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General (Site Wide Environmental Impact Statement)

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

As Required by the Mitigation Action Plan  
for the 1999 Site-Wide Environmental Impact Statement  
for Continued Operation of Los Alamos National Laboratory

April 2002

National Nuclear Security Administration  
Office of Los Alamos Site Operations  
Los Alamos, New Mexico



13627

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## List of Acronyms

BMPs	best management practices
BRMP	Biological Resources Management Plan
CFR	Code of Federal Regulations
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
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
LAAO	Los Alamos Area Office
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Scattering Center
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
OLASO	Office of Los Alamos Site Operations
PMRT	Planning, Management, and Review Team
PRS	potential release site
ROD	Record of Decision
SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
TCP	Traditional Cultural Properties
TYCSP	Ten-Year Comprehensive Site Plan
UC	University of California
UC/LANL	University of California/Los Alamos National Laboratory
WHRPP	Wildfire Hazard Reduction Project Plan
WMP	Watershed Management Plan

## Executive Summary

Congress established the National Nuclear Security Administration (NNSA) as a separate organization within the Department of Energy (DOE) on October 15, 1999, when it passed the National Nuclear Security Administration Act. The NNSA officially began operations on March 1, 2000. Los Alamos National Laboratory (LANL) was identified in this Act as one of the nation's national security laboratories. Managed for the NNSA by the University of California (UC), the central mission of LANL is enhancing the security of nuclear weapons and nuclear materials worldwide. LANL's statutory responsibility is the stewardship and management of the nuclear stockpile.

NNSA has a responsibility to act in the public interest as a trustee for natural resources at its facilities. In 1997, the DOE and LANL began an effort to develop a Natural Resources Management Plan to integrate management of groundwater, surface water, biological resources, threatened and endangered species, fire, soil, and geologic resources and air quality.

In 1999, the DOE issued the *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 Natural and Cultural Resources Management Plan (referred to as the IRMP in this document), described as an enhancement of existing programs, was included as a mitigation measure.

NNSA policy is to manage land and facilities as valuable national resources to support critical missions and protect the environment. The management of natural and cultural resources will be based on the principles of ecosystem management and sustainable development. NNSA policy calls for the integration of mission, economic, ecologic, social, and cultural factors in a comprehensive plan for each site that will guide land and facility use decisions.

NNSA believes that it is feasible and desirable to integrate mission needs and natural resource stewardship. The goal of IRMP implementation should be to provide a process that minimizes conflicts and to develop solutions that advance both mission and stewardship cost-effectively. 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 environmentally sound manner.

This IRMP establishes NNSA resource management principles and institutional goals and provides guidance to UC/LANL on those principles and goals. UC/LANL will then be responsible for implementing actions and developing an implementation strategy. NNSA will monitor progress on implementation.

NNSA's IRMP presents the agency's expectations for UC/LANL implementation strategy, including the need to define appropriate management units. NNSA will also expect UC/LANL to develop approaches for integrating compliance requirements and stewardship guidance for natural and cultural resources; prioritizing among and between resources, if there are potential overlaps or conflicts; and determining trade-offs. NNSA expects LANL to develop a methodology for documenting decision-making processes that enable missions to be accomplished without significantly adversely affecting the natural and cultural environment.



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

## **1.0 Introduction**

The National Nuclear Security Administration (NNSA) has policy to manage land and facilities as valuable national resources to support critical missions and to protect the environment. The management of natural and cultural resources will be based on the principles of ecosystem management and sustainable development. NNSA policy calls for the integration of mission, economic, ecologic, social, and cultural factors in a comprehensive plan for each site that will guide land and facility use decisions.

The Integrated Natural and Cultural Resources Management Plan (referred to as the IRMP in this document) will be a planning document designed to facilitate NNSA's mission at Los Alamos National Laboratory (LANL). It builds on existing programs and efforts and is part of the Integrated Safety Management System. The IRMP establishes NNSA resource management principles for LANL, with University of California (UC)/LANL responsible for implementing those principles. The IRMP supports NNSA's role as a steward of natural resources by integrating its mission and operations with ecological and cultural factors, using an integrated process that will guide land and facility use decisions at LANL.

The IRMP is in the early 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 IRMP is a high-level document that sets the stage for integration and outlining an overall approach. UC/LANL's implementation strategy will provide more detail on the integration process and on approaches for developing implementing actions that minimize conflict; maximize achievement of goals and objectives at the institutional, facility, and activity levels; and maintain adherence to institutional goals and objectives. The IRMP and implementation will evolve with changes in operations, resources, resource knowledge, and institutional needs.

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 environmentally sound manner. As IRMP implementation develops, the process for achieving that reality will be established.

This document is divided into a main body of four sections and three appendices. The main body of the plan presents NNSA's mission, vision, principles, and guidance for implementation. This first section introduces the IRMP. Sections 2 and 3 present federal and NNSA principles and guidelines for resource management. Section 4 presents NNSA's guidance on approaches to implementation, including a possible process by which the IRMP will be updated and revised in accordance with operational, regulatory, and environmental needs. The appendices present the context of integrated resources management at LANL. Appendix A provides background information on LANL operations. Appendix B provides background information on resources at LANL and the surrounding region. Appendix C discusses existing operational and resource management plans at UC/LANL, including the state of development of each plan.



## **2.0 Background**

This section presents a background discussion of information about NNSA natural and cultural resources management responsibilities and the specific requirements for an integrated resources management plan for LANL.

### **2.1 DOE and NNSA Missions**

Congress established the NNSA as a separate organization within the DOE on October 15, 1999, when it passed the National Nuclear Security Administration Act. The NNSA officially began operations on March 1, 2000. The mission of the Administration is

1. To enhance US national security through the military application of nuclear energy.
2. To maintain and enhance the safety, reliability, and performance of the US nuclear weapons stockpile, including the ability to design, produce, and test, in order to meet national security requirements.
3. To provide the US Navy with safe militarily effective nuclear propulsion plants and to ensure the safe and reliable operation of those plants.
4. To promote international nuclear safety and nonproliferation.
5. To reduce global danger from weapons of mass destruction.
6. To support US leadership in science and technology.

LANL was identified in this Act as one of the nation's national security laboratories. Managed for the NNSA by UC, the central mission of LANL is enhancing the security of nuclear weapons and nuclear materials worldwide. LANL's statutory responsibility is the stewardship and management of the nuclear stockpile (NNSA 2002).

Appendix A provides additional information on past and current operations at LANL.

### **2.2 Federal Guidance on the Management of Natural Resources**

#### **2.2.1 Executive Order 12580**

President Ronald Reagan signed Executive Order 12580, Superfund Implementation, on January 23, 1987. As a result of that Order, DOE has the responsibility to act in the public interest as a trustee for natural resources at its facilities (EO 1987).

#### **2.2.2 DOE's Land and Facility Use Policy**

In December 1994, Secretary of Energy Hazel O'Leary issued a Land and Facility Use Policy (DOE 1994), which stated

“It is 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."

### **2.2.3 Executive Order 13148**

President William Clinton signed Executive Order 13148, Greening the Government Through Leadership in Environmental Management, on April 21, 2000. The Executive Order states "each Federal agency is responsible for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions. Consequently, environmental management considerations must be a fundamental and integral component of Federal Government policies, operations, planning, and management." The Executive Order further stated that by "December 31, 2005, each agency shall implement an environmental management system at all appropriate agency facilities." An environmental management system should include measurable goals, objectives, and targets that are reviewed and updated annually (EO 2000).

Secretary of Energy Bill Richardson issued DOE Notice 450.4, Assignment of Responsibilities for Executive Order 13148, on February 5, 2001. The goals and objectives of the DOE Notice included achieving specific pollution prevention goals, continued environmental improvements, and energy efficiency goals. The specific goals were based on those developed by DOE on November 12, 1999. The goals focused on percentage reductions in waste generation, improving recycling, and improving energy usage. DOE field offices were held responsible for implementing these goals at their respective sites (DOE 2001a).

In July 2001, the Deputy Administrator for Defense Programs within NNSA issued instructions to its field offices, stating that Defense Programs "will strive for continuous improvement in environmental protection and reduction of environmental impacts." Defense Programs committed to applying pollution prevention, waste minimization techniques, and energy efficiency to its sites (DOE 2001b).

### **2.2.4 DOE Policy 450.1 and Draft Order 450.1**

DOE Policy 450.1, Environment, Safety and Health Policy for the DOE Complex, was first issued June 15, 1995. The Policy states, "The hallmark and highest priority of all our activities is daily excellence in the protection of the worker, the public, and the environment." To implement that policy, DOE is currently revising a draft order on the Environmental Protection Program, in 10 Code of Federal Regulations (CFR) 834. Included in the December 2001 draft is a requirement for DOE to

"Promote long-term, sustainable stewardship of a site's natural and cultural resources throughout its operational, closure, and post-closure life cycle" (DOE 1995).

### 2.2.5 DOE's Requirements for LANL

In August 1996, Thomas Todd, DOE's Area Manager at the Los Alamos Area Office (LAAO)<sup>1</sup>, provided direction to LANL to begin planning for natural resource management. The memo stated that:

“DOE is the trustee for natural resources at LANL (Executive Order 12580) and is subject to the natural resource provisions of CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] Sections 107 and 120, the Secretary's policy statement on land and facility use, and the soon to be codified sections of 10 CFR 834. DOE and LANL also have responsibilities to our neighbors with whom DOE shares land, water, air, and biological resources.”

The memo went on to direct UC/LANL to provide increased attention to the “management of natural resources at LANL through establishing and implementing biological/natural resources management plans and performing other measures necessary to fulfill DOE's natural resources stewardship responsibilities” (DOE 1996).

In 1997, DOE and UC/LANL began an effort to develop a Natural Resources Management Plan (NRMP) to integrate management of groundwater, surface water, biological resources, threatened and endangered species, fire, soil, and geologic resources and air quality with the intent of assisting operations managers at LANL. Each resource has its own set of regulations and requirements. The effort also included considerations for cultural (historic and archaeological) resources management. 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.

### 2.2.6 DOE's Mitigation Action Plan

In 1999, DOE issued the *Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory* (SWEIS; DOE 1999a), a Record of Decision (ROD), and a Mitigation Action Plan (MAP) (DOE 1999b). 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 MAP stated “The mitigation measures that are included in this section are those that will improve operational efficiency and minimize future potential impacts from LANL operations. The mitigation will support the continued development, implementation, and refinement of natural and cultural resources programs and plans at LANL. These measures will improve site operations and DOE's role as a regional steward of natural and cultural resources. The plans and their implementation (DOE 1999b) will provide the opportunity for

- future site development and operations planning;

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<sup>1</sup> In early 2002, LAAO was renamed the Office of Los Alamos Site Operations (OLASO).

- identification and assessment of potential impacts;
- development of appropriate and cost-effective mitigation measures;
- expedited required regulatory review and compliance processes;
- cost-effective operations by improving site-specific policies and implementation requirements for day-to-day operations; and
- improving interactions with external regulators and stakeholders.”

### **2.2.7 Natural Resources Management Plan**

The MAP stated that the objective of a NRMP would be 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.”

The MAP went on to explain that

“The development and implementation of a comprehensive natural resources management plan at LANL will directly support DOE’s policy to manage all of its land and facilities as valuable national resources. Through the implementation of such a plan, DOE will improve the agency’s role as a steward of natural resources by integrating its mission and operations with biological, water, and air resources, using a comprehensive process that will guide land and facility use decisions. One of the goals of natural resources management at LANL is to determine conditions and to recommend management measures that will restore, sustain, and enhance the biological quality and ecosystem integrity at LANL within the regional context of the Pajarito Plateau ecosystem. This process will furthermore consider the site’s larger regional context and be developed in consultation with regional land managing agencies and owners (particularly Bandelier National Monument, Santa Fe National Forest, and Native American Pueblos), State agencies, and the US Fish and Wildlife Service. This cooperative effort will ensure a consistent, integrated, and sustainable approach to regional natural resources management.”

## **2.3 Natural Resources at LANL**

With its historically restricted access and other unique land use practices, LANL supports the rich diversity of natural resources of northern New Mexico. While restricted access has provided habitat and protection for many plants and animals, other land use practices have resulted in natural resources management concerns that require effective and sustainable solutions.

Appendix B provides an overview of information on natural and cultural resources at LANL, with a discussion of the extent and condition of the resource, resource management considerations, and the current approach to resource management for each resource.

### **2.3.1 Established Natural Areas at LANL**

DOE (and its predecessor organization) recognized the diversity of natural resources at LANL and provided particular protection to portions of LANL by taking specific actions.

## **National Environmental Research Park**

In November 1976, the US Energy Research and Development Administration, precursor to DOE, designated four installations as National Environmental Research Parks. The Los Alamos Scientific Laboratory, now LANL, encompassing 43 square miles, was one of these four sites. The purpose of the Los Alamos park was to establish environmental research that contributed “. . . understanding of how man can best live in balance with nature, while enjoying the benefits of technology.” The National Environmental Research Park facilitates self-supported environmental research on the interactions between human-altered systems and adjacent natural systems and is available to individuals and organizations both within and outside LANL, under approved arrangement with the park coordinator (ERDA 1977).

## **White Rock Canyon Reserve**

The White Rock Canyon Reserve was dedicated by DOE on October 30, 1999. It contains approximately 1,000 acres on the southeastern portion of LANL along the Rio Grande. The objective of the Reserve is to conserve, protect, and enhance the site’s biological and cultural resources. Bandelier National Monument will co-manage it together with NNSA and UC/LANL, with input from other state and federal agencies, nearby Pueblos, and the local community. A comprehensive resources management plan for the Reserve, to be developed by Bandelier National Monument with NNSA review and approval, will be completed by 2005 (DOE 1999c).

### **2.3.2 Regional Importance of LANL Resources**

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.

A number of interagency organizations have been created to foster cooperation. The following describes these interagency organizations.

### **The East Jemez Resource Council**

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/NNSA, Santa Fe National Forest, US Fish and Wildlife Service, and Bandelier National Monument signed the Agreement establishing the Council. Other participating government entities include San Ildefonso, Cochiti, and Santa Clara Pueblos, the New Mexico Environment Department (NMED), New Mexico State Forestry Division, and New Mexico Department of Game and Fish.

### **Pajarito Plateau Watershed Partnership**

In 1999, when the Watershed Protection Management Plan 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 restore water quality in this watershed. Toward this end, the Partnership is

preparing a multiagency 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/NNSA, and UC/LANL.

### **The Interagency Wildfire Management Team**

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 the Santa Fe National Forest, Bandelier National Monument, UC/LANL, DOE/NNSA, Los Alamos County, the Pueblo of San Ildefonso, various New Mexico agencies, and other interested parties.

### **Cochiti Lake Ecological Resources Team**

The 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/NNSA, US Geological Survey, US Fish and Wildlife Service, New Mexico Department of Game and Fish, Cochiti Pueblo, US Forest Service, and UC/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.

## **2.4 Cultural Resources at LANL**

An additional enhancement program required by the SWEIS MAP was the preparation of an Integrated Cultural Resources Management Plan (ICRMP) that included Traditional Cultural Properties (TCPs). The objective of the ICRMP was to manage, preserve, and protect cultural resources and TCPs using an integrated approach. As the NRMP and the ICRMP were being developed, NNSA determined that combining the ICRMP and the NRMP (and the supporting resource-specific plans) into an Integrated Natural and Cultural Resources Management Plan (or IRMP) was appropriate.

Appendix B also contains additional information on cultural resources at LANL.

## **2.5 MAP Milestones**

The MAP for the SWEIS contains the following milestones for completion of the IRMP:

- DOE will complete and implement an integrated NRMP with biological, soils, water, and air resource elements that will integrate the principles of ecosystem management into the critical missions of LANL.
- Establish a tripartite Planning, Management, and Review Team (PMRT) representing DOE from the OLASO and the Albuquerque Operations Office, and UC/LANL—October 1999.
- UC/LANL to prepare and submit to the PMRT a Work Plan for the development of the NRMP, including identification of specific studies and tasks—December 1999.

- UC/LANL to submit a Preliminary Draft NRMP to the PMRT—December 2000.
- DOE to coordinate formal stakeholder coordination/review of Preliminary Draft NRMP—February 2001.
- UC/LANL to revise Draft NRMP to reflect comments received by stakeholders and submit to PMRT—December 2001.
- DOE to coordinate formal stakeholder coordination/review of Revised Draft NRMP—February 2002.
- UC/LANL to submit Final NRMP to PMRT, including implementation strategy—April 2002.
- UC/LANL to begin implementation of NRMP—October 2002.

All milestones up to the future implementation of the NRMP (IRMP) have been met.

## **2.6 Draft IRMP and Stakeholder Involvement**

The Draft IRMP was issued for public and stakeholder comments in June 2001. Copies were sent to a mailing list of approximately 250 to 300 members of the public and identified stakeholders. Comments were received and have been incorporated to the extent practicable. A number of the comments were more relevant to the resource-specific plans that underlie the IRMP; these comments have been provided to the preparers of those specific plans.

### 3.0 NNSA Resource Management Principles

NNSA believes that it is feasible and desirable to integrate mission needs and natural resources stewardship. The goal of IRMP implementation should be to provide a process that minimizes conflicts and to develop solutions that advance both mission and environmental stewardship—in a cost-effective manner. 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 feasible.

Figure 3.1 is a conceptual presentation of the relationships and interactions between LANL operations and the environment from the local environmental perspective (LANL 2001a). Not shown, but also important, is the regional environmental impact related to LANL operations. This schematic illustrates the importance of an integrated approach to resources management in support of NNSA's mission.

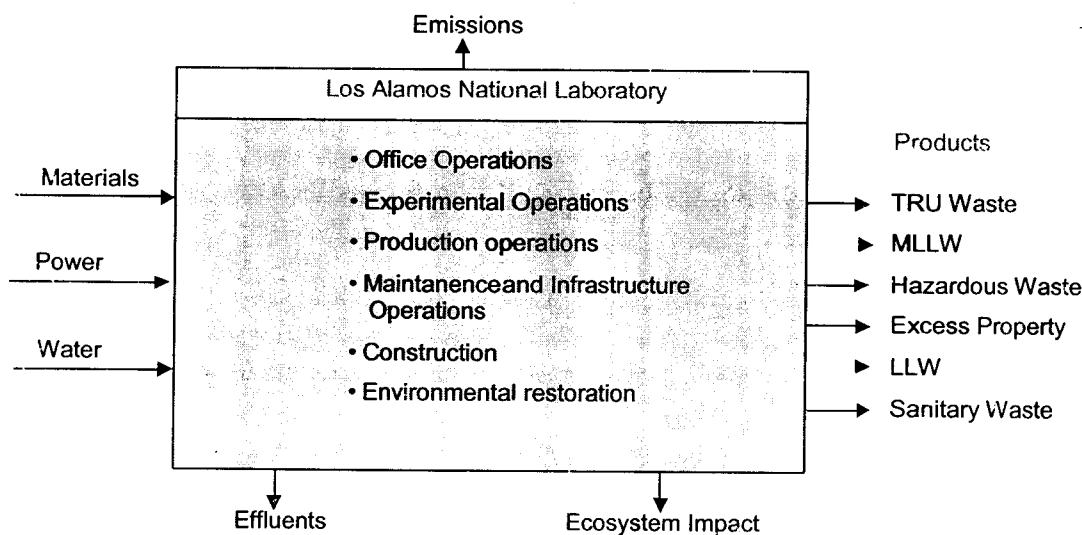


Figure 3.1. Relationships and interactions between LANL operations and the environment. (Note: TRU = transuranic, MLLW = mixed low-level waste, LLW = low-level waste.)



The underlying principles of the IRMP are as follows:

- Operate LANL's facilities consistent with LANL's mission assignments, sound ecological principles, and regulatory compliance.
- Develop new facilities consistent with LANL's mission assignments and sound ecological principles.
- Restore and maintain ecosystem viability while accomplishing LANL's mission assignments and operations.

NNSA expectations for the IRMP are that it will improve the following:

- Institutional planning and the project implementation process (specifically, operational efficiency).
- Regulatory review and the negotiation process (compliance).
- DOE, NNSA, and UC/LANL's relationship with regulators, stakeholders, and the public.
- Scientific understanding and management of LANL's natural and cultural resources.
- NNSA and UC/LANL's understanding and management not only of impacts but also of institutional and environmental risk factors.

Moreover, by recognizing LANL as a component of a regional ecosystem, NNSA, through the IRMP, will contribute to regional resources management. NNSA recognizes that LANL occupies only a part of the Pajarito Plateau ecosystem complex and that actions taken at LANL may affect regional ecosystem dynamics and visibility. The IRMP is built on the tenets of NNSA's landholder responsibilities, including responsibilities to neighbors, such as Bandelier National Monument, Santa Fe National Forest, Native American Pueblos, New Mexico State Agencies, the US 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

## **4.0 NNSA Guidance on Implementation**

NNSA's vision is to perform mission activities that work better, cost less, and increase accountability to the American taxpayer by providing a clear picture of the return on the investment of the resources entrusted to this agency. To accomplish this vision, NNSA values and needs to demonstrate leadership; improve communication and participation; identify and manage risk; embrace diversity; enhance trust of the public and other stakeholders, integrate environment, safety, and health (ES&H) into all activities; improve performance; and measure its performance (DOE 2001b).

### **4.1 Expectations**

NNSA's expectation is that UC/LANL will manage LANL's land and facilities as valuable national resources to support critical missions and protect the environment. The management of natural and cultural resources will be based on the principles of ecosystem management and sustainable development. In addition, implementation of the IRMP will consider the site's larger regional context and will be developed with stakeholder participation.

Natural and cultural resources management will be integrated into the overall management of LANL. The IRMP will serve as an essential component of the environmental management system that will integrate natural and cultural resources stewardship/compliance accountability into daily decision-making and long-term planning processes for all programs, facilities, projects, activities, and functions.

### **4.2 Approach**

This IRMP provides specific focus on environmental compliance and stewardship in support of NNSA's missions and operations at LANL; it is one element of LANL strategic planning that includes NNSA and UC/LANL requirements in specific areas. The Ten-Year Comprehensive Site Plan (TYCSP) (LANL 2001b) integrates the mission/operational plans at LANL. Figure 4.1 presents a conceptual linking of the various development and management plans, with the emphasis on the integrating role of the TYCSP. The TYCSP was developed in accordance with NNSA guidance. NNSA expects LANL to employ a parallel approach to integrating resource specific plans into the IRMP. Figure 4.2 is a conceptual presentation of the same basic mission and operational plans as in Figure 4.1, but this time with the emphasis on the integrating role of the IRMP. NNSA looks forward to developments in the IRMP that will lead to linking environmental stewardship more closely with budget/projects, as contained in the TYCSP.

Details on the plans identified in Figures 4.1 and 4.2 are presented in Appendix C, with summaries of LANL's current operations management plans and environmental resources management plans, which are either being implemented or are in various stages of development.

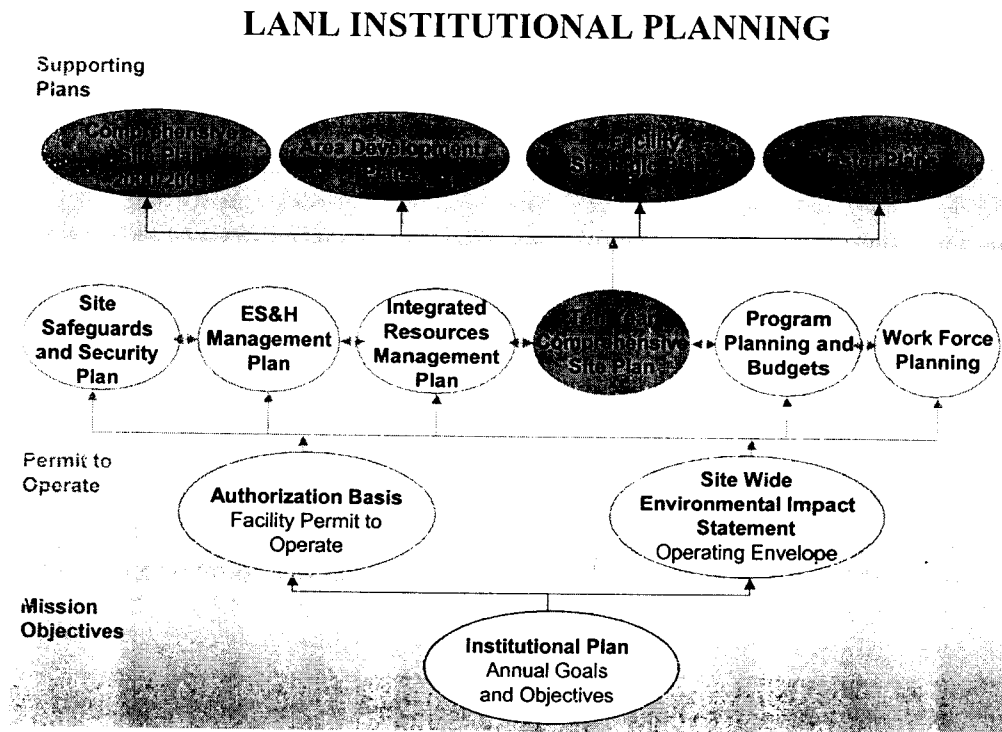


Figure 4.1. Linking of the various development and management plans, with the emphasis on the integrating role of the TYCSP

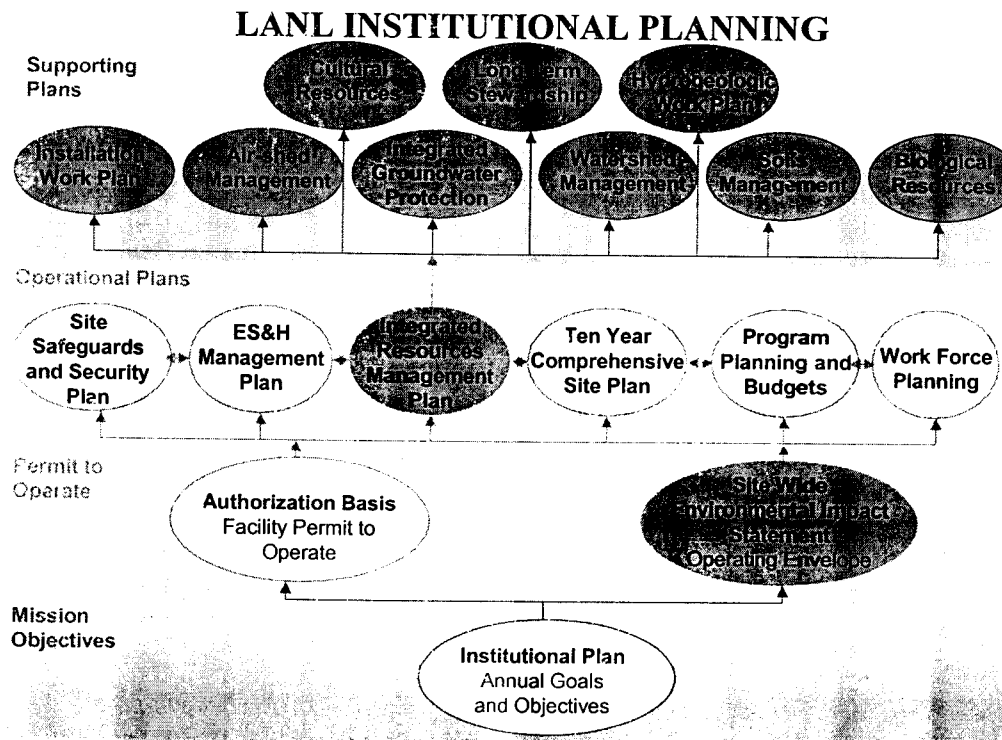


Figure 4.2. Conceptual presentation of the same basic mission and operational plans as in Figure 4.1, but this time with the emphasis on the integrating role of the IRMP.

NNSA expects that UC/LANL will implement the IRMP through the Integrated Safety Management System<sup>2</sup> (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 planning and performance of work. ISM is a comprehensive, systematic approach for setting, implementing, and sustaining the execution of safety and environmental expectations for LANL operations. The IRMP and the supporting individual resource-specific plans (described in Appendix C) 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. UC/LANL will need to define management units for detailed implementation.

UC/LANL will need to develop approaches for the following:

- integrating compliance requirements and stewardship guidance for natural and cultural resources,
- prioritizing among and between resources, if there are potential overlaps or conflicts,
- determining trade-offs, and
- enhancing public and stakeholder confidence.

NNSA expects UC/LANL to develop a methodology for documenting decision-making processes that enable missions to be accomplished without significantly adversely affecting the natural and cultural environment.

The SWEIS MAP called for LANL to begin implementation of the IRMP in October 2002. NNSA therefore expects LANL to provide information on implementation in that time period. NNSA will monitor progress on an annual basis.

#### **4.3 Role of the SWEIS**

The IRMP uses the baseline environmental envelope established for LANL through the SWEIS by DOE as the starting point for integration of operations and resources. The IRMP and its implementation will evolve with changes in operations, resources, resource knowledge, and institutional needs. The SWEIS Yearbook will be an important tool in identifying operational changes.

##### **4.3.1 SWEIS Baseline**

The SWEIS evaluated operations at LANL for the preferred alternative (Expanded Operations), and DOE concluded that emissions, effluents, etc., from these operations (at the anticipated levels) would not result in unacceptable impacts to the local environs. The SWEIS specifically addressed major resources of interest related to the IRMP (air, water, soil, biological, and cultural) and the effects of each major operation on each specific resource. Thus, as long as

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<sup>2</sup> 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 UC/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.

emissions, effluents, and operational parameters stay within the limits evaluated in the SWEIS, unacceptable impacts to existing resources do not exist.

The SWEIS analysis was broad in scope and limited to existing information. The IRMP will use the SWEIS as an initial baseline. The baseline will be augmented by information on LANL's existing and future operational impacts (as well as appropriate mitigation measures) as part of operational implementation. LANL's environmental monitoring system will be a key source of this information. The monitoring system will be documented in the resources management plans supporting the IRMP (see Appendix C). As more information becomes available through the implementation of the IRMP, managing both operations and associated impacts will be improved.

#### **4.3.2 SWEIS Yearbook**

In collaboration with NNSA, UC/LANL initiated a program to evaluate actual operations against SWEIS projections. This data is published in an Annual SWEIS Yearbook (LANL 1998b). 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 consistency 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 institutional or facility level to maintain uniformity in approach.

A tool being developed for the ongoing National Environmental Policy Act (NEPA) compliance program will greatly assist with problem identification in resource allocation. LANL-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.

#### **4.4 Goals and Objectives**

Goals and objectives are important elements of a resources management plan. However, the IRMP is a plan still in the early 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 of the IRMP. In addition, UC/LANL's implementation approach will need to develop several processes for setting new goals and objectives, reviewing implementing actions and identifying and resolving or avoiding conflicts, such that the overall goals and objectives can be achieved as much as possible.

#### **4.4.1 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., concluding that the parameters of such changes remain would, therefore, remain within projections, which 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 1999b). NNSA's initial goals for LANL were

- **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 will 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.

LANL has successfully met these measures; the specifics of completion are contained in the Annual MAP Report (NNSA 2001). NNSA expects that LANL will continue to develop goals and objectives to improve performance in these important areas of resource conservation.

#### **4.5 Monitoring and Updates**

To maintain the IRMP and enhance its utility as a resource management framework, NNSA working in concert with UC/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:

- **Operational**—those measures that determine how well the ongoing mission is supported and maintained by the IRMP;

- Environmental—those measures that determine how well UC/LANL’s resources management system works in protecting the environment and managing resources; and
- Regional—those measures that evaluate how well UC/LANL’s resource management options fit within the overall management of resources of the Pajarito Plateau.

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## **Appendix A**

### **LANL Operations**

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

#### **A.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 A.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 A.1).

LANL is divided into technical areas that are used for building sites, experimental areas, waste disposal locations, etc. (Figure A.2). However, these uses account for only a small part of the total land area. Development is limited by steep slopes and by the need for security and safety buffers because of the work being performed. Over one-half of the total acreage has slopes with grades over 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.

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.

#### **A.2 Historic and Current Operations**

##### **A.2.1 The War Years (1942–1946)**

During World War II, the main technical area (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

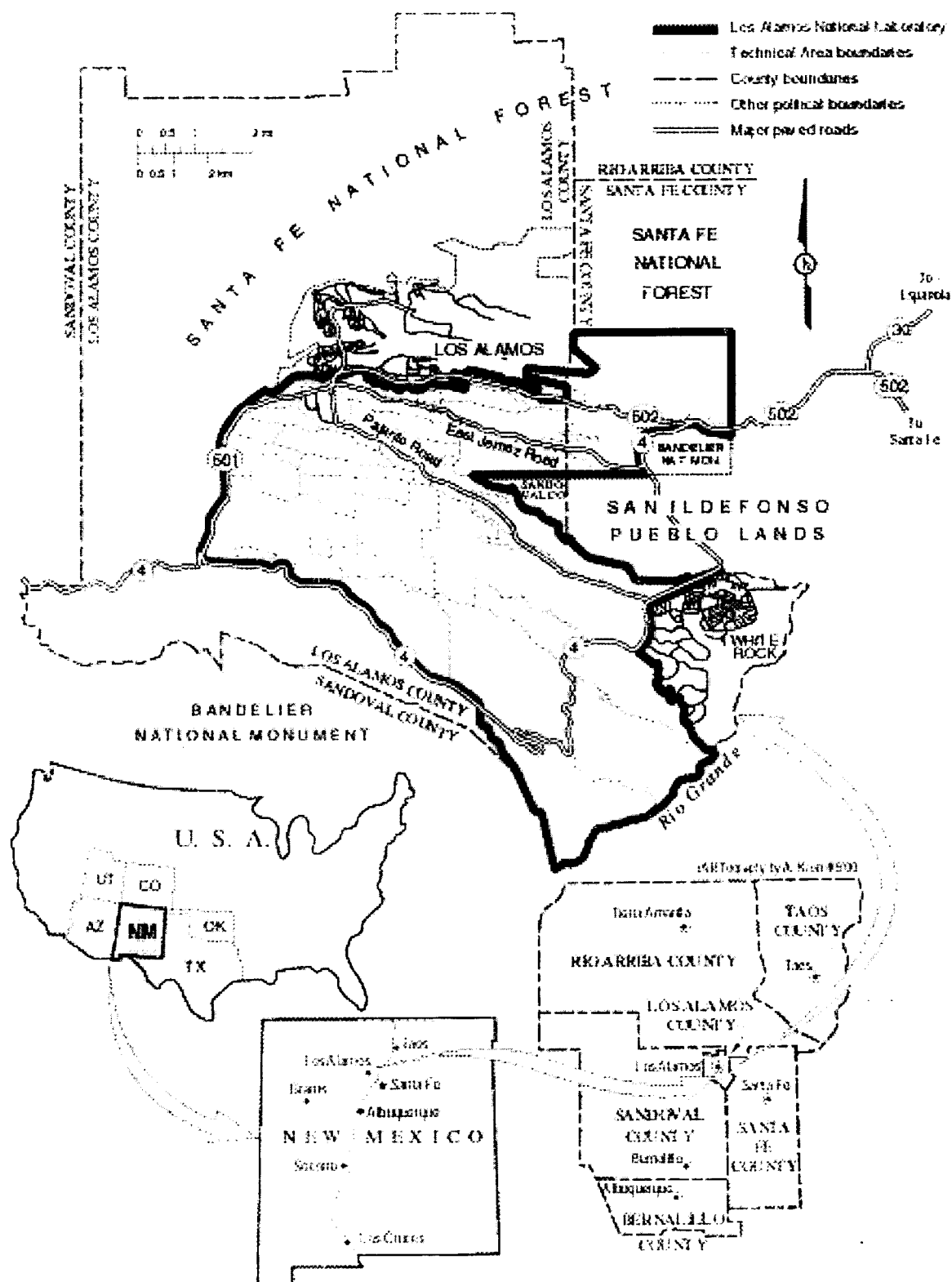


Figure A.1. Location of LANL.

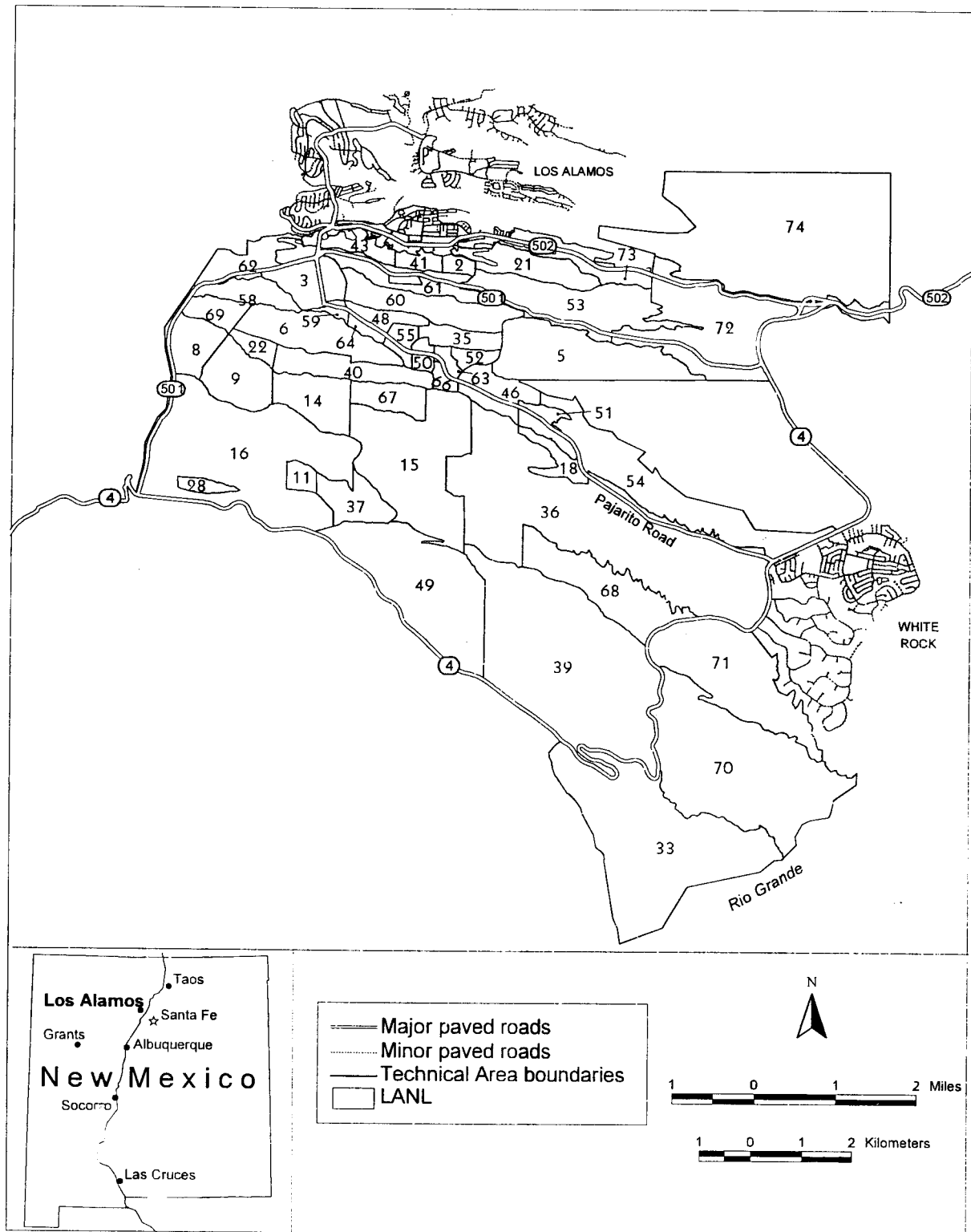


Figure A.2. Technical areas at LANL.

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. UC/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, hydrofluoric, and orthophosphoric), and various types of organic compounds. In addition, regular office activities, routine nonhazardous waste operations, and the town site 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 NMED.

### **A.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 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.

### **A.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 Complex at TA-3.

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.

## **Appendix B**

### **B.1 LANL Resources—Introduction**

This appendix provides some of the resource-specific context necessary for understanding the purpose and intended use of the IRMP for managing the natural and cultural resources occurring at LANL. It includes information regarding the extent and condition, resource management considerations, and the current approach to resource management associated with each of the following resources: air, surface water, groundwater, biological resources (including soils), and cultural resources. The information in this appendix represents the current understanding and management status for each resource. It is based on historic and on-going studies and publications including the SWEIS for LANL and supporting documentation (DOE 1999a; LANL 1997; LANL 1998b; LANL 1999), updated as appropriate.

#### **B.1.1 Background**

A key component of managing natural and cultural resources at LANL are the relationships between resources on both a regional and site-specific scale. Consideration of the administration of LANL operations and activities within a site-specific and regional context is also important. Administrative boundaries, however, do not necessarily coincide with ecological boundaries. LANL facilities, infrastructure, operations, and impacts (positive, negative, and undetermined) are part of the patterns and processes of a complex regional landscape making up the Pajarito Plateau. Major watersheds (Figure B.1), canyon systems, and vegetation zones (Figure B.2) 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. Because of this ecological continuity and interconnectedness, 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.

#### **Watersheds**

The regional ecosystem has been defined to include eight major watersheds, each of which has significant tributaries (Table B.1). 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.



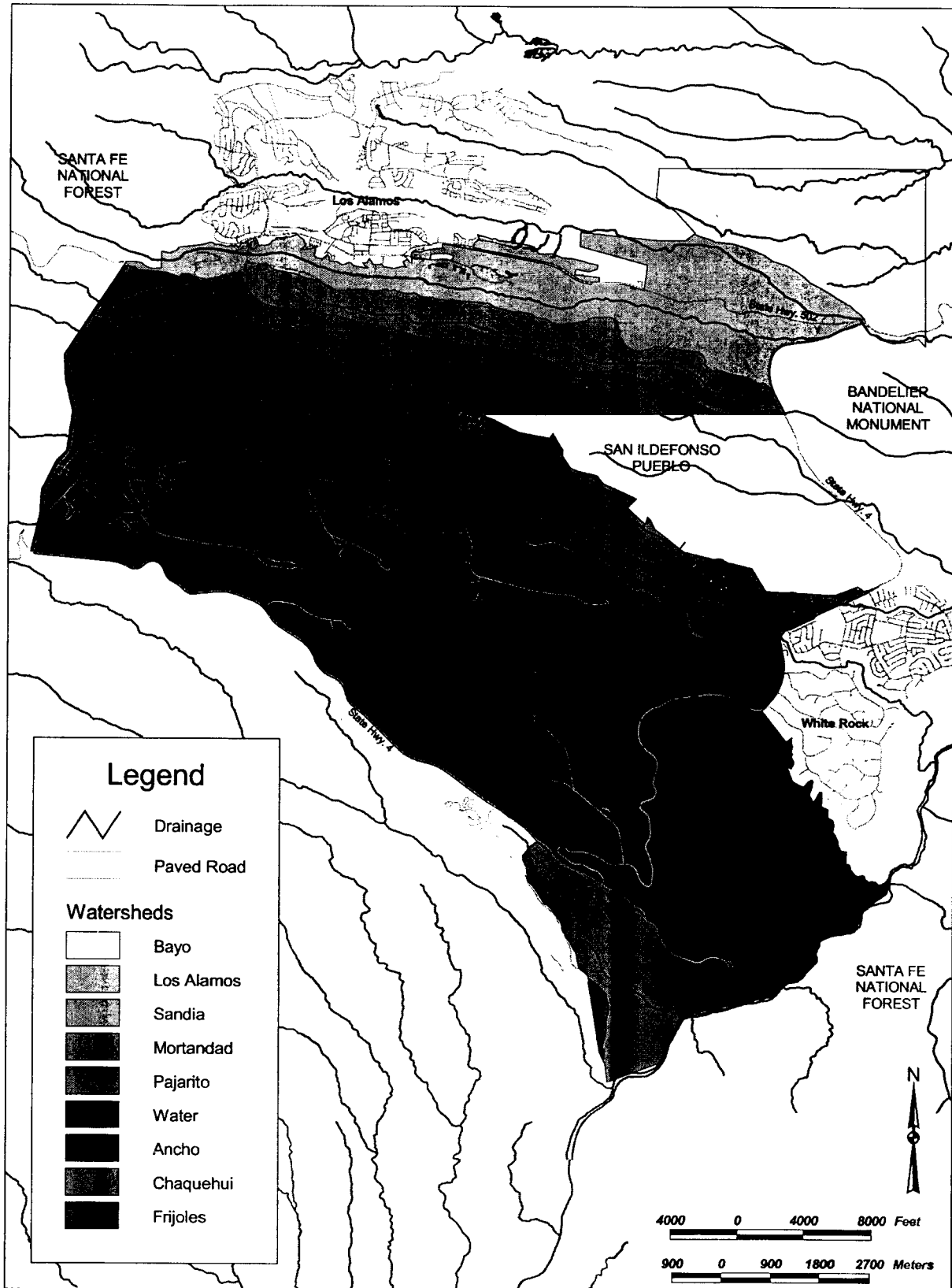


Figure B.1. Watersheds at LANL.

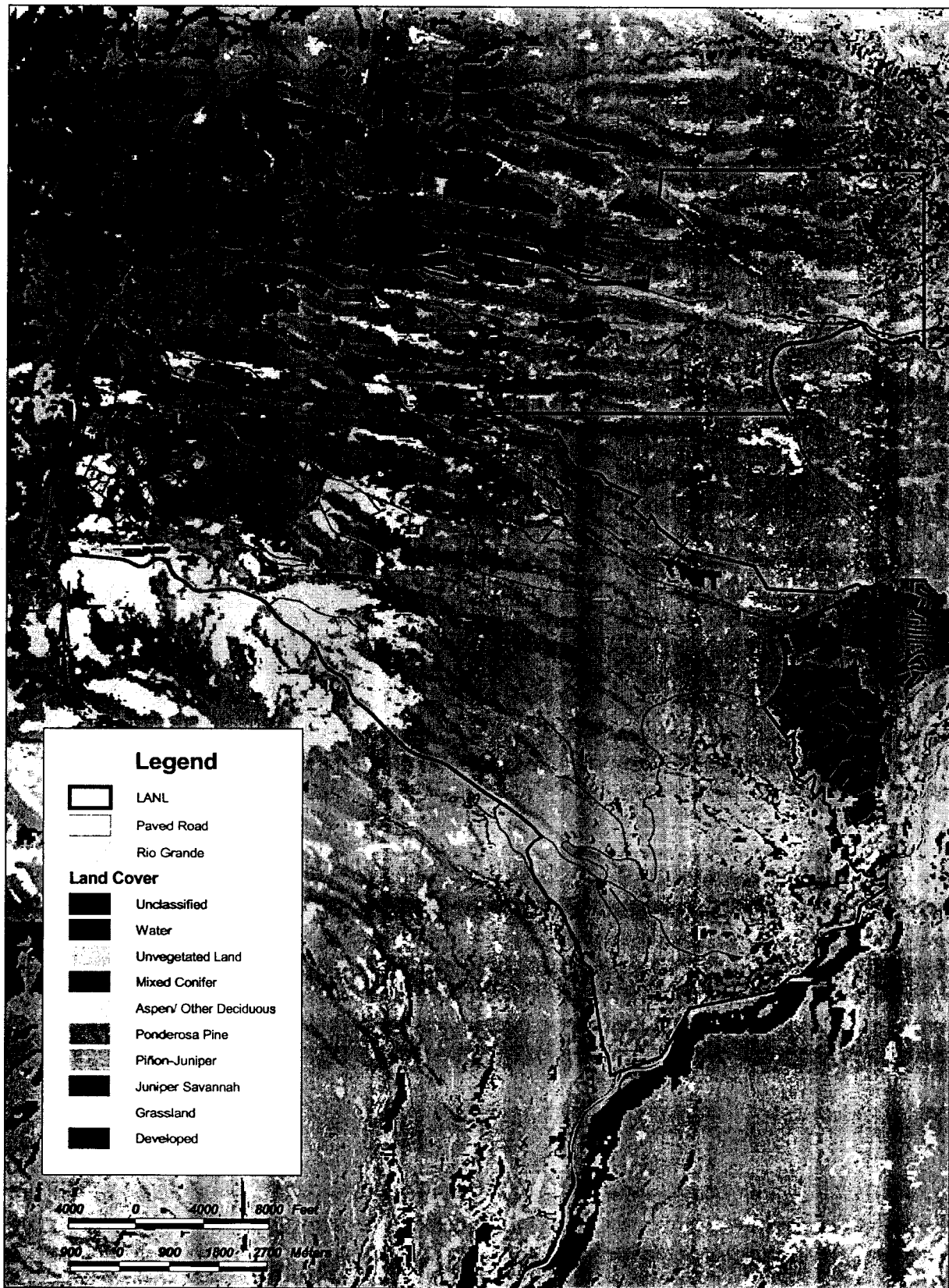


Figure B.2. Vegetation zones at LANL.

Table B.1 Watersheds and Main Tributaries

Watersheds <sup>a</sup>	Major Tributaries to the Watershed <sup>b</sup>
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

<sup>a</sup> These watersheds drain the Pajarito Plateau, some portion of NNSA property, and discharge to the Rio Grande.

<sup>b</sup> Many of these tributaries receive surface flow from other, lesser, named and unnamed, tributaries.

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.

### **Major Vegetation Zones**

While watersheds traverse all or part of the elevational gradient, major vegetation zones (Figure B.2) 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 or no 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.

## **B.2 Resources**

The resources included in this section are those that are currently considered to be regionally important and determined to be most relevant to the NNSA mission at LANL.

### **B.2.1 Air**

#### **B.2.1.1 Extent and Condition**

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. LANL operations meet all state standards.

In addition to these industrial-type emissions, LANL also has emissions of hazardous air pollutants, such as beryllium and radioactive materials, that are regulated by the EPA under the National Emissions Standards for Hazardous Air Pollutants. LANL also uses ozone depleting substances in its refrigeration equipment. The use of these substances is regulated under Title VI of the Clean Air Act.

NNSA currently complies with all applicable air quality regulations at LANL and also takes measures to ensure that its already compliant emissions remain low. Examples of these efforts include installing new control equipment where appropriate and evaluating environmental monitoring data to identify increases in ambient impacts.

#### **B.2.1.2 Resource Management Considerations**

##### **Radiological Air Quality**

Individuals are continuously exposed to airborne radioactive materials. These materials come primarily from natural sources such as uranium and its daughters, including radon. In addition to these natural sources, some LANL operations result in the release of radioactive materials to the

ambient air from point sources such as stacks and vents or from non-point (or diffuse) sources such as dispersed radioactive contamination in soils. The concentration of radionuclides in point source releases is continuously sampled using EPA-approved methodologies or is 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, and plutonium.

The largest contributors to LANL radiological point-source emissions are LANSCE and the Laboratory's tritium operations (e.g., TA-21 and TA-16). LANL non-point sources of radiological emissions include fugitive emissions from LANSCE, the Pulsed High-Energy Radiographic Machine Emitting X-rays (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.

EPA regulations require UC/LANL to demonstrate annually that radioactive airborne emissions from operations do not result in public exposures that exceed 10 mrem per year. This is accomplished through modeling measured and estimated stack releases and by measuring ambient air concentrations of radioactive materials. In addition to the annual evaluation, the UC/LANL Air Quality Group also maintains a program of routine data evaluation that is used to identify increased emissions of radioactive materials and to take actions, where appropriate, to minimize these increased emissions.

### **Nonradiological Air Quality**

LANL operations can result in releases of nonradiological air pollutants that may affect the air quality of the surrounding region. Construction activities and other operations have the potential 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 can 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.

The major source of nonradiological air emissions is the release of NO<sub>x</sub> from LANL's TA-3 power plant. Although these emissions are relatively small compared to other sources in the state, UC/LANL is taking steps to reduce these emissions. A new control device, Flue Gas Recirculation, is being installed in the power plant. Although the actual reduction in emissions is not yet known, the literature indicates that a 70 percent reduction is possible.

#### **B.2.1.3 Current Approach to Resource Management**

The air resources at LANL are currently managed using a compliance-oriented Quality Management Plan. Under this plan, the Air Quality Group implements a policy to develop programs to help ensure that airborne emissions from LANL operations are not only compliant with regulatory requirements but that responsible measures are pursued to minimize airborne emissions to protect the northern New Mexico airshed. To that end, the Air Quality Group recognizes that decreasing air emissions may result in increased impacts to other media (e.g.,

water, soil, waste). When this possibility is identified, the Air Quality Group evaluates and pursues alternative courses of action that minimize collective impacts on the environment. This approach is recognized as an opportunity to integrate the management of air resources with other natural resources management strategies through the implementation of the IRMP.

## **B.2.2 Groundwater**

### **B.2.2.1 Extent and Condition**

Groundwater in the LANL area occurs in three modes: shallow alluvial groundwater in canyon bottoms, intermediate zone perched groundwater, and the regional aquifer. The hydrology, topography, and underlying geology of the LANL region play a major role in the movement and distribution of groundwater by directly influencing infiltration, percolation, and recharge rates. The geology underlying the mesas of the Pajarito Plateau (Bandelier Tuff) contains variations (welding, surge beds, ash-flow structures, air-fall pumice beds) and fractures that influence the flow of water below the LANL site. The hydrogeologic dynamics within and between these three modes of groundwater are the subject of on-going characterization and groundwater monitoring. Details regarding groundwater quality monitoring results can be found in the annual Environmental Surveillance Report for LANL during 2000, completion reports for Hydrogeologic Work Plan characterization wells, and the Groundwater Annual Status Reports.

#### **Alluvial Groundwater**

Infiltration of surface water flow (caused by effluent discharges, spring discharge, or stormwater runoff) maintains shallow groundwater in the alluvium of some canyons. Alluvial groundwater is unconfined and is perched on underlying Bandelier Tuff, Cerros del Rio basalts, or Puye Formation. Alluvial groundwater is a source of recharge to underlying intermediate perched zones and to the regional aquifer, usually by unsaturated flow. In some of the wetter canyons percolation might occur by saturated flow. Faults, fractures, joints, surge beds, and higher permeability geologic units that underlie saturated alluvium could provide pathways for downward movement of water. The extent, condition, and implications of alluvial groundwater within the LANL boundary are still being characterized, evaluated, and monitored.

#### **Intermediate Perched Groundwater**

Intermediate perched zones occur beneath major canyons and in the western portion of the Laboratory. Intermediate perched zones are found particularly beneath wet canyons that receive effluent discharges, have large surface water flow, or head in the Jemez Mountains. These intermediate perched zones occur in the Guaje Pumice Bed at the base of the Bandelier Tuff, the underlying Cerros del Rio basalts, and the Puye Formation. The location of intermediate perched zones is determined by presence of sufficient recharge, permeability variations of the rocks (reflecting lithologic variations), and geologic structure. Intermediate perched zones may be confined or unconfined. Discharge at springs and percolation into the underlying rocks (resulting in recharge to the underlying regional aquifer) deplete intermediate perched groundwater. In the western portion of the Laboratory, groundwater occurs as a large (300 ft-thick) intermediate perched zone within the lower Bandelier Tuff and the Puye Formation, approximately 700 ft below the mesa top. Most recharge for this zone originates as underflow of groundwater from the Jemez Mountains, with some contribution from recharge through mesas and canyon bottoms. The extent, condition, and implications of perched groundwater zones within the LANL boundary are still being characterized, evaluated, and monitored.

## **Regional Aquifer**

The regional aquifer below the Pajarito Plateau is the primary source of drinking water for the region including LANL, Los Alamos, White Rock, and Bandelier National Monument. This regional aquifer occurs in rocks of the Puye Formation, the Cerros del Rio lavas, lavas of the Tschicoma Formation, and the Santa Fe Group. The aquifer is unconfined below in the west portion of LANL and confined or partially confined in some locations near the Rio Grande. The slope of the water table is generally to the east. The estimated slope gradients range from 0.01 to 0.03. The hydraulic conductivity of aquifer rocks is heterogeneous. The distance from the land surface to the deep aquifer water table varies from approximately 1,200 feet along the western boundary of LANL, to approximately 600 feet along the eastern boundary near the Rio Grande. The radiocarbon ages of water from deep wells beneath the Pajarito Plateau range from about 1,000 to 6,000 years, although activities of tritium indicate that a portion of the water is less than 50 years old. The chemistry of groundwater in many wells near the Rio Grande is different from that beneath the Pajarito Plateau and from the eastern Española Basin. This suggests that old water (about 30,000 years) discharges near the river. The Rio Grande is the main discharge area for the regional aquifer. The largest component of recharge occurs as underflow of groundwater from the Sierra de los Valles, to the west of the Pajarito Plateau. Recharge also occurs by leakage from mesas, from alluvial groundwater in canyon bottoms, and from intermediate perched groundwater. The extent, condition, and implications of groundwater in the regional aquifer below LANL are still being characterized, evaluated, and monitored.

### **B.2.2.2 Resource Management Considerations**

The groundwater in the LANL area is an important regional resource. Characterizing the mode, location, movement, and condition of groundwater is an important aspect of natural resources management at LANL. Although groundwater resources have been studied for decades at LANL, there is still much to be learned about the geology and the hydrogeologic system beneath the Pajarito Plateau. This kind of resource management information is critical to maintaining positive relationships with regulators and stakeholders and is vital to understanding the complicated connection between monitoring results and the potential impacts of historic operations at LANL.

### **B.2.2.3 Current Approach to Resource Management**

The current groundwater resource management and protection approach at LANL focuses on the regional aquifer, but also considers perched groundwater found within canyon alluvium and the intermediate perched zones above the regional aquifer. Since the mid-1990s, groundwater resources at LANL have been managed under the Groundwater Protection Management Program per requirements under DOE Order 5400.1. This program addresses environmental monitoring, resource management, aquifer protection, and on-going hydrogeologic investigations. Extensive groundwater characterization efforts are implemented under the Hydrogeologic Work Plan. The program and work plan are used as tools for coordinating institutional groundwater issues and for interacting with federal and state regulators. The development and implementation of the IRMP provides an opportunity for integration between the Groundwater Protection Management Program and other resource-specific plans and programs.

## **B.2.3 Surface Water**

### **B.2.3.1 Extent and Condition**

Water is a limited resource in the semiarid climate of northern New Mexico. Canyon-bottom streambeds 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.

Surface water in the Los Alamos area occurs primarily as wetlands (Figure B.3) and short-lived or intermittent reaches of streams in floodplains (Figure B.4). 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 these are depleted by evaporation, transpiration, and infiltration. Before the Cerro Grande fire, only runoff from heavy thunderstorms or heavy snowmelt reached the Rio Grande several times a year in some drainages. After the Cerro Grande fire, more of the runoff from precipitation events reaches the Rio Grande. 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.

### **B.2.3.2 Resource Management Considerations**

After the Cerro Grande fire in May 2000, flood flows increased by one to two orders of magnitude in fire-affected drainages during the 2000 and 2001 summer monsoon seasons. These flood flows reached the Rio Grande more frequently and with significantly larger volumes of water, sediment and ash than previously measured. Best management practices (BMPs) were established throughout the burn areas on LANL property to reduce runoff and sediment and contaminant transport from LANL in the years following the fire. Flood flows are expected to diminish to pre-fire conditions within about six to ten years from the date of the fire.

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.

Effluents from sanitary sewage, industrial water treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain some wetlands and 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.

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.



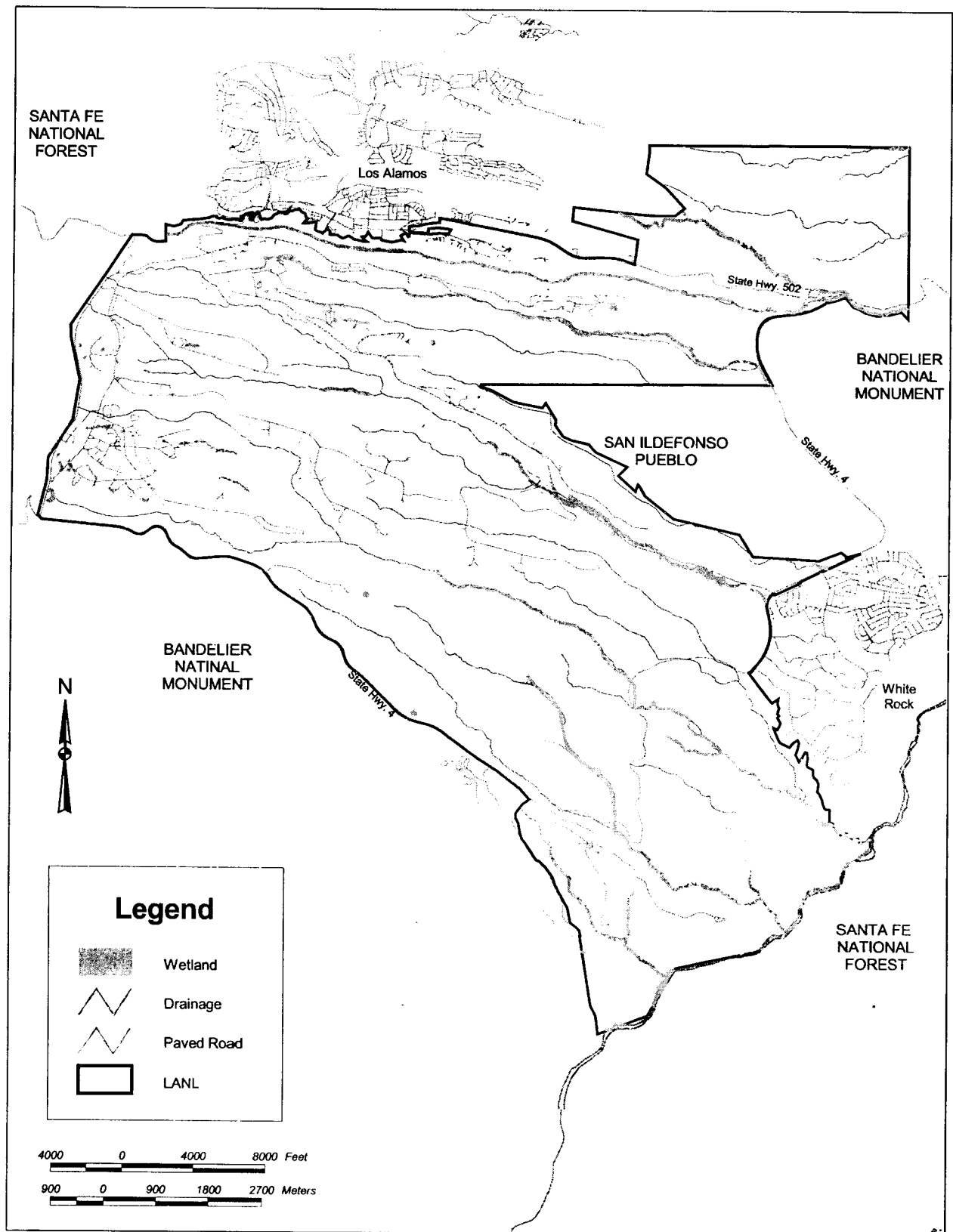


Figure B.3. Wetlands at LANL.

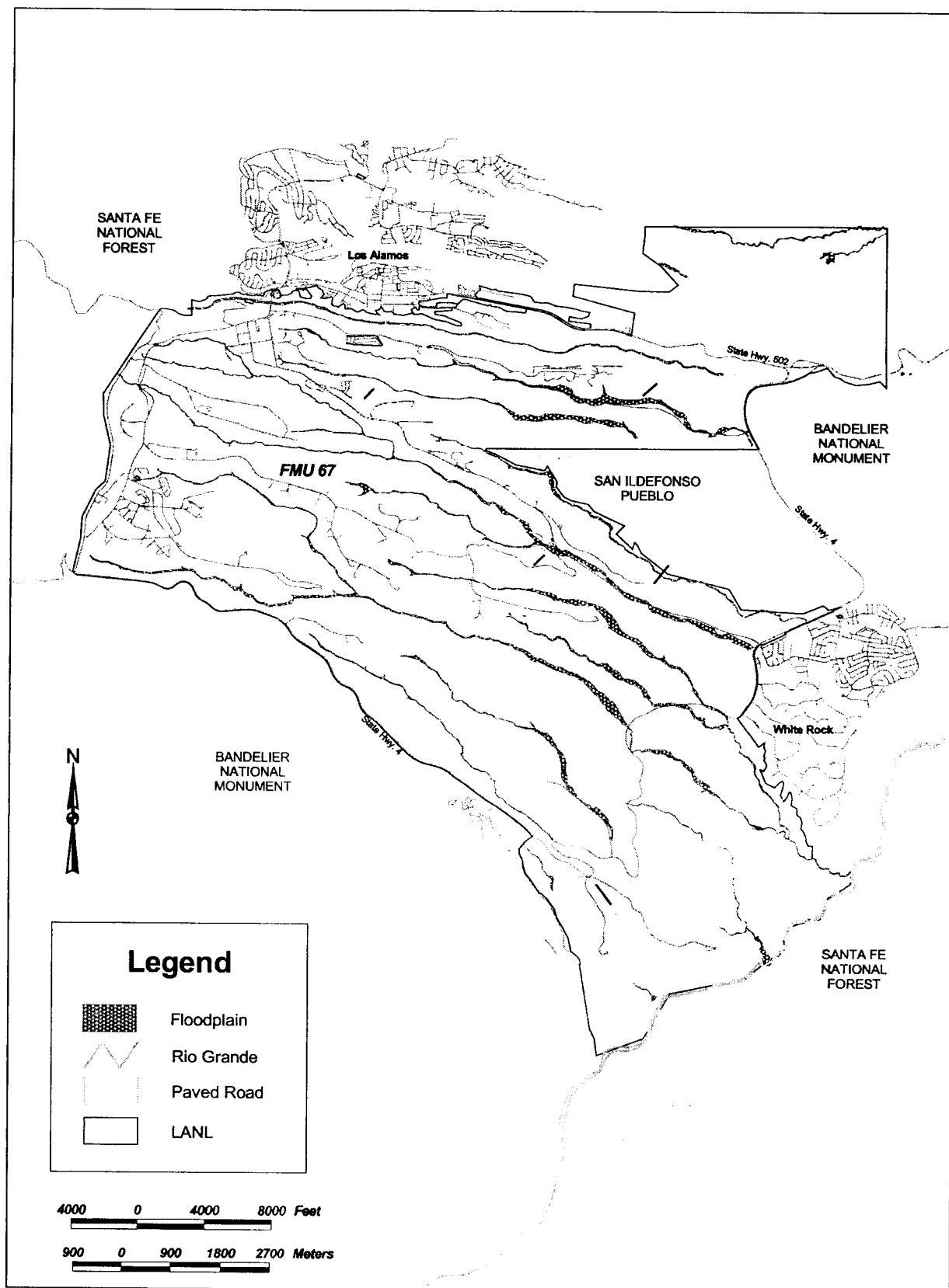


Figure B.4. Floodplains at LANL.

### **B.2.3.3 Current Approach to Resource Management**

The general strategy for surface water protection at the Laboratory includes the following elements: 1) comprehensive monitoring of storm water and persistent surface water, 2) analysis of surface water quality and quantity data to identify issues of concern, 3) assessment of risk to wildlife and humans, and 4) identification and implementation of appropriate BMPs to minimize risks. The same general approach is currently being applied to managing wetlands. The monitoring network at LANL is one of the most comprehensive networks in the nation, with 60 automated stations nested within eight major drainages on the Pajarito Plateau. Stations include automated flood stage and water quality sampling. Diverse Laboratory-wide monitoring programs are integrated through the Watershed Integration Team to ensure all forms monitoring data are taken into account in making water quality management decisions. This team is also leading the effort to prepare an institutional Watershed Management Plan. The assessment, monitoring, and management of wetlands will be addressed in the Institutional Biological Resources Management Plan (BRMP).

### **B.2.4 Biological Resources**

#### **B.2.4.1 Extent and Condition**

The biological resources at LANL are extensive, diverse, and dynamically connected with the regional landscapes. LANL's biological resources are considered to include the soils, vegetation, and animals that exist within or move through the site boundaries. The mesa tops and canyons include many landforms, ecological transition zones, vegetation types, and wildlife habitats. The federal government for several decades has restricted public access to LANL lands, and the current site is also situated adjacent to the largely undeveloped lands of Bandelier National Monument and the Santa Fe National Forest. As a result, LANL exists in a region that functions as a refuge for a biologically diverse collection of plants and animals.

#### **Forest, Range, and Soils**

There are two dominant forest types that occupy the majority of LANL acreage: piñon-juniper woodlands (46.2%) and ponderosa pine forest (29.3%). Each of these forest types has its own characteristics; however, they each show effects of fire suppression over the last 100 years, coupled with past grazing practices 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.

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. Approximately 6.6% of LANL acreage is bare soil. 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.

The Cerro Grande fire has changed the extent and condition of much of the forest, range, and soils of the LANL site. Even more dramatic changes have occurred within the mountain slopes and canyons to the west and up slope of LANL. Several hundred acres of LANL forest and rangelands burned with variable intensity during the fire. These areas are under various stages of

rehabilitation and postfire recovery. Site soils, particularly in severely burned areas and drainages, have become more vulnerable to erosion because of loss of vegetation and the increased flooding potential resulting from the fire.

### **Wildlife, Sensitive Species, and Habitats**

The lands within and around LANL have diverse, unique biological communities with 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.

LANL's lands support state- and federal-listed threatened and endangered species. A number of regionally protected and sensitive species of concern have been documented on or near LANL's lands. These consist of two federally listed endangered species, two federally 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). There are potentially more than 20 state-listed species residing within LANL boundaries.

Wetlands, mostly restricted to the bottoms of these canyons, provide valuable 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.

#### **B.2.4.2 Resource Management Considerations**

LANL facilities and operations are somewhat unique among DOE and NNSA sites in that they occur within an ecologically diverse and relatively undisturbed region protected under a myriad of federal and state regulations, policies, and orders. LANL is also surrounded by many different stakeholder communities that expect the site to operate in a compliant and responsible manner. LANL projects and activities must be planned and implemented in a manner that minimizes risk to both institutional activities and the surrounding environs via processes that integrate the mission and biological resources management.

### **Forest, Range, and Soils**

In the last 50 years, the LANL region has sustained 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 serious fire event increases. These conditions are an important consideration in the effort to address the risk of wildfire at LANL and within the region.

Soil erosion can have serious consequences to maintenance of biological communities and is also a mechanism for moving contaminants across LANL and off site. Wildfire, construction,

and other similar activities at LANL can displace these soils, and runoff 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. The Cerro Grande fire dramatically increased the risks associated with soil erosion.

### **Wildlife, Sensitive Species, and Habitats**

Some specific wildlife management considerations that have been identified by LANL biologists, other Laboratory personnel, and external stakeholders include (1) minimizing vehicle-animal collisions; (2) identifying and protecting key habitats on LANL; (3) maintaining the ability of animals to travel across LANL in the face of increasing development, fencing, and other disturbances; (4) minimizing transmission of zoonotic diseases (such as hantavirus) to humans; (5) minimizing uptake and transport of contaminants by wildlife; (6) evaluating and mitigating impacts of wildlife on other natural resources; and (7) evaluating and mitigating impacts of the Cerro Grande fire on wildlife species.

NNSA operations and activities at LANL have the potential to impact threatened, endangered, and sensitive species. These species are protected under federal and state laws as well as institutional policies. These laws and policies are designed to avoid or mitigate potential impacts associated with removal and fragmentation of key habitat, disturbance during breeding seasons, and alteration of hunting and foraging areas (Figure B.5). Conversely, these species may impact institutional planning and operations by requiring certain areas to remain undisturbed and restricting the amount of land space available for locating and operating new facilities.

LANL wetlands (Figure B.3) are considered sensitive habitats that provide resources for local and regional wildlife. These wetlands provide habitat and resources for threatened and endangered species, aquatic invertebrates, amphibians and reptiles, and numerous species of local and migratory birds and are also used by other wildlife like large game species as water sources. LANL wetlands, and the floodplains in which they exist, are protected under federal and state laws. Some of these wetlands are the result of industrial outfalls regulated under the Clean Water Act. To reduce the amount of pollutants released to the environment, some of these outfalls are being eliminated, and the associated wetlands are being reduced or lost. One of the significant considerations associated with managing LANL wetlands is the institutional trade offs between eliminating outfalls as a source of pollution while reducing or losing the associated wetlands.

### **Biocontaminant Monitoring**

The subject of contaminants at LANL is important to several of LANL's regulators and many of the regional stakeholders. The management of contaminants is also essential to good environmental stewardship. The nature and extent of contamination, including the variety of contaminants present at low levels, are somewhat unique to DOE sites such as LANL and can also be quite different between DOE sites. While there are many different aspects of managing contaminants, one critical focus area is monitoring contaminants in biological organisms (biocontaminant monitoring). Biocontaminant monitoring is essential to long-term resource stewardship and an important part of managing (in the broadest sense) the habitat and organisms in which contaminants reside. The concern with biocontaminants was heightened by the recent Cerro Grande fire and this consideration addresses issues related to the fire as well.

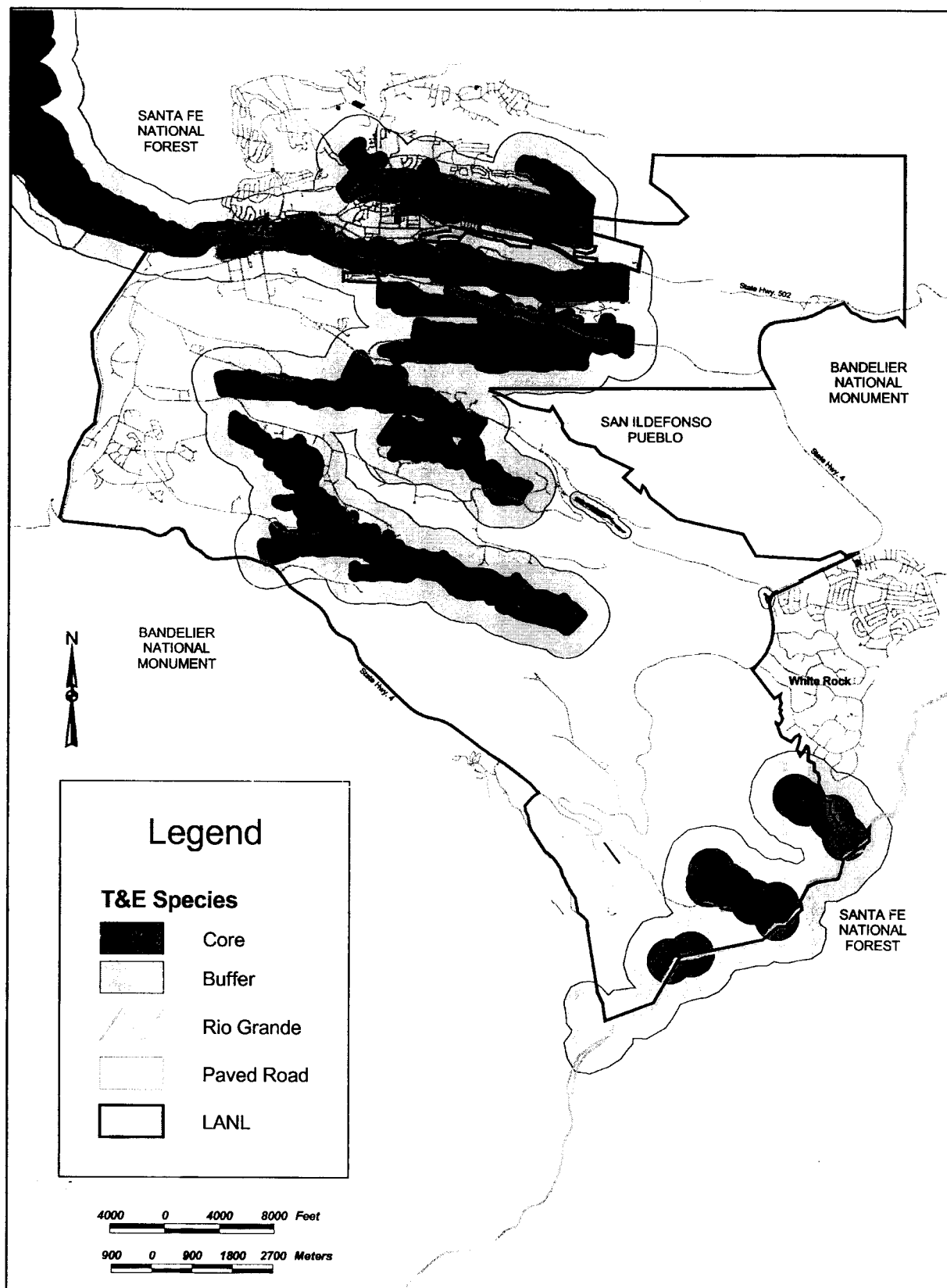


Figure B.5. Threatened and endangered species habitat at LANL.

#### **B.2.4.3 Current Approach to Resource Management**

The current approach to managing biological resources at LANL includes the development of an Institutional BRMP and on-the-ground resource management activities (e.g., forest thinning and fuels treatment). The plan is currently being developed to address the need to integrate short- and long-term mission activities and compliant and effective management of LANL's biological resources. The plan uses a combined discipline- and geographic-based approach to identify and integrate actions for management of biological resources. It addresses the following biological resources elements: forest and range, wildlife, sensitive species and habitats (including wetlands), and biocontaminant monitoring.

Intensive forest management is currently being conducted under an institutional wildfire hazard reduction project. Heavily forested areas at LANL are being strategically thinned to reduce the risk of wildfire to key facilities and operations, workers and the public, and biological resources. This work is being implemented via the Wildfire Hazard Reduction Project Plan and associated documents.

The 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. Soil erosion associated with LANL facility construction, operations, and other activities are managed through the implementation of BMPs under a variety of federal and state regulatory requirements.

Wildlife management at LANL is currently being addressed through facility-specific mitigation and a variety of site-specific and regional applied research projects. The wildlife management criteria and institutional objectives are being developed as part of the Institutional BRMP.

Management of LANL's threatened and endangered species is specifically accomplished through the implementation of the Threatened and Endangered Species Habitat Management Plan (HMP). The HMP is the institutional tool for maintaining compliance with the Endangered Species Act and is part of the Laboratory Implementation Requirements for constructing and operating new and existing facilities.

Wetlands at LANL are managed according to applicable federal and state laws. There is an institutional initiative underway to develop a site-wide strategy for managing and protecting wetlands. The final strategy will be implemented as part of the Institutional BRMP.

The concerns associated with biocontaminants are currently being addressed through an institutional Ecological Risk Assessment Program. This program is currently designed to establish institutional criteria and design procedures for identifying and evaluating the biological risk associated with contaminants located throughout LANL. The program is also used to integrate mission and resources management strategies for addressing the issue of biocontaminants.

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## **B.2.5 Cultural Resources**

### **B.2.5.1 Extent and Condition**

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 under several state and federal laws, regulations, executive orders, and policies. NNSA and UC have maintained compliance with all applicable laws, regulations, orders, and policies governing cultural resources management at LANL.

#### **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 (Figure B.6). 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. This LANL database includes 1,295 prehistoric sites and is organized primarily by site type. 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.

#### **Historic**

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 US 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 with an emphasis on two periods: 1) the Manhattan Project Period (1943–1946) and the Early Cold War Period (1947–1963).

#### **Traditional Cultural Properties**

A TCP is a significant place or object associated with the historical and cultural practices or beliefs of a living community and is essential in preserving cultural identity through a variety of social, spiritual, political, and economic uses. Several of the regional and local Native American Indian Tribes have confirmed that LANL contains these cultural resources in the form of ancestral villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas. Many of the known TCPs have been identified over the past several decades on a case-by-case basis through specific reviews and consultation processes associated with siting and implementing



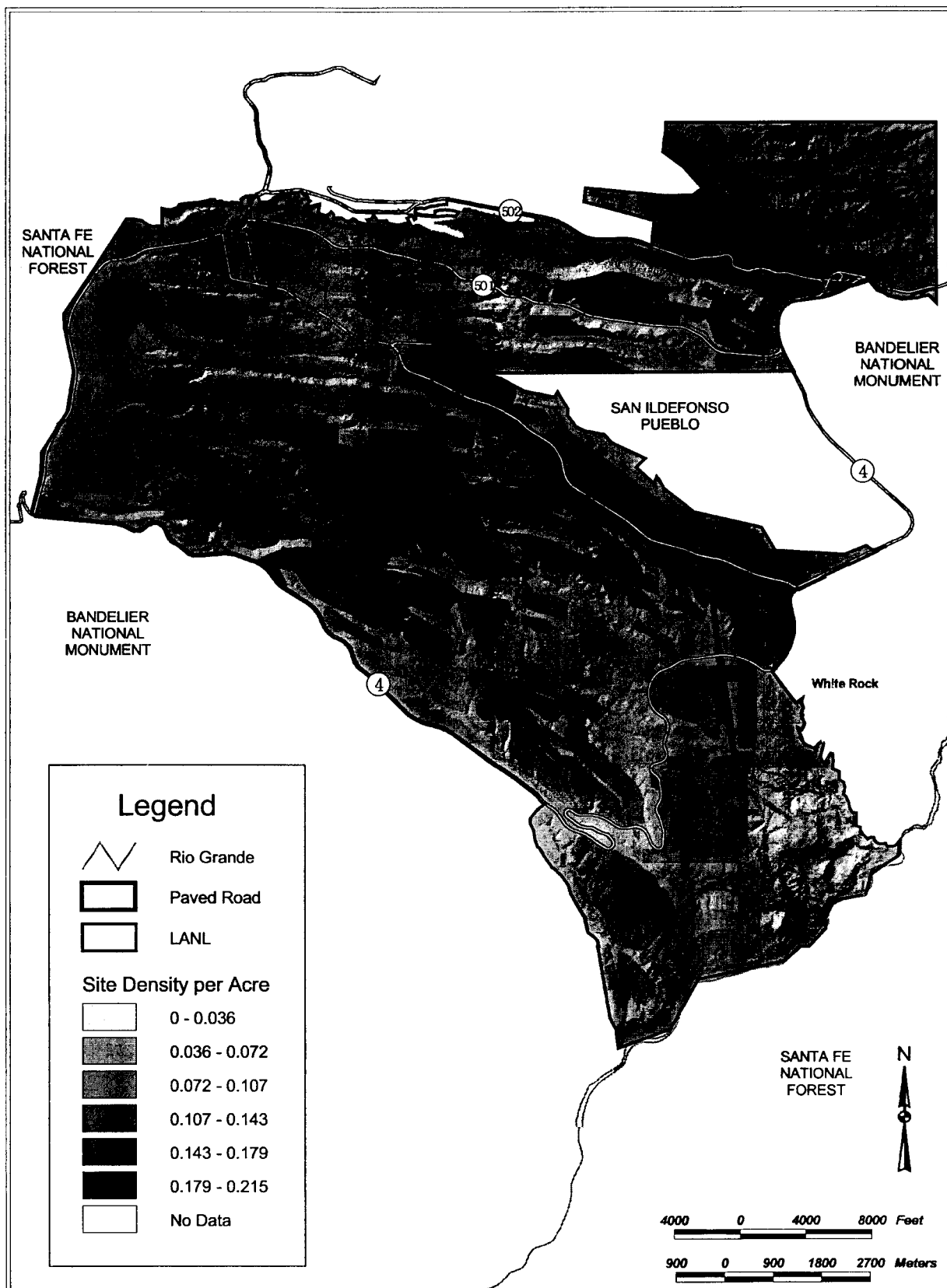


Figure B.6. Cultural resources at LANL.

LANL projects. LANL likely contains many more TCPs that have not yet been openly declared and specifically located by regional and local Native American Indian Tribes.

#### **B.2.5.2 Resource Management Considerations**

The cultural resources at LANL are diverse, distributed widely throughout the site, and are regionally and nationally significant. These resources must be managed in a manner that maintains compliance with a comprehensive set of regulatory drivers while enabling NNSA to implement its mission at LANL in a responsible, cost-effective, and sustainable way. The cultural resources management strategy at LANL has, until recently, been focused on project-specific compliance and consultation processes. This approach has resulted in resource management constraints including site-wide assessment and inventory limitations and difficult regulatory compliance and consultation processes. The complications associated with these constraints include compliance processes that result in infrastructure and land use restrictions, inadvertent risk to cultural resources, and strained relationships with regulators and Native American Indian stakeholders.

#### **B.2.5.3 Current Approach to Resource Management**

NNSA and UC have an institutional program in place at LANL to manage on-site cultural resources for compliance with all applicable state and federal regulations, orders, and policies. The program is designed to meet compliance requirements, improve cultural resources management accuracy and efficiency, and continue to strengthen the important relationships between NNSA and UC, state and federal regulators, and Native American Indian Tribes. The current approach to cultural resources management is to transition from site-specific to site-wide management of cultural resources. This approach is being pursued through the development of programmatic agreements with regulators, a TCP Consultation Plan, and an institutional Cultural Resources Management Plan. These initiatives provide ideal opportunities for integration with other institutional resources management efforts, resource-specific plans, and the IRMP.



## **Appendix C**

### **Operations and Environmental Resources Management Plans**

This IRMP provides specific focus on environmental compliance and stewardship in support of LANL mission operations. It is one element of LANL strategic planning that includes NNSA and UC/LANL requirements in specific areas. This section summarizes current operations management plans for LANL and environmental resources management plans, which are either being implemented or are in various stages of development. The following sections provide an overview of these plans and establish the context in which the IRMP will manage the relationship between operations and the environment.

#### **C.1 Summary of Institutional Operations Management Plans**

All work at UC/LANL is conducted within the framework established by institutional operations management plans. LANL strategic planning processes evaluate four levels that build upon each other to achieve scientific and operational excellence. These levels are represented as mission objectives, permit to operate, operational plans, and supporting plans.

The mission objectives level defines what work will be undertaken at LANL. The objectives are developed through the Institutional Plan and its process, which includes development by UC/LANL's Laboratory Senior Executive Team of annual strategic goals in each program area (e.g., Weapons Engineering and Manufacturing, Threat Reduction, and Strategic Research).

Environmental protection, health and safety, and technical limits are defined in the permit to operate level. The SWEIS and supporting plans define operating envelopes. Health and safety of workers and the public and technical requirements for the operation of specific facilities are evaluated in the Authorization Basis process. These plans provide key operating limits.

Figure C.1 diagrams the relationship of the LANL TYCSP to other plans. The operational plans depicted in Figure C.1 are site-wide in nature. They are interrelated in that each plan uses information from and provides information to the others. These plans provide guidance and information from which environmental issues may be drawn. The LANL ES&H Management Plan identifies vulnerabilities to be addressed in site and facility plans. The LANL Site Safeguards and Security Plan includes analysis of site-wide protection programs, strategies, and estimates of resources to implement identified requirements. Program plans and budgets provide insights into prioritization and growth vectors. The workforce plan includes critical skills requirements and broad estimates of changes in the workforce population based on budget projections.

##### **C.1.1 Annual Institutional Plan**

###### **C.1.1.1 Purpose and Scope**

The UC/LANL Institutional Plan is an integrated, single-document summary of UC/LANL's internal plans and their connections to the DOE Agreement with the President, the DOE Strategic Plan of 2000, and various roadmaps of DOE. This document meets the DOE Institutional Planning requirement as well as requirements in the contract between DOE and UC for managing LANL. The links among the DOE's plans and roadmaps, UC/LANL's Strategic Plans, UC/LANL's program plans, and the infrastructure and support plans are more clearly visible because they are summarized in one document.

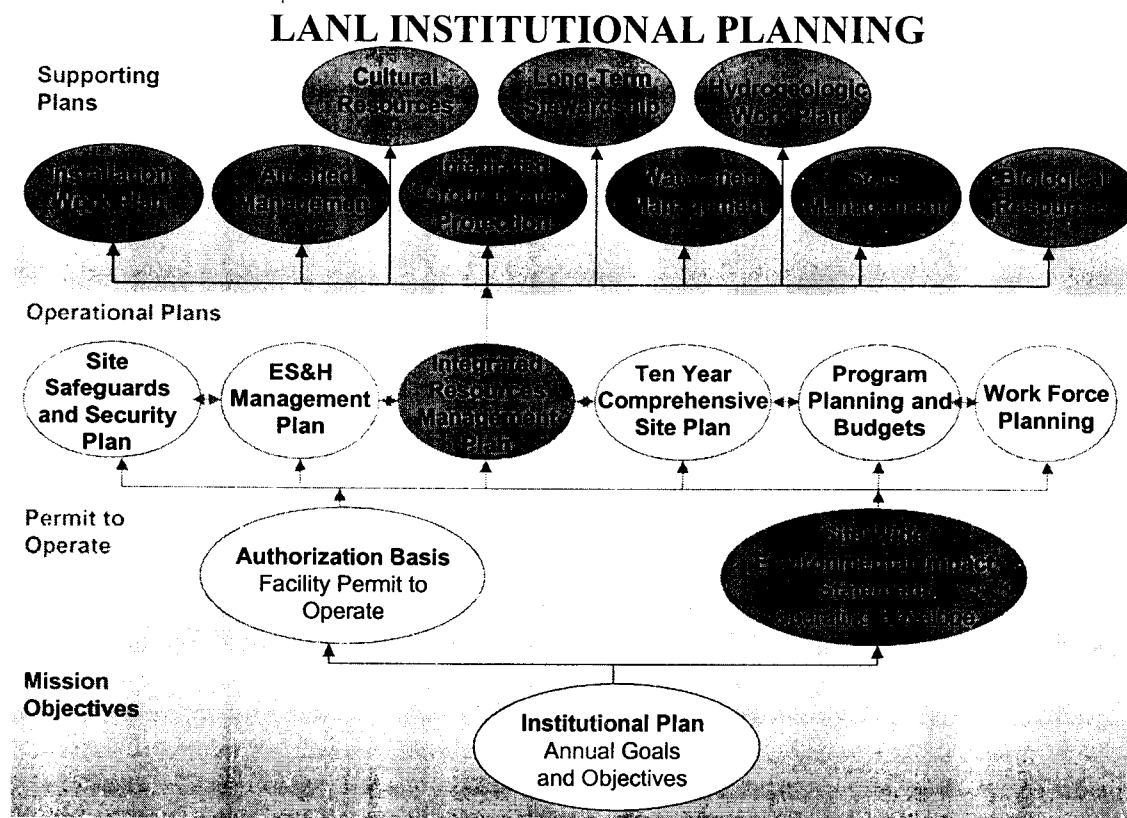


Figure C.1. The relationship of the LANL TYCSP to other plans.

### C.1.1.2 Status

The LANL Institutional Plan is prepared annually. The current version covers FY2001–FY2006.

### C.1.1.3 Relationship to Other Plans

This plan provides an overview of the various plans used to direct operations at LANL. It is primarily mission oriented and has no specific direct connection to resource management plans.

## C.1.2 Ten-Year Comprehensive Site Plan

### C.1.2.1 Purpose and Scope

The LANL TYCSP is a document that identifies major construction projects that the Laboratory proposes to meet current and future missions in an effective and efficient manner. It provides the key link between land use planning, project planning, and the Laboratory budget. Ten-year recommendations are proposed for facilities and infrastructure, which address maintenance backlog, space utilization, excess facilities, decontamination and decommissioning, and new construction. A prioritized project list is provided in addition to a project cost spreadsheet for line item projects, general plant projects, capital equipment, maintenance, and large expense items. Information produced by other Laboratory plans is coordinated and integrated into the TYCSP. It can be expected that projects listed in the TYCSP will be funded and built.

### **C.1.2.2 Status**

The first LANL TYCSP was submitted to DOE in September 2001 and is to be updated annually.

### **C.1.2.3 Relationship to Other Plans**

The LANL TYCSP is the single plan that integrates other plans addressing proposed facility and infrastructure construction projects.

## **C.1.3 Comprehensive Site Plan**

### **C.1.3.1 Purpose and Scope**

The LANL CSP is the guiding physical development plan for the 43 square miles at LANL. The CSP notes major development issues, and includes land use, transportation, facilities, environment, safety, security, space, utilities, and urban design direction. The CSP presents the UC/LANL 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.

### **C.1.3.2 Status**

Until the TYCSP, the CSP was the major planning document addressing physical planning. CSP 2000 was updated in 2000 and is updated every five years.

### **C.1.3.3 Relationship to Other Plans**

The CSP itself has a relationship to UC/LANL's resource management plans through opportunities/constraints maps. The CSP supports the annual TYCSP, UC/LANL's Institutional Plan, and UC/LANL's Strategic Plan and program/divisional plans. It does so by proposing development actions necessary to meet the requirements of those other plans.

## **C.1.4 Other Site Plans**

### **C.1.4.1 Purpose and Scope**

Area Development Plans, Facility Strategic Plans, and Master Plans are all plans prepared to provide more detailed physical development guidance.

### **Area Development Plan**

Area Development Plans are prepared to provide more detailed physical development guidance. Each of ten plans focuses on the specific work and missions within a prescribed geographic area and details needs as they relate to the key CSP development issues. Area Development Plans also link land use and facility relationships within the geographic area and adjacent areas.

### **Master Plan**

Master Plans are prepared to look at smaller areas within an Area Development Plan to provide more detailed development designs. The Master Plan identifies the best locations for buildings, roads, utility easements, and infrastructure and relates to operational needs. A Master Plan often starts when there is a decision made about a major project so that it can be integrated with other potential and desired development. Master Plans prioritize development into near-,

mid-, and long-term phases. Near-term projects should be listed within the TYCSP to assure they will be funded.

### **Facility Strategic Plans**

Organization-based facility plans are prepared, using a business approach to improve operational efficiency and effectiveness by applying facility strategies. This process may result in relocating or consolidating personnel and functions. Facility strategic plans identify priorities and sequencing of new construction, renovation or upgrades, maintenance levels, excess space, and decontamination and decommissioning. They support development of the TYCSP prioritized project list.

#### **C.1.4.2 Status**

These plans are developed as needed.

#### **C.1.4.3 Relationship to Other Plans**

These other plans all support the development of the TYCSP. Near-term projects should be listed in the TYCSP to assure funding.

### **C.2 Summary of Institutional Resources Management Plans**

Environmental operations, like all operations, function within the above framework. UC/LANL has an active environmental monitoring program and publishes an annual environmental surveillance report. This annual report assesses emissions data from LANL operations and includes major pathways of concern (air, water, food, etc.) to humans and the local environs. UC/LANL has a major environmental restoration effort underway to address historic releases of contaminants to the environment. UC/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 or are in various stages of development. The IRMP will provide an analogous position to the TYCSP, as the plan that integrates the supporting environmental plans. The relationship among the environmental plans is presented in Figure C.2, demonstrating the integrating nature of the IRMP.

#### **C.2.1 Air Shed Management Plan**

##### **C.2.1.1 Purpose and Scope**

Air shed management is addressed in the Air Quality Management Plan, which assures that processes are in place to identify and review all proposed new LANL operations or modifications to existing LANL operations for impacts on air quality and to identify increased impacts from air emissions.

##### **C.2.1.2 Status**

The current draft of the Air Quality Management Plan is dated August 20, 2001. It is reviewed at least annually to determine whether revisions are necessary; however, more frequent revisions can be made, if needed.

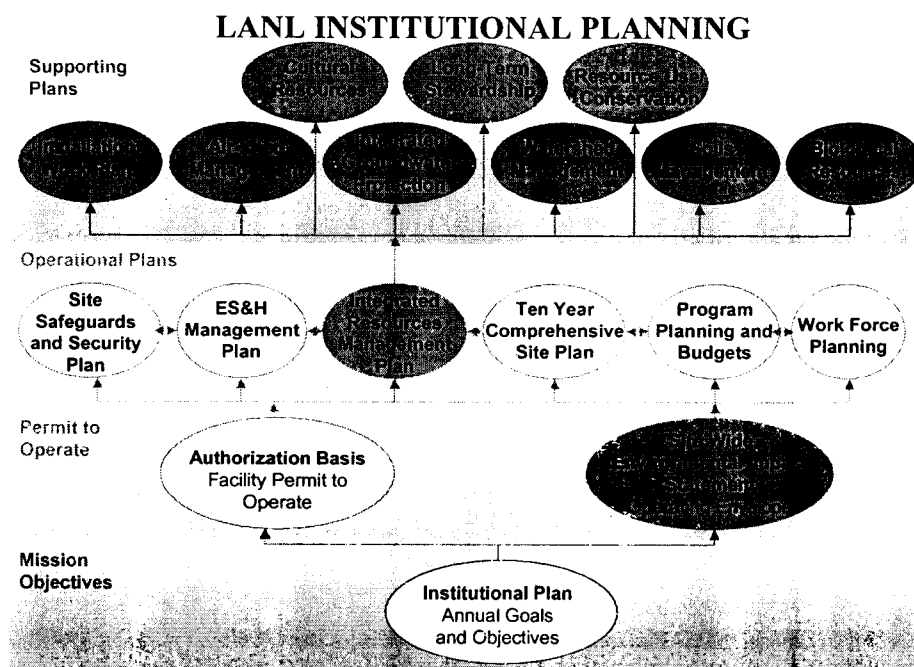


Figure C.2. The relationship among the environmental plans that demonstrate the integrating nature of the IRMP.

### C.2.1.3 Relationship to Other Plans

The impact of air emissions on other media (e.g., soil, water, waste) has not been evaluated to date. Such an analysis would be used to determine whether additional efforts related to air emissions are needed.

## C.2.2 Integrated Groundwater Protection Implementation Plan

### C.2.2.1 Purpose and Scope

The Integrated Groundwater Protection Implementation Plan will describe UC/LANL's groundwater protection strategy and implementation elements. The plan integrates hydrogeologic characterization, contaminant source identification and control, and monitoring actions to protect the groundwater as a resource for current and future uses. The technical basis of integration is a risk-based decision process that uses water flow and solute transport models (parameterized and calibrated using all available site-specific data) to simulate the movement of contaminants from operational discharges and legacy sources over time. The simulation models will be used to optimize actions such as additional hydrogeologic or source characterization, source control, and monitoring to ensure protection of supply wells and to detect contamination before it moves beyond the Laboratory boundary.

### C.2.2.2 Status

UC/LANL has developed a draft of this plan. It will be completed once the baseline site-wide groundwater pathway risk assessment is completed as an objective basis for identifying and



optimizing actions necessary to meet to site-wide groundwater protection criteria. Groundwater protection criteria are being developed by a core team of high-level decision-makers from UC/LANL, DOE, and NMED.

#### **C.2.2.3 Relationship to Other Plans**

The Integrated Groundwater Protection Implementation Plan complements the Hydrogeologic Work Plan, assimilating the data obtained through the Hydrogeologic Work Plan into a decision framework that will accomplish the goals of the Groundwater Protection Management Program Plan.

#### **C.2.3 Watershed Management Plan**

##### **C.2.3.1 Purpose and Scope**

The Watershed Management Plan will provide a framework from which UC/LANL will implement an enhanced surface water monitoring network, support field-based water and sediment quality studies, and carry out integrated data analysis. The plan will focus on developing 1) an understanding of how LANL activities impact surface water quality and the in-stream and riparian/floodplain environment and 2) processes for controlling contaminant transport and improving in-stream water quality and the near-stream environment both on and downstream from LANL.

UC/LANL will accomplish the goals of the Watershed Management Plan by providing a framework for intra-LANL and external communication and coordination; establishing a LANL-wide information system where all watershed protection data will be stored and available across LANL and to the public and stakeholders; and conducting additional surface water and sediment monitoring to reduce data gaps and uncertainties.

##### **C.2.3.2 Status**

The draft Watershed Management Plan was issued in 1999; the next major revision is expected in 2003.

##### **C.2.3.3 Relationship to Other Plans**

Data collected under the Watershed Management Plan supports the ER Project, the Environmental Surveillance Program, and the NPDES Storm Water Program. This data will also support the Biological Resources, Groundwater, and Geological Resources and Soils management plans by identifying where surface water quality issues may be impacting other resources.

#### **C.2.4 Soils Management Plan**

##### **C.2.4.1 Purpose and Scope**

There is no separate institutional soils management plan. Soils are addressed in the water plans and in the BRMP.

#### **C.2.5 Institutional Biological Resources Management Plan**

##### **C.2.5.1 Purpose and Scope**

The Institutional BRMP will provide a mechanism for minimizing risk to both LANL's mission and regional ecosystems through active planning and adaptive management of biological resources. Some specific ecological and operational problems addressed are forest and wildfire

management, soil erosion and contaminant transport, ecological risk management, and vehicle collisions and other human and wildlife conflicts.

Two related plans were completed during the last several years, the HMP and the Wildfire Hazard Reduction Program Plan (WHRPP). The HMP provides protection for three federally listed species under the Endangered Species Act while facilitating implementation of the Laboratory mission. The WHRPP describes forest thinning and fire road improvements, including associated planning areas, stand treatment prescriptions, and environmental protection measures.

#### **C.2.5.2 Status**

The development of the Institutional BRMP began in 2000 but was delayed as a result of the Cerro Grande fire. In consideration of the effects of the fire on biological resources, a Transitional BRMP was prepared in March of 2001. An Interim BRMP, designed to integrate the biological resources management strategies for both the fire recovery and the institutional mission, is under development and will be completed in 2002. The Final BRMP is scheduled for completion in 2003.

#### **C.2.5.3 Relationship to Other Plans**

The BRMP will provide high-level guidance for implementation of the HMP, prepared in 1998, and the WHRPP, completed in 2001. It will also interface with the ICRMP and the Watershed Management Plan (erosion and contaminant transport) and will provide the foundation for the institutional ecological risk approach (ecological risk management).

### **C.2.6 Integrated Cultural Resources Management Plan**

#### **C.2.6.1 Purpose and Scope**

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 UC/LANL's mission.

The Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites, issued in August 2000, presents a framework for collaborating with ethnic groups in identifying TCPs and sacred sites. The ICRMP will provide high-level guidance for implementation of this comprehensive plan.

#### **C.2.6.2 Status**

The ICRMP is due to be complete in 2004 and will be updated every five years after issuance.

#### **C.2.6.3 Relationship to Other Plans**

The BRMP (particularly the HMP) may limit access to certain cultural resource sites. Erosion control under the water plans will have a potential impact on cultural resource sites.

### **C.2.7 Installation Work Plan**

#### **C.2.7.1 Purpose and Scope**

The Installation Work Plan presents UC/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. The Installation Work Plan is a regulatory-driven document prepared for the NMED. The Installation Work Plan was revised in March 2000 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.

#### **C.2.7.2 Status**

Updated annually. Updates were submitted to NNSA and NMED in March 2000 and March 2001.

#### **C.2.7.3 Relationship to Other Plans**

The Installation Work Plan states that investigations of impacts on the regional aquifer will be conducted in accordance with the LANL Hydrogeologic Work Plan.

### **C.2.8 Long-Term Environmental Stewardship Plan**

#### **C.2.8.1 Purpose and Scope**

The Long-Term Environmental Stewardship Plan will describe process by which uncertainty (risk) in the long term (greater than 100 years) hazard of residual Laboratory environmental contamination will be objectively identified and programmatically managed (reduced) to minimize the risk imposed on future generations.

The technical process involves an iterative application of quantitative (probabilistic) risk assessment and decision analysis (expected value of information) models to calculate the long-term (100 to 1,000 years) probability of cumulative health hazards (risk) posed by residual LANL contamination in air, surface water, soil, sediment, groundwater, and biota; identify high-risk sites or sources; determine specific factors that cause those sites or sources to be high-risk in the long term; identify alternative actions to mitigate the factors that cause sites or sources to be high risk in the long term; conduct cost/benefit analysis of alternative actions; scope and implement high-benefit actions in a phased program.

UC/LANL's ER Project is developing the risk assessment and decision analysis models for the groundwater pathway this year. This will demonstrate the process that will be implemented in a cumulative (all sources, all pathways) application.

#### **C.2.8.2 Status**

A draft of the plan will be completed in FY02.

#### **C.2.8.3 Relationship to Other Plans**

The Long-Term Environmental Stewardship Plan will be a complement to the existing environmental resource management plans (air, watershed, groundwater, soils, and biological). The models used to plan long-term stewardship program elements in a phased approach will use data obtained through the implementation of these resource-specific plans. In addition, the models used for long-term uncertainty management will identify data needs and actions that will be incorporated into resource-specific plans.

### **C.2.9 Resource Conservation and Use Plans**

In addition to the environmental resource protection plans, the IRMP includes plans that are aimed at reducing the use of resources, preventing pollution, and minimizing waste. Conserving resources is viewed as simply another aspect of an integrated approach to managing natural resources. In accomplishing DOE's missions and assignments, UC/LANL procures services, materials, equipment, new facilities, and commodities (electricity and natural gas). Water from the regional aquifer and air from the surrounding atmosphere are also used as LANL resources. As in any other activity, waste and pollution are generated in executing LANL activities. Figure 4.3 shows a schematic of the LANL process map and the substance and energy inflows. The following text describes the plans that have been developed to address this area of the IRMP.

#### **C.2.9.1 Site-Wide Water Conservation Plan**

##### **Purpose and Scope**

The objective of the plan is to institutionalize water conservation and implement BMPs in all LANL water-related activities. As recently as 1999, LANL water usage has been as high as 85 percent of NNSA's allocation of water rights. There is concern that without conservation measures, UC/LANL will exceed the allocation when the Supercomputing Center comes on line in 2002.

The Water Conservation Plan analyzes water use and outlines a program plan for water conservation. The plan is the result of nearly two years of data gathering, evaluation, and analysis. The plan follows the suggested outline from the Environmental Protection Agency Manual on Water Conservation Plan Guidelines. The key recommendation of the plan is the establishment of an Interim Water Conservation Committee and an Acting Water Conservation Officer. These entities would be tasked with producing the plans recommended in the plan, ensuring ongoing activity for maintaining the plan, and developing further recommendations for establishing a long-term committee or office approach to water conservation at LANL.

##### **Status**

The Water Conservation Program Plan was completed in August 2001. In September 2001, a Water Conservation Committee was established and an Officer was appointed. The first milestone in the plan is the preparation of an Emergency and Drought Management Plan, with a draft due by June 2002.

##### **Relationship to Other Plans**

The Water Conservation Program Plan is related to the Environmental Stewardship Roadmap, which outlines opportunities for conservation. In addition, the plan is linked to the operational plans, in particular the TYCSP, which outlines future projects and potential water resource needs.

#### **C.2.9.2 Pollution Prevention Roadmap**

##### **Scope and Purpose**

The Pollution Prevention Roadmap is a plan that describes current operations at LANL and outlines improvements that will eliminate potential sources of adverse environmental impacts. In particular, the plan identifies opportunities for waste minimization, pollution prevention, and conservation improvements. The plan is designed to assist UC/LANL in achieving DOE's 2005

Pollution Prevention Goals as well as one of UC/LANL's own goals—zero environmental incidents.

**Status**

The Roadmap is prepared annually. The most recent publication was December 2001.

**Relationship to Other Plans**

The Roadmap supports the Water Conservation Plan.

**C.2.9.3 Waste Management Program Plan**

**Scope and Purpose**

The requirement for this plan has recently been assigned to LANL by NNSA/OLASO. The scope of this plan is currently being developed.

**Status**

The plan is expected to be complete later this summer.

**Relationship to Other Plans**

To be determined.

**C.2.9.4 Waste Management Facilities Strategic Plan**

**Scope and Purpose**

This plan is required by the Readiness in Technical Base and Facilities program and is an Appendix F performance measure for LANL. The plan will document the strategy for Waste Management facilities over the next 10 years. This is an annual plan that feeds the TYCSP. One of the goals for the plan is to identify ways to reduce the overall cost of facilities while meeting mission requirements and improving efficiency and effectiveness of our operations. One key strategy for accomplishing this goal is to search for opportunities to consolidate functions and facilities to reduce the overall footprint of Waste Management facilities. The goal will be to invest in a set of higher quality yet smaller facilities.

**Status**

The plan is due on September 30, 2002.

**Relationship to Other Plans**

To be determined.