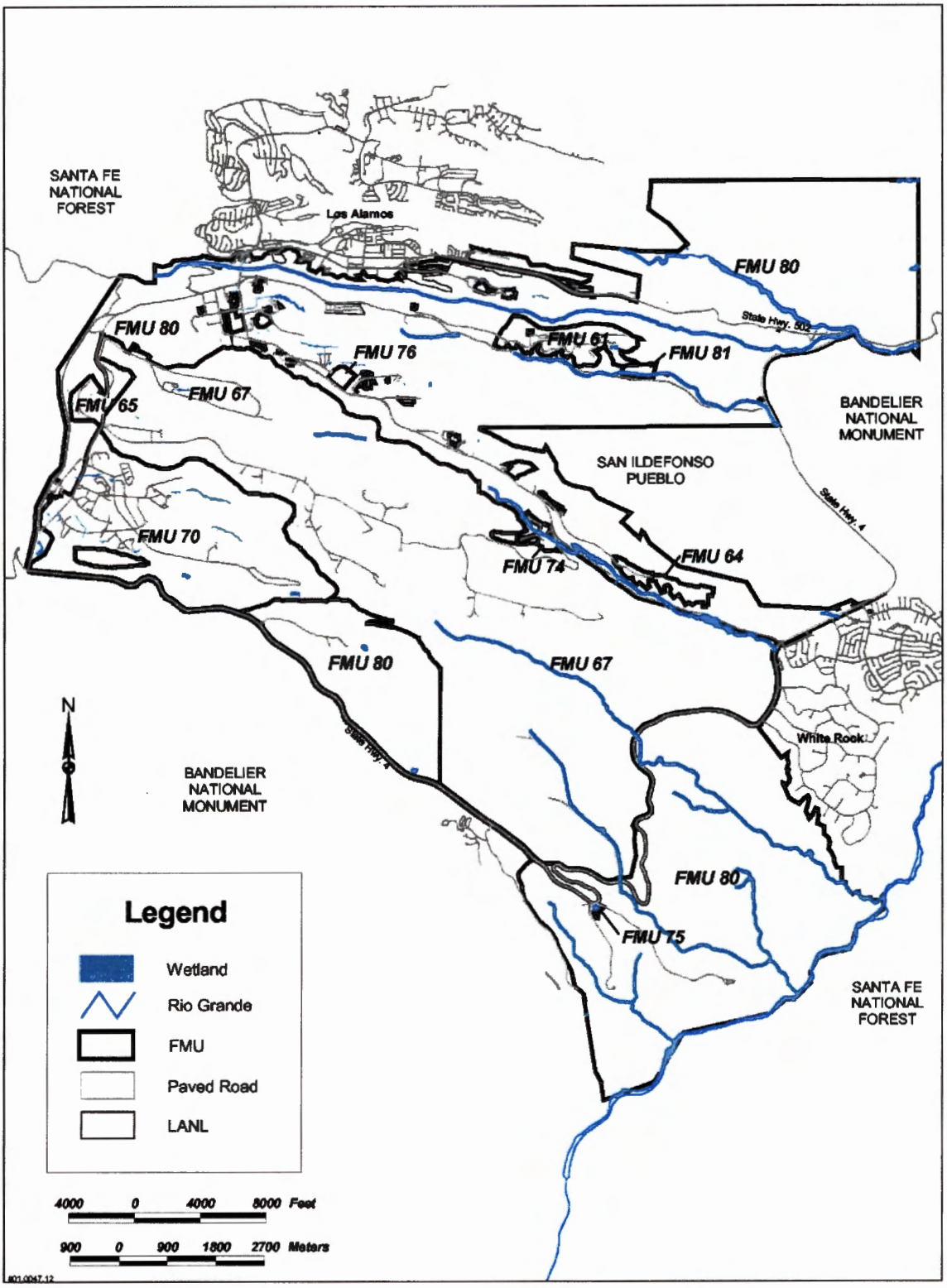

Figure A-4 Wetlands at LANL.

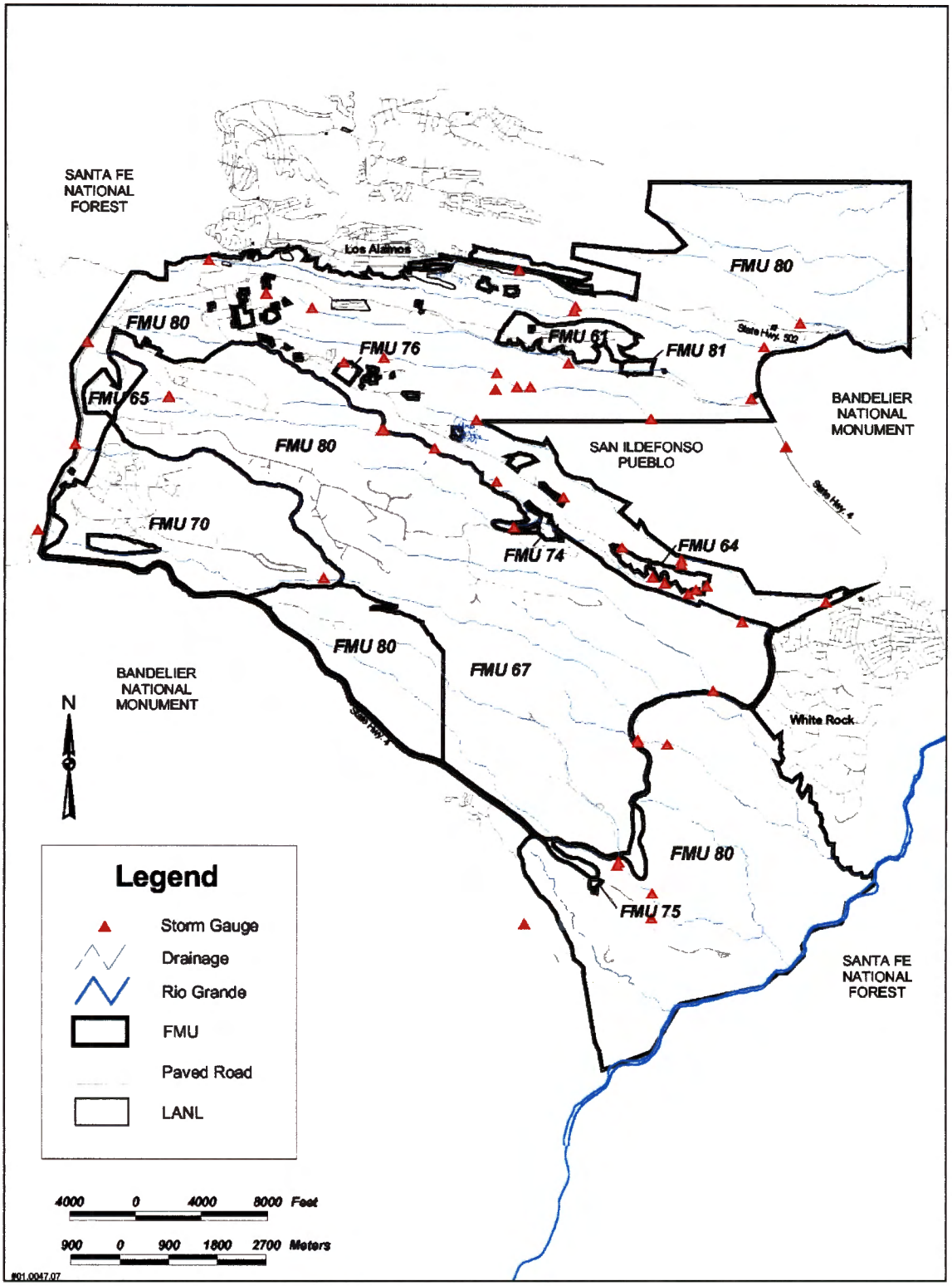

Figure A-5 Storm water gauging stations at LANL.

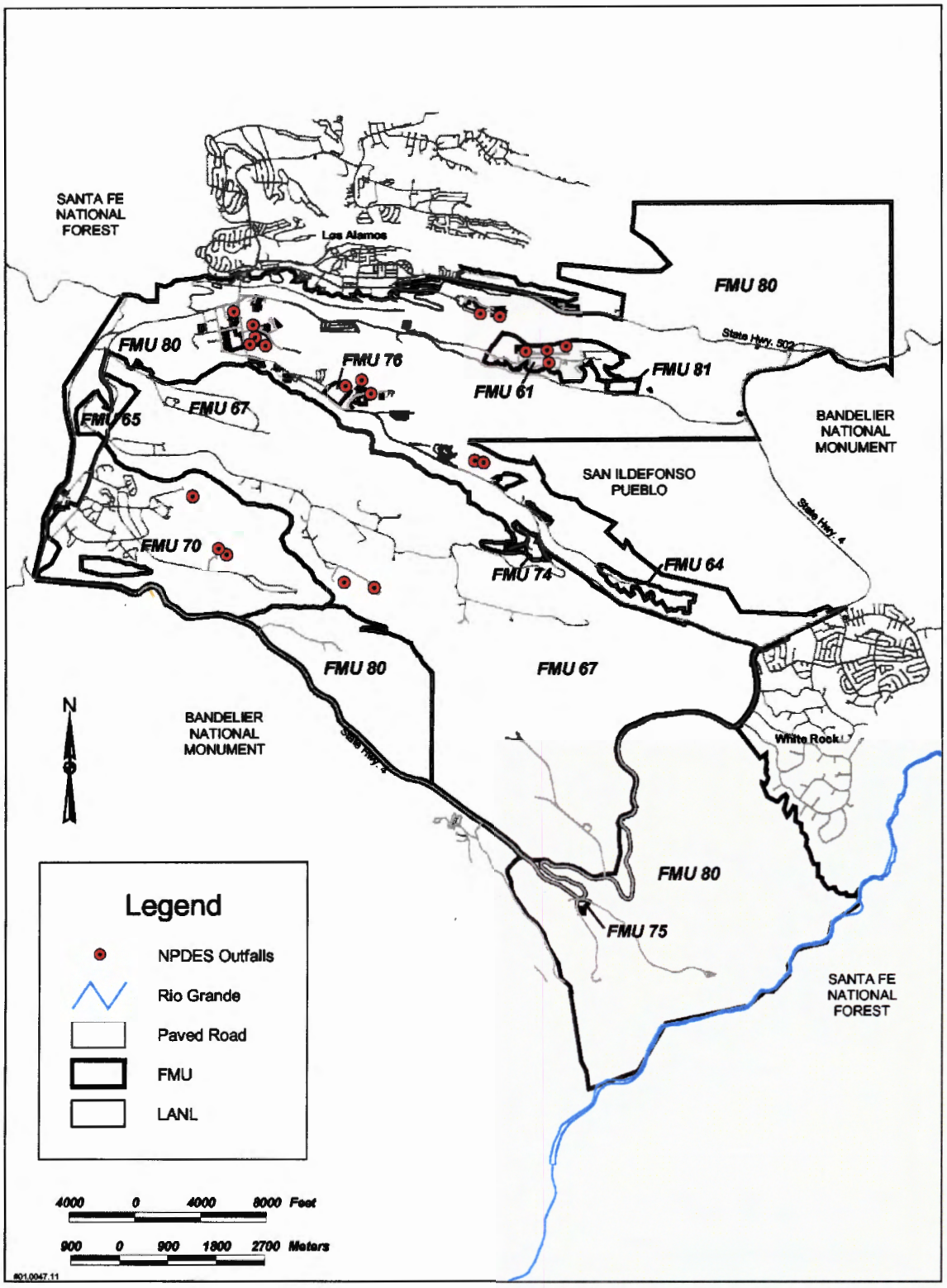

Figure A-6 NPDES outfalls at LANL.

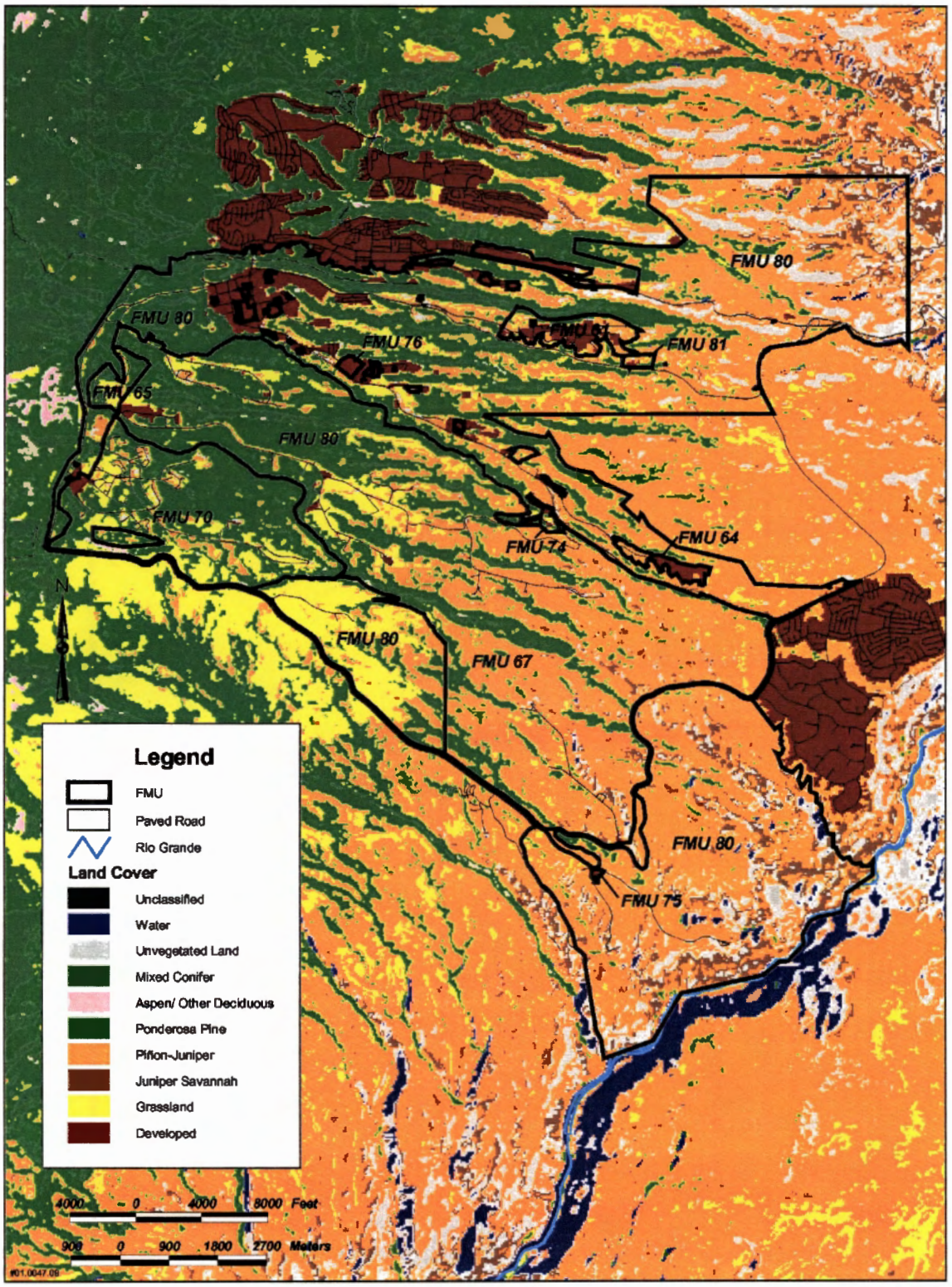

Figure A-7 Vegetation zones at LANL (pre-Cerro Grande Fire).

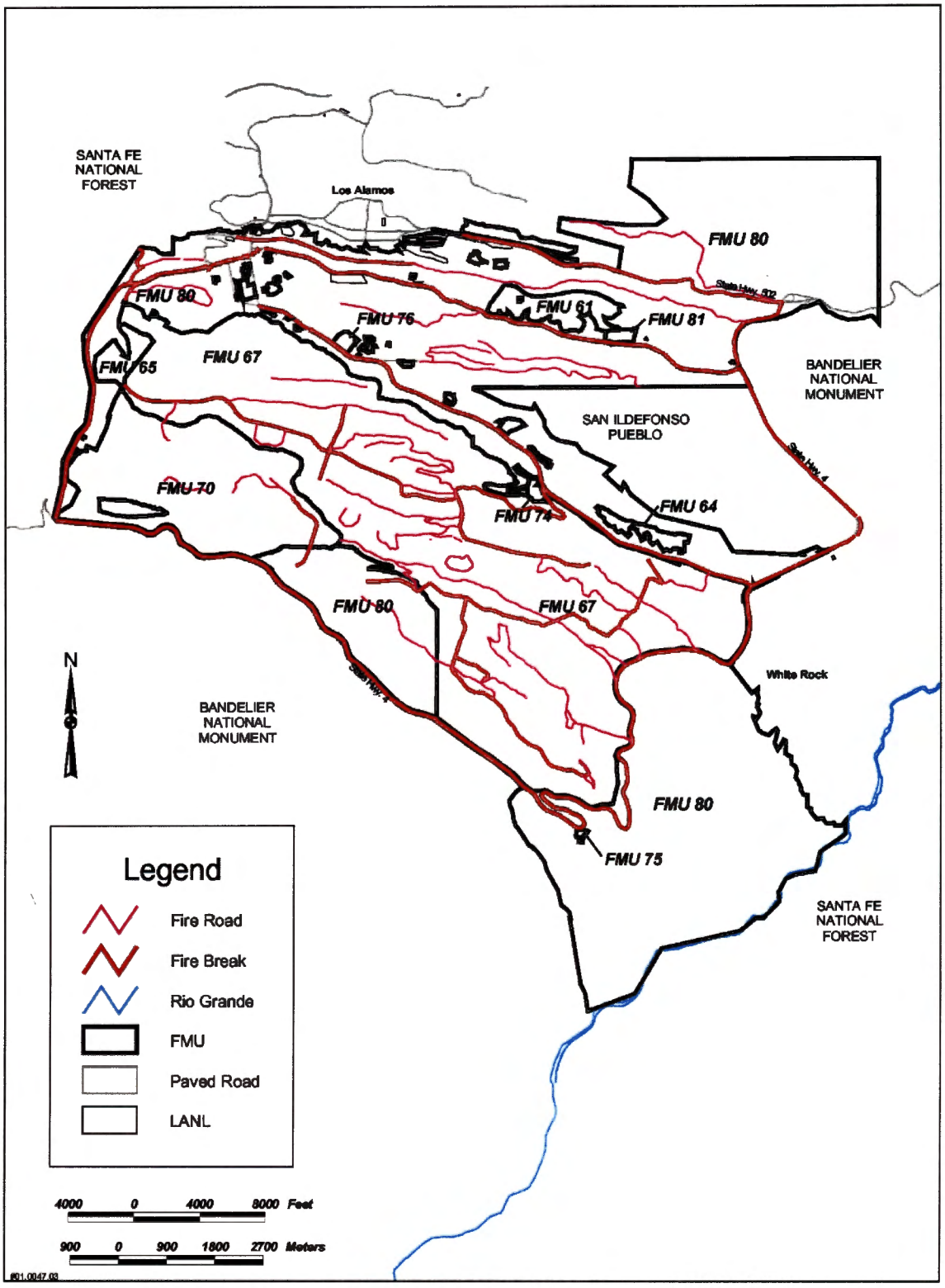

Figure A-8 Fire roads and firebreaks at LANL.

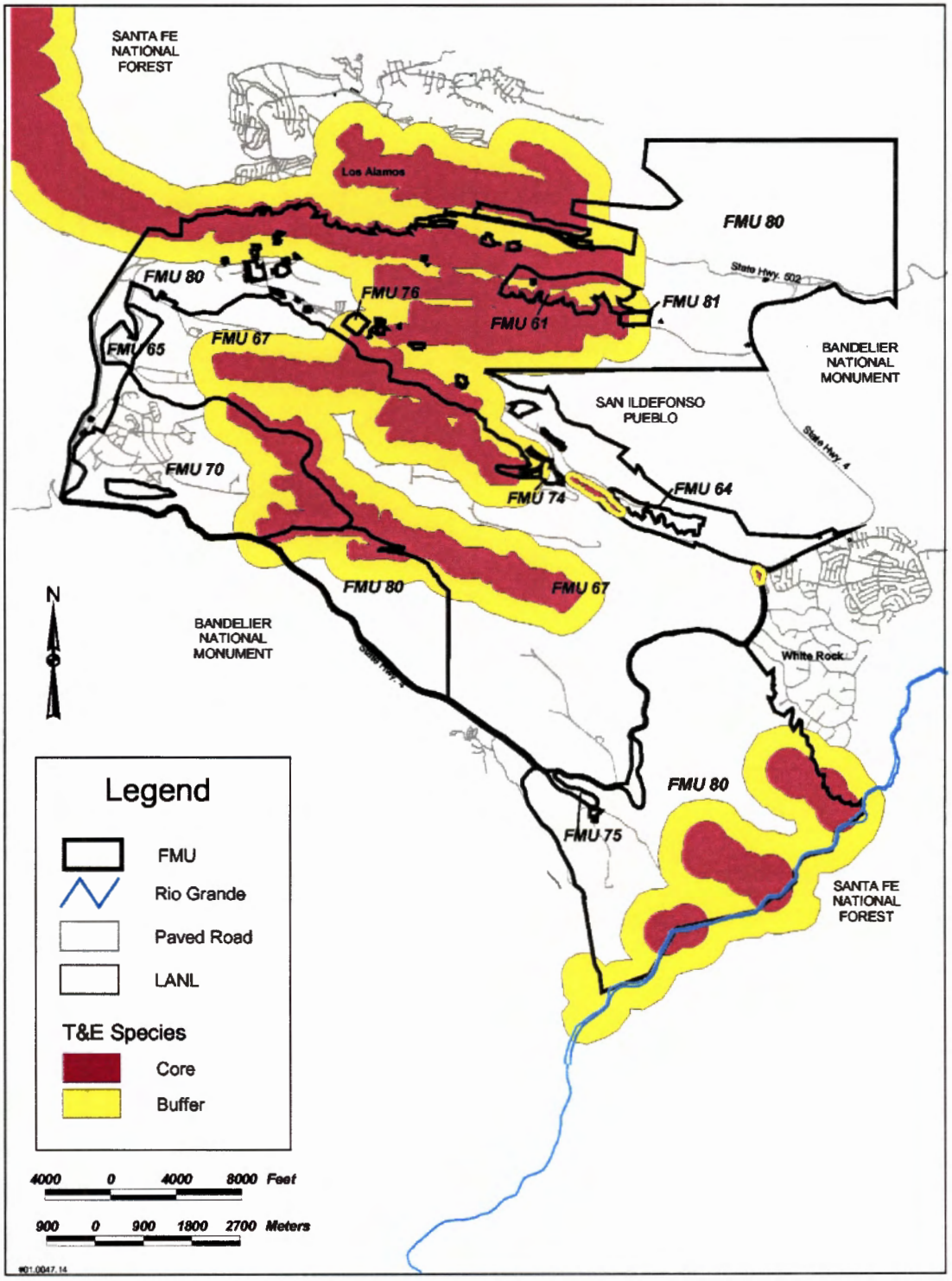

Figure A-9 Threatened and endangered species habitat at LANL.

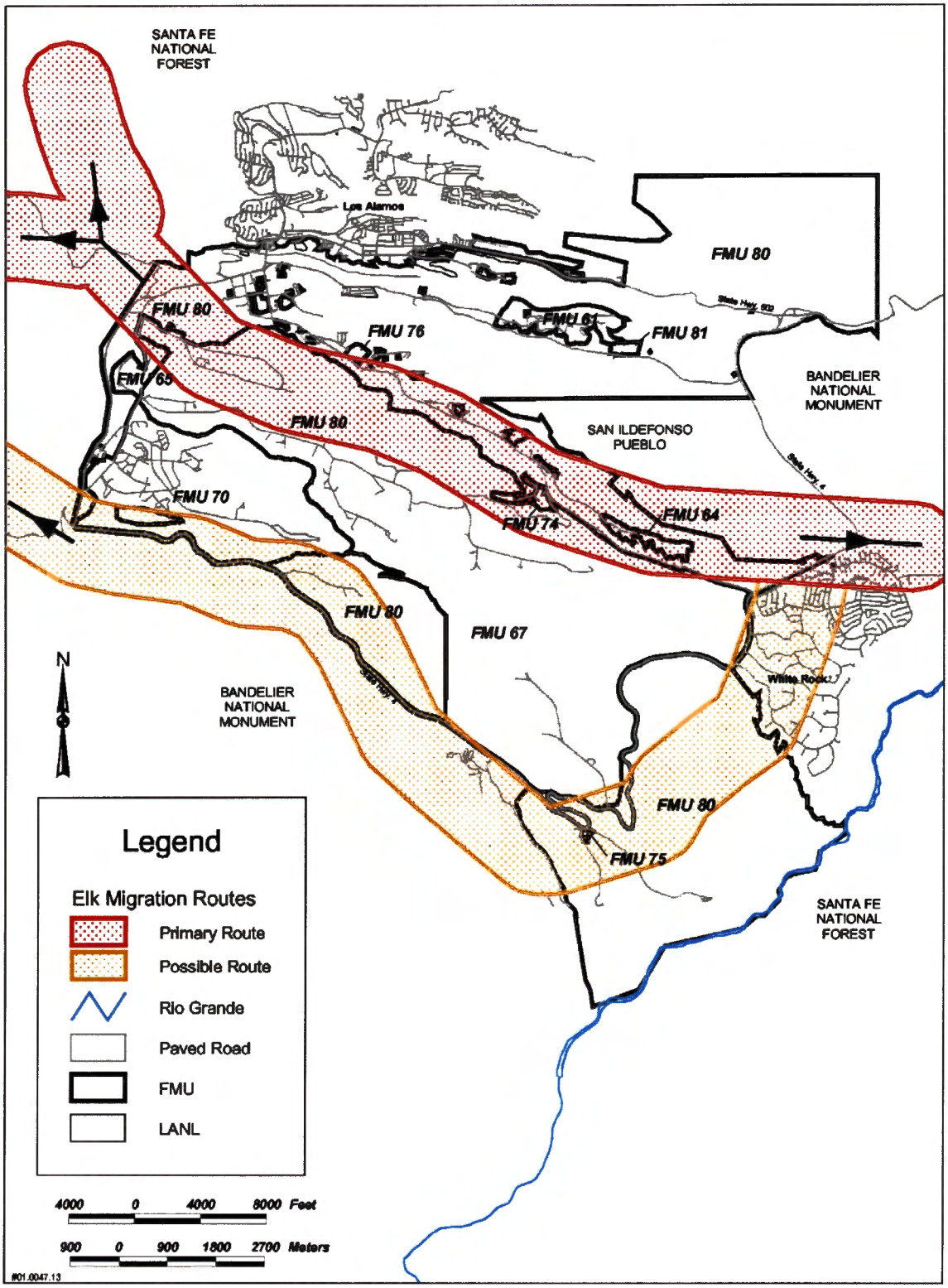

Figure A-10 Elk migration routes (pre-Cerro Grande Fire).

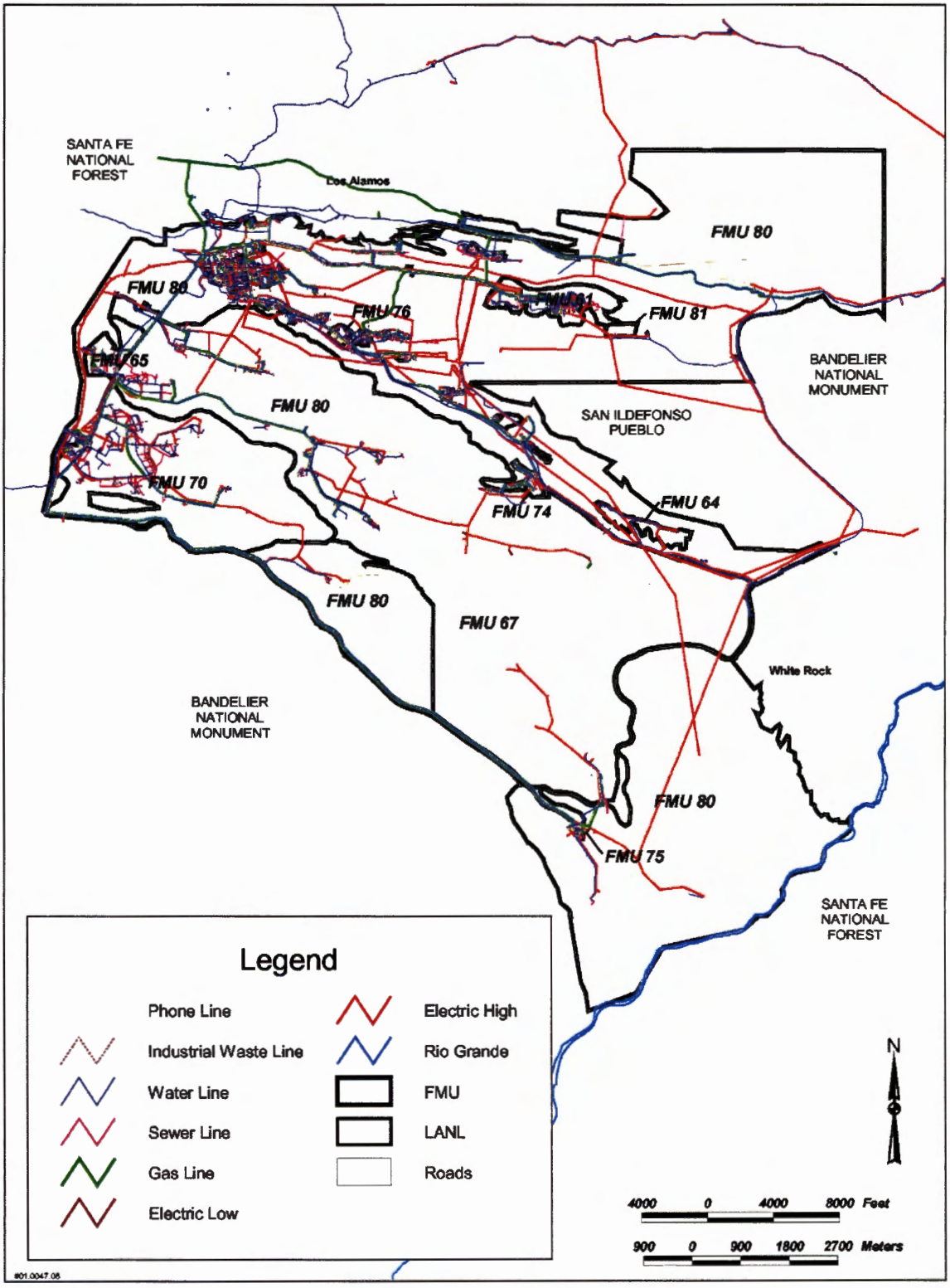

Figure A-11 Utilities at LANL.

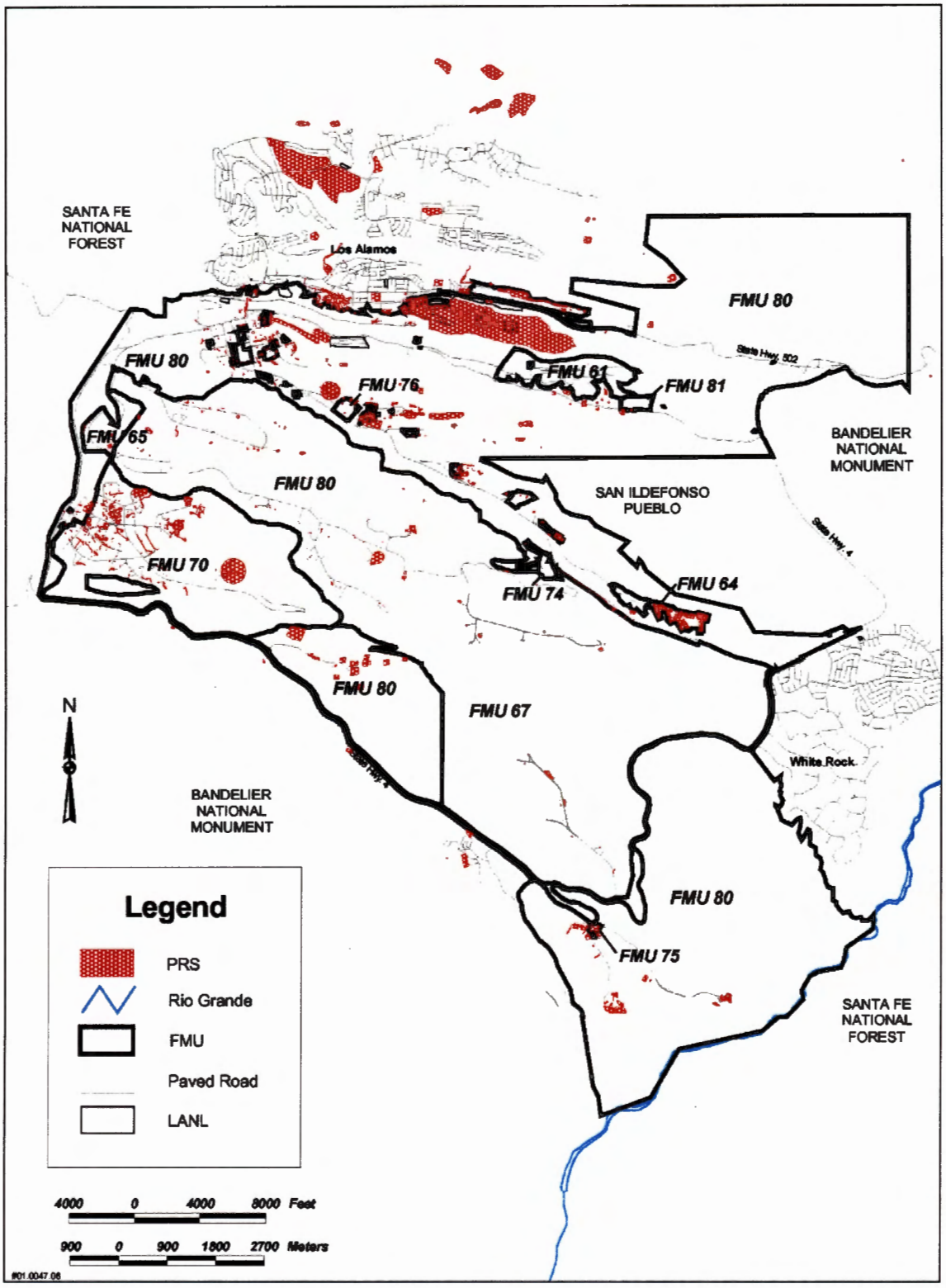

Figure A-12 PRSs at LANL.

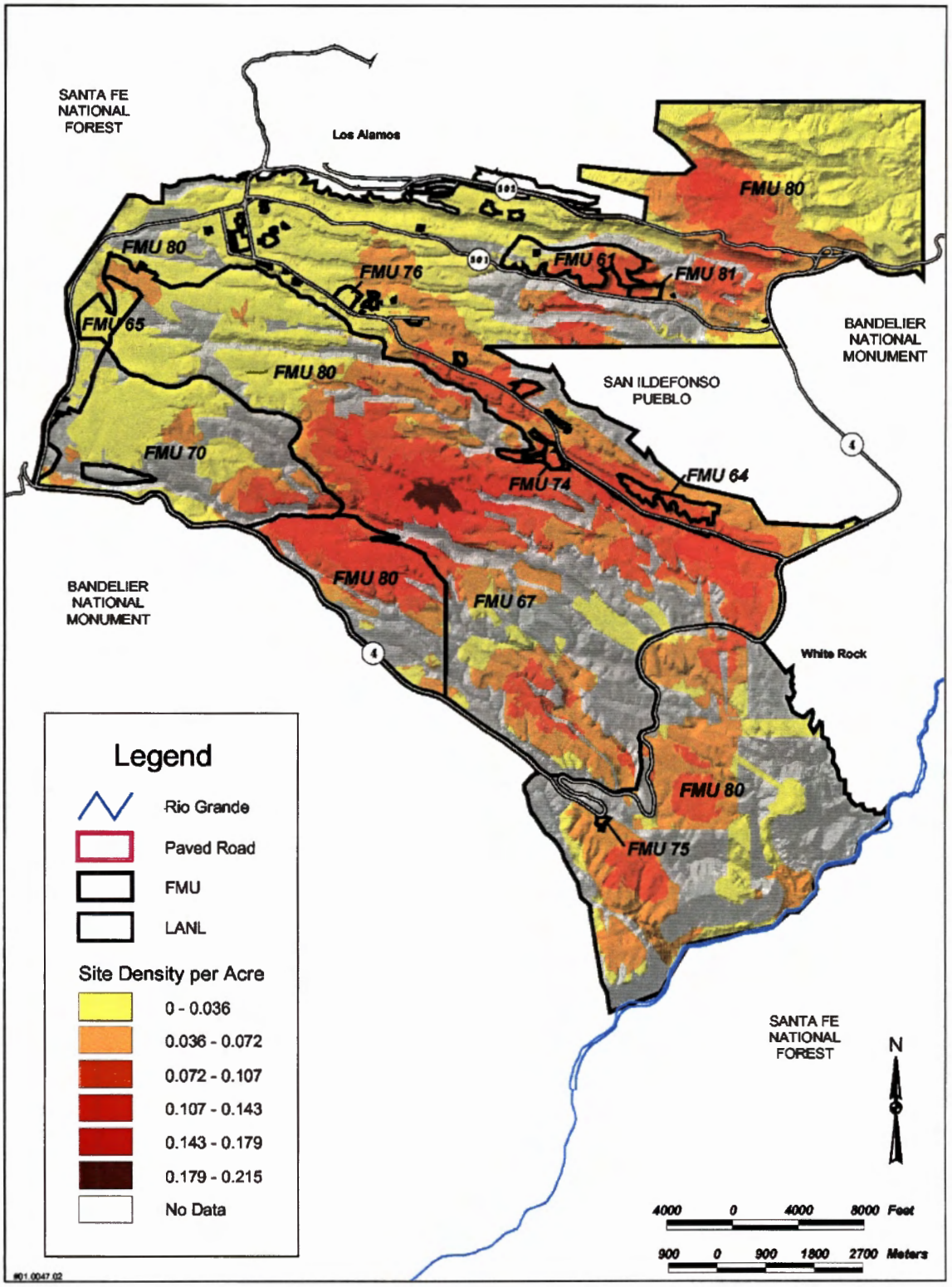

Figure A-13 Cultural resources at LANL.

List of Acronyms

BRMP	Biological Resources Management Plan
CMR	Chemistry and Metallurgical Research (Building)
CSP	Comprehensive Site Plan
DOE	Department of Energy
EPA	Environmental Protection Agency
ER	Environmental Restoration (Project)
ES&H	environment, safety and health
ESR	environmental surveillance report
FMU	facility management unit
GWPMP	Ground Water Protection Management Program (Plan)
HE	high explosives
HMP	Threatened and Endangered Species Habitat Management Plan
ICRMP	Integrated Cultural Resources Management Plan
IRMP	Integrated Cultural and Natural Resources Management Plan
ISM	Integrated Safety Management
IWP	Installation Work Plan
LAAO	Los Alamos Area Office
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Scattering Center
LIRs	Laboratory Implementing Requirements
LPRs	Laboratory Performance Requirements
MAP	Mitigation Action Plan
NEPA	National Environmental Policy Act
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRMP	Natural Resources Management Plan
PMRT	Planning, Management, and Review Team
PRS	potential release site
ROD	Record of Decision
RSRL	regional statistical reference level

SWEIS	Site-Wide Environmental Impact Statement
TA	technical area
TCP	Traditional Cultural Properties
UC/LANL	University of California/Los Alamos National Laboratory
WHRPP	Wildfire Hazard Reduction Project Plan
WMP	Watershed Management Plan
WSS	work smart standards