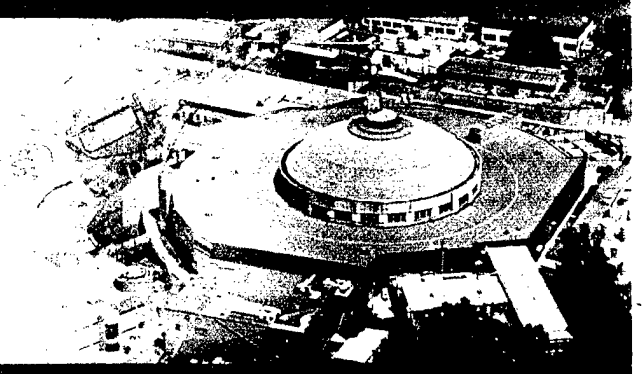
PUB 5436

BERKELEY LAB

Ernest Orlando Lawrence
Berkeley National Laboratory

Comprehensive Facilities Plan

September 1997



Ernest Orlando Lawrence Berkeley National Laboratory
University of California | Berkeley, CA 94720

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PURPOSE

The Ernest Orlando Lawrence Berkeley National Laboratory's Comprehensive Facilities Plan (CFP) document provides analysis and policy guidance for the effective use and orderly future development of land and capital assets at the Berkeley Lab site. The CFP directly supports Berkeley Lab's role as a multiprogram national laboratory operated by the University of California (UC) for the Department of Energy (DOE). The CFP is revised annually on Berkeley Lab's Facilities Planning Website. Major revisions are consistent with DOE policy and review guidance.

Facilities planning is motivated by the need to develop facilities for DOE programmatic needs; to maintain, replace and rehabilitate existing obsolete facilities; to identify sites for anticipated programmatic growth; and to establish a planning framework in recognition of site amenities and the surrounding community. The CFP presents a concise expression of the policy for the future physical development of the Laboratory, based upon anticipated operational needs of research programs and the environmental setting. It is a product of the ongoing planning processes and is a dynamic information source. The specific purposes of the CFP are to:

- Summarize the physical and community setting of the Laboratory.
- Describe the existing Laboratory organization, programs, site, and facilities.
- Analyze programmatic trends and their facilities and asset requirements, shortfalls, and redevelopment needs.
- Provide policy guidance, and 20-year and 5-year plans to support effective use and orderly growth, development, and life cycle maintenance of the Berkeley Lab site.
- Describe the Laboratory's facilities and asset planning approach and methodology.
- Discuss asset-based databases and analyses.

Planning objectives are as follows.

- Insure a safe, healthful, and environmentally respectful workplace in full compliance with building and fire codes.
- Protect the national investment in valuable government-owned research and support assets.
- Evaluate future mission projections and anticipate DOE national research facility needs.
- Consolidate research and support services through proper siting of new buildings.
- Make efficient use of unique Laboratory assets and the adaptive reuse of facilities to support Laboratory mission.
- Promote cost reductions and energy conservation through efficiencies in building design and location, operation and maintenance, and parking and transportation.
- Improve communications within the Laboratory and with the surrounding community.
- Work with UC Berkeley (UCB) to identify projects with synergistic benefits.

MANAGEMENT ISSUES

Berkeley Lab's site-planning management issues focus on developing the strategic framework for structures and utilities necessary to achieve the Laboratory's mission safely and protect the environment. These issues include improving the reliability of utility systems, ensuring a safe working environment, restoring and rehabilitating obsolete buildings, consolidating support functions, and accommodating the scientific guests and visitors using Berkeley Lab's national research facilities.

The Laboratory, established in 1931 by Ernest O. Lawrence as a single-purpose accelerator-based University research facility, has evolved into a multiprogram national laboratory with a mission to:

- Perform leading multidisciplinary research in the energy sciences, general sciences, and biosciences in a manner that ensures employee and public safety and protection of the environment.
- Develop and operate unique national experimental facilities that are available to qualified investigators: the Advanced Light Source, National Energy Research Scientific Computing Center (NERSC), Energy Sciences Network (ESnet), National Center for Electron Microscopy, 88-Inch Cyclotron, Biomedical Isotope Facility, and National Tritium Labeling Facility.
- Educate and train future generations of scientists and engineers to promote national science and education goals.
- Transfer knowledge and technological innovations and to foster productive relationships among Berkeley Lab research programs, universities, and industry to promote national economic competitiveness.

The Laboratory mission supports DOE's mission to "provide Americans with a secure and reliable energy system that is environmentally and economically sustainable" and to "ensure that the United States sustains its leadership in science and technology," as enunciated in DOE's Strategic Plan.

SITE PLANNING CONCEPTS, OBJECTIVES, AND GUIDELINES

The Berkeley Lab CFP is based on Berkeley Lab site-plan concepts, objectives and guidelines that accommodate the facilities improvement needs within existing geophysical, environmental, and operational conditions. They provide a basis for understanding and evaluating the more detailed elements of the planning process.

Concepts. To guide development, Berkeley Lab has developed the following planning concepts. These are based on long-range institutional goals supportive of Berkeley Lab's mission.

- Provide outstanding research facilities and the flexibility to accommodate change required for national scientific needs.
- Protect the environment, provide site amenities, and buffer activities from adjacent populations.
- Ensure a safe, healthful, and attractive workplace; improve access and communication with the surrounding communities, and provide transportation and parking systems for employees and visitors.
- Protect and sustain the investment in valuable government-owned research and support facilities.
- Improve support and research services through consolidation and proper siting of functions.
- Promote energy conservation and cost economies through efficient design, location, operation, and maintenance.

Objectives. To implement the concepts, Berkeley Lab has defined five specific objectives. These objectives accommodate the Laboratory's facilities requirements within the site's physical, environmental, and operational conditions. The objectives provide a basis for understanding and evaluating the more detailed elements of the site plan, such as specific buildings, utilities, and transportation elements. The site planning objectives are:

- Consolidate activities within functional planning areas to enhance interaction and efficiency.
- Redevelop obsolete buildings and infrastructure, eliminate use of trailers for permanent functions, and improve building arrangements to increase safety and energy efficiency.
- Coordinate development along the main east-west circulation and utilities axes to enhance transportation and service systems, e.g., develop off-road parking and improve pedestrian pathways.
- Improve and maintain overall environmental quality. Maintain undeveloped areas in a sustainable and fire-safe manner respectful of neighbors.
- Provide off-site locations for receiving, warehousing, and other support and research activities suited to decentralized locations.

Guidelines. Berkeley Lab has instituted design guidelines to ensure that Laboratory development respects site considerations and provides coherence among building elements and the landscape. These guidelines address the following areas:

- Safety Considerations. New and rehabilitated buildings will conform with applicable federal, state, and local code requirements to safeguard the staff and the community.
- Utilities Corridors. Utility distribution systems are, where feasible, to be placed in trenches and under roadways. Central and localized distribution stations and feeder lines are located and sized for future building locations and anticipated demand.
- Utility Centers. Utility centers that serve more than one building will be located in zones that are dedicated to utilities and that are not suitable for building development. They will consolidate and centralize mechanical and electrical equipment such as cooling towers, chillers and pumps. Equipment will be sized separately for each building and interconnected in parallel so the system can respond efficiently to variable demand, from partial to full load.
- Building Mass, Orientation, and Exteriors. Buildings are to be designed to fit well into the slope of the land, to conserve important landscape features and open space, and to be closely integrated with the landscape plan. They are to be no more than five stories high and may not present an uninterrupted wall greater than four stories high. Exteriors of buildings are to be compatible in design with surrounding building elements and landscaping. Textures and colors, including those of roofs, are to be unobtrusive.
- Building Use Flexibility. Building circulation and utility systems are to provide flexible and modular space to allow for changes.
- Circulation and Parking. Circulation and parking plans are to provide compatibility between vehicle use and pedestrian safety. Pedestrian paths are to be separated from vehicles, where practical, with distinct access and termination points so that bus stops, parking areas, loading docks, and building entrances are safe and efficient. Emergency vehicle and handicap access is to be incorporated into building and circulation design. Shuttle-bus stops are provided with a shelter structure where there is no other shelter nearby.
- Topography and Grading. Grading and retaining walls are to contribute to the stability of slopes and soils, to allow for smooth topographic transition between hillsides and structures, and to be constructed of materials visually suitable for their locations. Design solutions shall minimize grading and the height of retaining walls.
- Landscaping and Open Space. Landscaping contributes to the compatibility of buildings with hillside vegetation. It visually screens service areas, reduces fire danger, contributes to slope stability, provides summer shade, and creates new areas for the use and enjoyment of employees and visitors. Existing natural landscaping is generally to be preserved.

If you have questions or comments, please contact Berkeley Lab Facilities Planning.

1. INTRODUCTION AND REGIONAL CONDITIONS

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BACKGROUND/HISTORY

The Ernest Orlando Lawrence Berkeley National Laboratory is a national laboratory operated by the University of California (UC) for the U.S. Department of Energy (DOE). The Laboratory is an independent academic unit of the University of California system and is located adjacent to the University of California, Berkeley (UCB), Campus.

Berkeley Lab began as an accelerator laboratory in 1931, when Ernest O. Lawrence established the Radiation Laboratory with the construction of the 27-Inch Cyclotron on the UCB Campus. In 1939 the need for higher-energy accelerators resulted in the construction of the 184-Inch Cyclotron on a hill overlooking the campus and the City of Berkeley. Driven first by pioneering nuclear physics and biophysics research, then by the Manhattan Project during World War II, and later by high-energy physics, the Laboratory's growth continued. During the period of rapid growth, between 1940 and 1946, the original hillside Laboratory site became crowded with temporary wooden buildings hastily erected in response to national defense needs. However, development during the 1950s was more carefully planned, with the construction of permanent concrete and steel-frame structures east and west of the earlier construction. Figure 1-1 is an aerial view of the Laboratory.

In response to the 1973 oil embargo, several new research programs broadly relevant to national energy supply and end-use were initiated in 1975, following the reorganization of the Atomic Energy Commission into the Energy Research and Development Administration and the Nuclear Regulatory Commission. The Laboratory grew to its largest population in 1979, following the establishment of the DOE, but no permanent buildings were constructed to accommodate this growth. Temporary buildings and leased space in the cities of Berkeley and Emeryville housed some research programs and most support services. By 1980, 25% of the Laboratory's programs were in high-energy and nuclear physics, down from 75% in 1970. The Laboratory had become a multiprogram national laboratory, with a fundamental shift in mission since long-range development plans were initially prepared in the 1950s.

From 1980 to 1982, Federal support for energy research dropped precipitously, and basic research declined, resulting in a 19% reduction in Berkeley Lab's work force. Subsequently, the Laboratory's planning reemphasized basic, laboratory-based research founded on Berkeley Lab's multidisciplinary

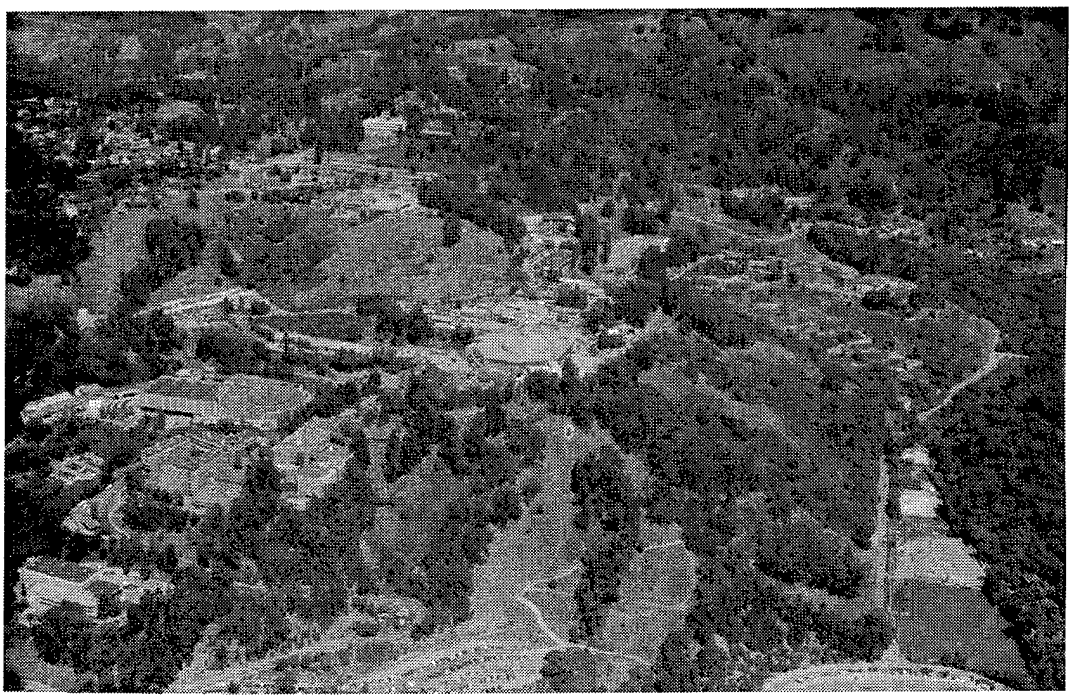


Figure 1-1. Aerial view.

scientific strengths. These plans called for the development of basic energy sciences and life sciences while maintaining historically important roles in high-energy and nuclear physics. In 1984 the National Center for Electron Microscopy was completed. The strongest of the energy-conservation and environmental-research programs in building sciences, energy storage, and indoor air quality that had developed during the 1970s were retained into the 1980s. Plans were initiated for facilities in support of research programs with long-term potential for contributing to the nation's capabilities in materials science, chemistry, biology, and the earth sciences.

This diversification toward multiprogram research activities and the development of the basic energy sciences are reflected in the Laboratory budgets over the past two decades. Over the past decade the Laboratory has emphasized the need for increased capital investment in its physical plant (compared to the low funding during the late 1960s and 1970s) to revitalize existing facilities and to build major new research facilities to support DOE's programs. The Comprehensive Facilities Plan (CFP) provides guidance for using these capital funds effectively and for accommodating the significant changes in the Laboratory's mission.

REGIONAL OVERVIEW

The western coast of the United States, notably California and the San Francisco Bay Area, strongly influences science and engineering research and development in the Pacific Basin. Berkeley Lab has the advantage of being situated close to high-technology industries in the microelectronics, biotechnology, aerospace, telecommunications, petroleum, and advanced materials development fields (Figure 1-2).

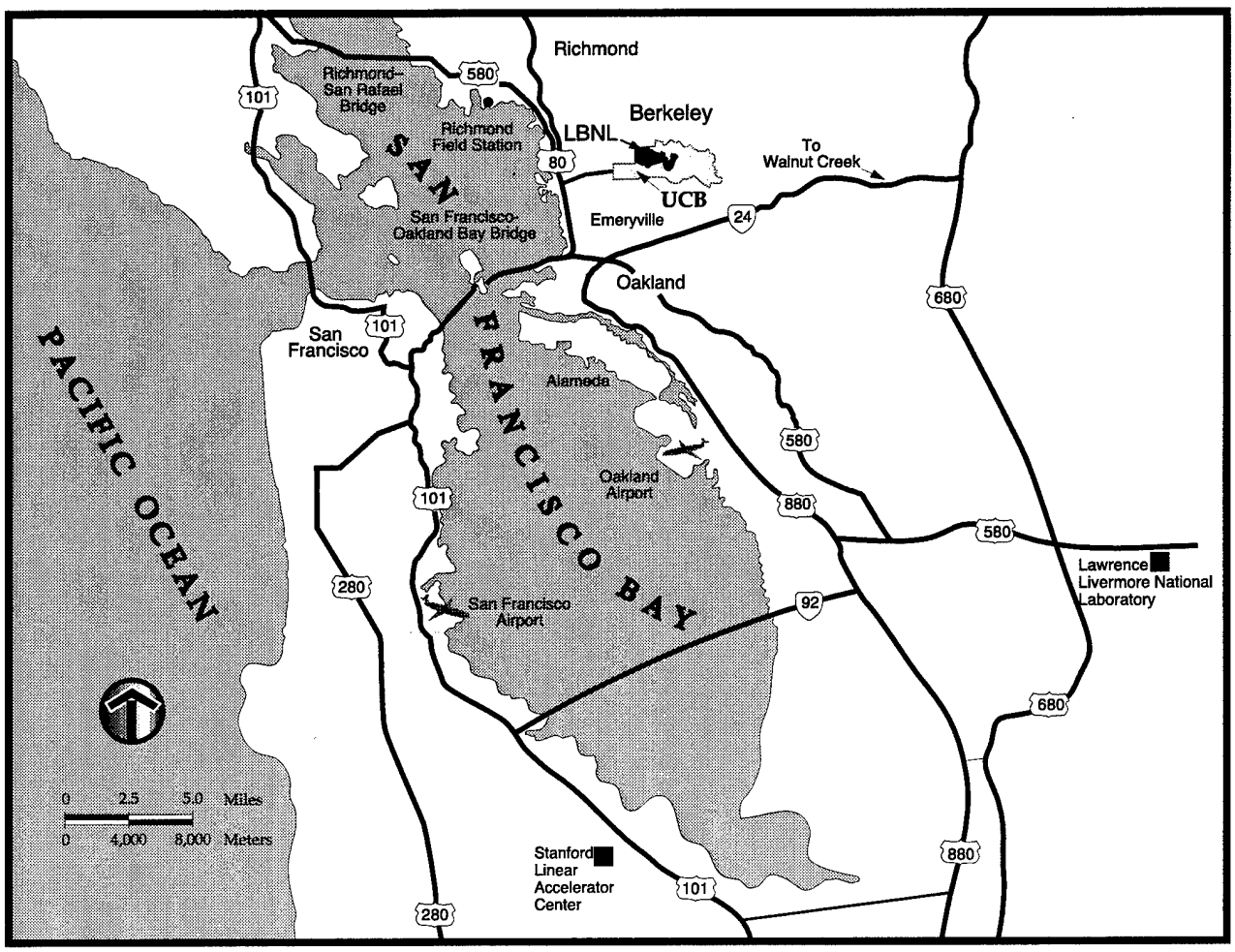


Figure 1-2. Regional map.

This exciting research and development environment is enhanced by the desire of Japan and the developing Pacific Rim countries to develop and use new technologies. High-quality academic, private, and Federal research and development programs create a San Francisco Bay Area job market that attracts development programs, and a San Francisco Bay Area job market that attracts a first-class labor pool. Interactions are facilitated by regional transportation systems and comprehensive telecommunications and computing resources. Necessary raw and finished materials and equipment are in most cases readily available because of the high local demand these research activities generate.

Technology transfer to and from industry is enhanced in many cases by the proximity of many industrial organizations. Graduate students, post-doctoral associates, and professors from many other U.S. and foreign universities benefit from involvement with Berkeley Lab research programs and user facilities. The UC system comprises nine top-rated campuses, including four medical schools, with a wide variety of scientific strengths. The Laboratory has strong interactions with other top California universities, such as Stanford and the California Institute of Technology.

VICINITY OVERVIEW

San Francisco Bay Area

Berkeley Lab is located five kilometers east of San Francisco Bay on the slopes of the Coast Range within 479 hectares (1183 acres) of contiguous UC land. Most of the Laboratory's main-site buildings are owned by DOE and were constructed on University land under long-term lease to the Federal government (Appendix D). The Laboratory's 82 hectare (200-acre) site is in Alameda County, with the eastern portion of the site in Oakland and the western portion in Berkeley—a university, residential, and industrial city with a population of 105,900 (Figure 1-3). LBNL

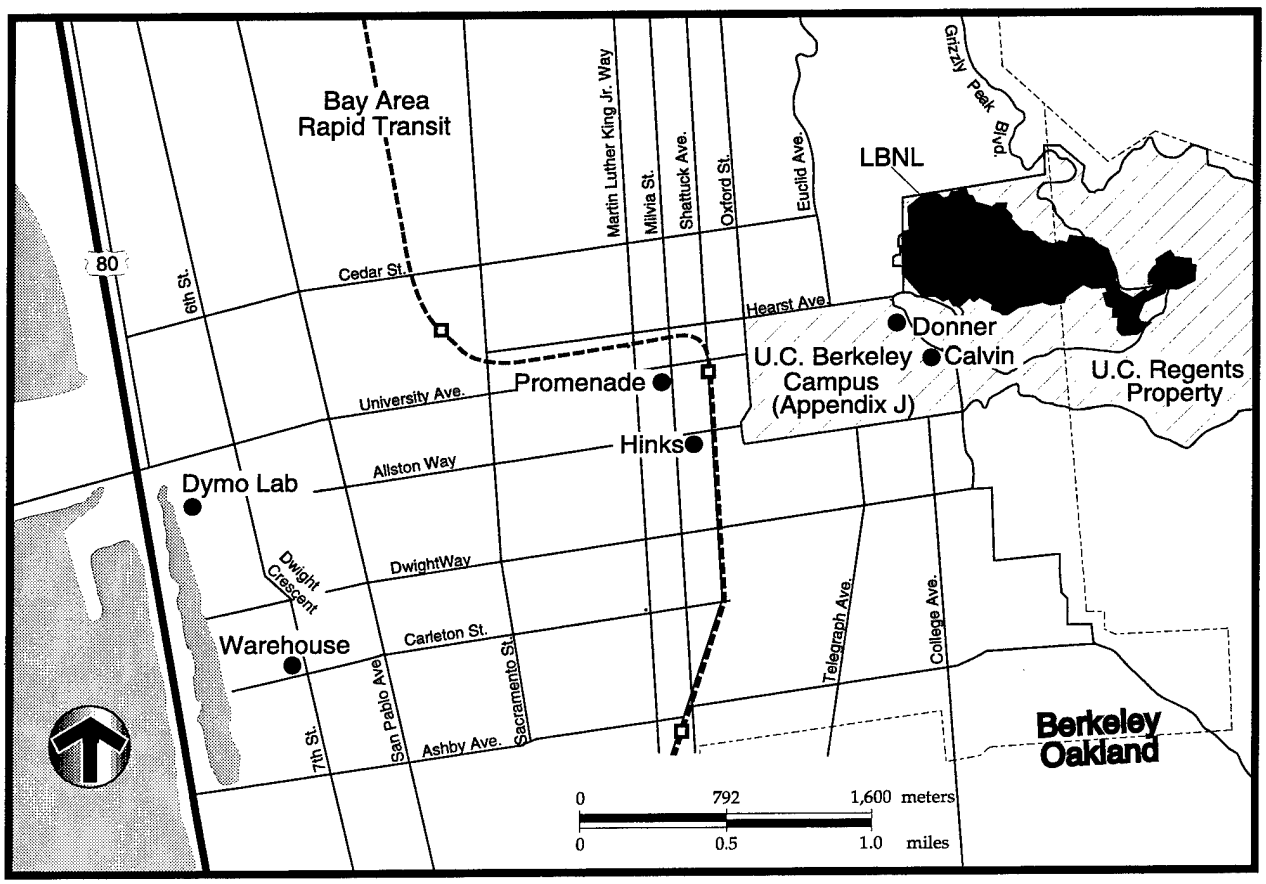


Figure 1-3. Vicinity map.

research is also conducted in buildings on the UCB campus, (student population 31,000) and in local off-site leased buildings.

The San Francisco Bay Area is a cosmopolitan region comprising nine counties with a total land area of 1.9 million hectares (4.6 million acres) and a population of 6.0 million. Although metropolitan areas are highly developed, only 12% of the total land has been developed as residential area, commercial, industrial, or highways. The highly diversified, technology- and service-oriented labor force of the region totals 3.3 million people. The industrial base is not oriented toward cyclically sensitive heavy industry but toward high technology. Aerospace, computers, electronics, scientific instruments, and communications equipment comprise more than 50% of all manufacturing jobs.

The Bay's topography consists of a valley 145 kilometers (90 miles) long formed between two geological faults—the San Andreas Fault, along the San Francisco Peninsula and Marin County, and the Hayward Fault, along the East Bay Hills. The coastal ranges surrounding the Bay reach to 1283 meters (4,210 feet). The Bay itself covers 673 km^2 (260 square miles) and moderates the local climate. The East Bay, comprising the Counties of Alameda and Contra Costa, is a large and diversified area but shares such features as a common water distribution system, unified public transit systems for buses and rail transit, and a unified regional park system.

Alameda County, with a population of 1,280,000 and an area of 189,950 hectares (469,400 acres), has major educational, research, industrial, and agricultural resources, including six colleges and universities, large private and public research laboratories, heavy and light industry, and extensive nursery and viticulture acreage. Important industries include electronics, automobile assembly, biotechnology, and food processing. Most of the growth is projected for the southern area of the county. The Alameda County Planning Department prepares General Plans that are primarily directed toward the unincorporated areas of the County. The County General Plan for the Central Metropolitan, Eden, and Washington Units was prepared in 1981 and includes the communities and area surrounding Berkeley Lab. These plans include land use, noise, scenic routes, and housing.

Cities of Oakland and Berkeley

Oakland is the county seat and, with a population of 388,100, is the sixth largest community in California. The port of Oakland can accommodate any vessel in the Pacific trade fleet, and a transcontinental railroad serves the city. Growth in Oakland is expected to occur primarily in the vicinity of the airport and in downtown Oakland. Oakland is a member of the Association of Bay Area Governments. The principal planning document of the City is the Oakland Master Plan.

Berkeley is a residential, university, and industrial city encompassing 2,720 hectares (6,720 acres). The City is best known for the University of California. Industries include major biotechnology, electronics, chemical, and pharmaceutical companies; small foundries and fabrication companies; and other high-technology companies and service industries. The population of Berkeley has not changed during recent years. Berkeley is a member of the Association of Bay Area Governments. The principal planning document of the city is the Berkeley Master Plan, which is now being updated. Berkeley has also prepared a Draft Berkeley Downtown Plan, the Housing Element, and various neighborhood plans. The Laboratory is exempt from local zoning and planning regulations but cooperates with the Cities of Berkeley and Oakland, and with other local communities, on matters of mutual concern.

The Laboratory is sited within the Strawberry Creek watershed, on the ridges and draws of Blackberry Canyon, which forms the central part of the site, and Strawberry Canyon, which generally forms the southern boundary. The area to the south includes a residential area across Strawberry Canyon and University recreational facilities, University offices and maintenance facilities, and the University Botanical Garden within the canyon. Above and to the east of the Laboratory are located the University's Animal Behavior Institute, Lawrence Hall of Science, and the Mathematical Sciences Research Institute. Berkeley Lab is bordered on the north by predominantly single-family homes and on the west by multi-unit dwellings, student residence halls, and private homes. The area is developed in an "inter-mix" pattern, a mixture

of developed and somewhat natural appearing vegetation. A large wildland area exists to the east of the site. This area includes previously disturbed areas owned by the University, East Bay Regional Parks District, and East Bay Municipal Utilities District (watershed lands).

Adjacent land use consists of residential, institutional, and recreation areas (Figure 1-4). The Laboratory works with municipal, county, and university planning staffs to maintain and improve relationships.

The Laboratory is served by a network of state, county, city, University, and Berkeley Lab roadways and by public, University, and Laboratory transit services. The Laboratory is within commuting distance to the Lawrence Livermore National Laboratory and the Stanford Linear Accelerator Center. The DOE field office at Oakland (DOE/OAK) is located in Oakland. In addition DOE/OAK maintains offices and staff at its Site Office at Berkeley Lab.

RELATIONSHIP WITH THE COMMUNITY

Overview

UC Berkeley (UCB) is immediately adjacent to Berkeley Lab and is the largest employer in the City of Berkeley. It is the second largest campus of the 9-campus/3-laboratory UC system and has an enrollment of about 31,000 students. The academic staff is 4,000, and the total number of employees is 11,000. The University maintains its own planning department. The Laboratory works with the University on matters of mutual planning concern, and provides advance notice during the planning stages of Berkeley Lab construction projects.

The Laboratory and UCB interact to develop plans and programs of mutual benefit. These involve elements of scientific program plans as well as facilities and environmental issues. The Laboratory's Long Range Development Plan (LRDP) was presented for discussion before the UCB Campus Planning Office Staff and the Chancellor's Planning Committee.

A historic preservation review of the 184-Inch Cyclotron Building (Building 6), conducted by an independent consultant in 1987, makes recommendations to ensure Berkeley Lab's compliance with environmental quality-assurance guidelines. Additional background and planning documents for fire prevention, parking and traffic control, and historical preservation are included in Appendix A.

The Laboratory also recognizes its responsibility to make its facilities available to the nonscientific public through tours and educational programs. For example, the Laboratory schedules an "Open House" and invites the community in for tours and discussions, operates science education programs, and offers college- and graduate-level education programs to both teachers and students. The Laboratory also

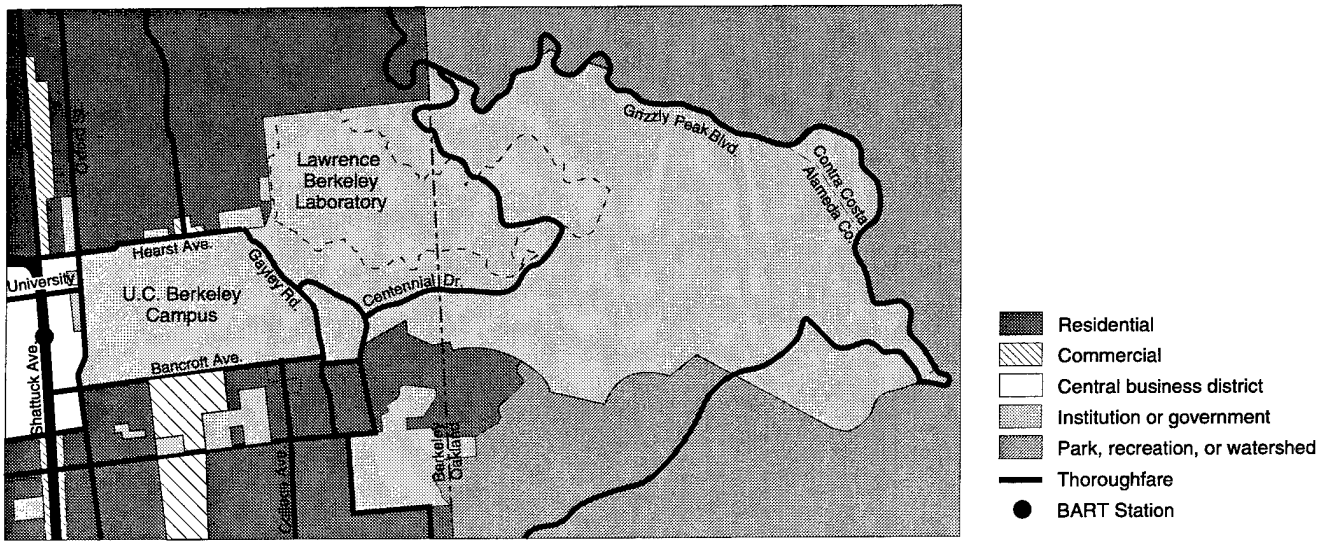


Figure 1-4. Adjacent land use.

provides school and public tours, enabling 3,000 visitors annually to learn about Berkeley Lab facilities and research.

It is the policy of the Laboratory and the University to cooperate with local agencies on planning matters of mutual concern. The Laboratory's planning staff meets with the UC Berkeley Planning Liaison committee and city commissions of Berkeley and Oakland, as well as neighborhood groups to inform the citizens in bordering communities of major changes to the site. To facilitate smooth transitions in changes to the site, Berkeley Lab planners communicate and coordinate activities with the cities of Berkeley and Oakland, UCB, and DOE/OAK.

Security and Fire Protection

Berkeley Lab is part of the Alameda County mutual aid system. Security and fire protection services in the area are provided by Police and Fire Departments of the cities of Oakland and Berkeley, by the Alameda County Sheriff's Department, and by the California Highway Patrol. The Oakland Police Department has a staff of 600 officers, and its central command center is in downtown Oakland. The Oakland Fire Department has 450 firefighters organized into 23 engine companies and 7 truck companies. Three engine companies and a truck company are within 5 kilometers of the Laboratory. Berkeley Lab, with its own fire services, has reciprocal agreements with Berkeley and Oakland to cooperate on fire response.

The Berkeley Police Department has 175 officers and is located in the downtown Civic Center. The Berkeley Fire Department has 125 firefighters, 7 engine companies, 2 truck companies, and 3 ambulances. Three Berkeley engine companies and one truck company are located within 1.6 kilometers (one mile) of the Laboratory. Local emergency preparedness is coordinated through the Alameda County Office of Emergency Services, with a command center in Oakland. The area is a part of Region 2 of the State Office of Emergency Services, which has its regional command center in Pleasant Hill in Contra Costa County. Berkeley Lab conforms to Region 2 emergency plans and has communications access to the statewide emergency communications network.

The Laboratory maintains a Fire Department and contracts for security services. The security service provides a continuing dedicated patrol at Berkeley Lab during all three daily 8-hour shifts to maintain 24-hour security at the Laboratory. Facilities and equipment include guard stations at the three gates and patrol vehicles.

The Berkeley Lab Fire Department occupies two buildings totaling 700 gsm (7,500 gsf). It provides fire protection, basic life support, and ambulance services to the Laboratory and provides supervisory monitoring of the fire alarm and sprinkler systems in Laboratory buildings. In addition, it assists the local municipal fire departments in controlling an average of 3–4 fires annually in the neighboring communities. The Laboratory's fire protection and ambulance capabilities will continue to be available to augment local community services.

Public Utilities

The Laboratory's primary water supply is from the East Bay Municipal Utility District (EBMUD). Natural gas and electricity are provided by the Defense Fuel Supply Center and Western Area Power Administration (respectively), and delivered via Pacific Gas and Electric Company (PG&E) transmission lines. Berkeley Lab's sanitary sewers connect to the City of Berkeley system, which terminates at an EBMUD sewage treatment plant in Oakland. The Berkeley Lab storm drains empty into Blackberry and Strawberry Creeks, which flow into the City of Berkeley storm sewer system and then into San Francisco Bay.

EBMUD supplies water to Berkeley Lab primarily from large-capacity reservoirs (260 million m^3) (68 trillion gallons or 210 thousand acre feet) in the Sierra Nevada foothills. Water is transported via 150 km (90 miles) of aqueducts to 5 local reservoirs. The system supplies 20 communities, comprising 1.1 million people (348,000 water meters) in an 821-km^2 (317 square-mile) service area.

While most electrical service is provided by WAPA, PG&E or private vendors make up the rest. All power to Berkeley Lab is firm. PG&E serves 48 counties in California, which have a population of 11 million, and has a system-wide generating capacity of 21,700 MW. The East Bay service region of PG&E (Contra Costa and Alameda Counties) has a peak demand of 3,000 MW and annually consumes 15 million MW hours of electricity. The Laboratory had a peak demand of 12.6 MW and consumed 76,600 MW

hours of electricity in FY 1997. Average demand was 11 MW. The Laboratory is fed by a dedicated 60-MW substation owned by the University of California. PG&E and private vendors have ample capacity to meet anticipated demand for the foreseeable future. Electricity rates are regulated by the California Public Utilities Commission.

Public sewers connect to the Laboratory at Hearst Avenue and along Strawberry Canyon. The City of Berkeley is in the 10th year of a 20-year rehabilitation program to modernize and increase capacity of the sanitary sewer drain system. Sanitary sewer wastes are disposed of by EBMUD. The dry weather primary treatment capacity is 1.1 million m^3 (300 million gallons) per day. Secondary treatment capacity is 650,000 m^3 (170 million gallons) per day. Typical daily treatment flows to the system are 340,000 m^3 (90 million gallons) per day. Wet weather flow can exceed capacity during some storms. The Utilities District has initiated a five-year program to construct additional wet weather facilities to handle the expected increases from contributing communities. With the new facilities the peak wet-weather treatment capacity will be 1.6 million m^3 (415 million gallons) per day, which, with the new retention capacity, will accommodate a total flow in the sewer system of 2.9 million m^3 (775 million gallons) per day during storms.

The Laboratory owns and operates its own voice, data-communications, and computer-network telecommunications systems. The Integrated Communications System (ICS) provides voice and data services and links with external networks, including Pacific Bell (the local telephone company), AT&T, and the Federal Telecommunications System. LBLnet is a Laboratory-wide computer network connected through gateways to external networks, including ESNet, DARTNet, HEPNET, NSFNET, MILnet, BARRNet, and the UCB Campus network.

Transportation Systems

The Laboratory and the City of Berkeley are served by Bay Area Rapid Transit (BART) trains, regional and local bus services, many trucking companies, three major airports (San Francisco, San Jose, and Oakland International Airports) with frequent ground transportation to Berkeley, and major railroads (Figure 1-5). The Laboratory operates a shuttle bus service to downtown Berkeley, which is served by local transit routes. BART is an automated rapid rail transit system with 150 km (93 miles) of double track serving 40 stations in Alameda, Contra Costa, and San Francisco Counties. The system provides approximately 200,000 passenger trips per day and maintains 450 rail cars. Three stations are located in Berkeley and are within 3.2 km (2 miles) of Berkeley Lab. Laboratory shuttle buses provide transportation to and from the downtown station.

The Alameda-Contra Costa Transit District is the largest bus transit service in the Bay Area and operates a fleet of 830 buses over a system with 3,540 directional street-kilometers (2,200 miles). The system provides service at 7,000 bus stops for approximately 220,000 passengers per day. The bus stops adjacent to the Lawrence Hall of Science and at Hearst and Gayley roads are approximately 100 m (100 yards) from Laboratory entrances.

Primary access to Berkeley Lab is via three gates: the main entrance, Blackberry Gate, off Hearst Avenue (which becomes Cyclotron Road), directly east of the UCB campus; Grizzly Gate, off Centennial Drive; and Strawberry Gate, also off Centennial Drive. There are additional pedestrian gates located adjacent to residential areas. Approximately 50% of Berkeley Lab employees and guests live within a 6.5-km radius (15-minute driving time) of Berkeley Lab.

Berkeley Lab has been working to identify ways to reduce Berkeley Lab single-occupant vehicular traffic while fully meeting the transportation needs of Berkeley Lab employees. In an ongoing planning effort, the Lab has created pedestrian gates adjacent to neighboring residential areas, added bicycle racks on shuttle buses, installed additional on-site bicycle racks, constructed additional shower facilities in or near all major Laboratory buildings, developed telecommuting options, constructed additional pathways and improvements to shuttle bus stops and system capacity, and provided carpools with preferential parking. The Lab also promoted computerized ride matching in new-employee orientations and makes an effort to identify new opportunities through surveys and discussions with Lab employees and discussions with the City of Berkeley Transportation Commission.

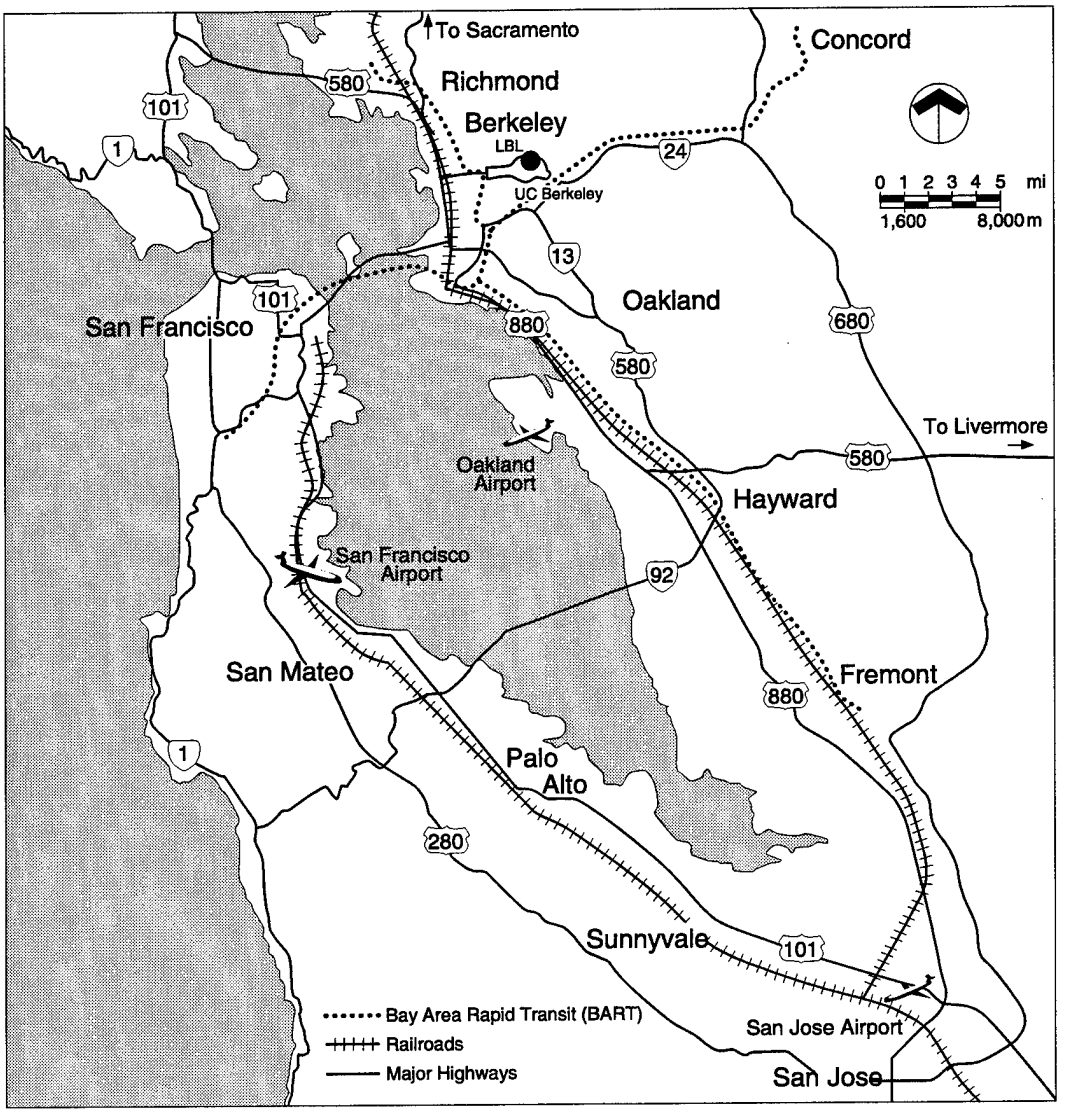


Figure 1-5. Public transportation.

REGULATIONS AND PLANNING REQUIREMENTS

Berkeley Lab conducts its planning, operation, and construction activities in full compliance with Federal laws and regulations and with applicable state and local regulatory requirements. Specific DOE requirements are provided in enabling legislation, the Code of Federal Regulations, and orders and guidelines provided by the DOE. Berkeley Lab construction projects and site development activities are reviewed by the DOE and other Federal agencies, by state and local government, and by the public, using procedures and documentation requirements established by the National Environmental Policy Act (NEPA). As required by the University of California in its management of the DOE laboratories, plans and specific projects may also undergo review in consistency with the California Environmental Quality Act (CEQA). These acts provide for the common development of environmental documentation to minimize duplication and to provide for lead-agency jurisdiction by the DOE. Regulatory and planning activities involve the following principal agencies:

Federal

- Department of Energy. Comprehensive oversight, audit, appraisal, and compliance responsibilities for program activities; site

planning, construction and asset management; NEPA compliance; environmental, safety, and health planning and operations; radiation protection; facilities maintenance; personnel; legal affairs; and budgeting and other administrative activities. DOE requirements, reviews, and appraisal activities form an important basis for staffing levels and costs and the schedule of implementation of Berkeley Lab direct and indirect operations. The DOE/OAK coordinates an annual review of Berkeley Lab's site planning program.

- Environmental Protection Agency. Standards for solid, liquid, and gaseous waste, National Pollution Discharge Elimination System permits, notification and emergency spill response, and requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Regulations promulgated by EPA help define Berkeley Lab environmental, health, and safety policies and affect costs and staffing of Berkeley Lab programs.
- Department of Labor. Occupational safety and health surveillance carried out by DOE in accordance with a Memorandum of Understanding with the Department of Labor. Occupational health and safety standards, including construction standards for the handicapped, are an essential part of Berkeley Lab construction planning and program operations.
- Department of Transportation. Shipping and waste-handling requirements and procedures. DOT standards define the requirements for shipping materials off site and influence schedules, costs, and activities for wastes from demolition, hazardous-waste handling, and other facilities and procedures.

State

- University of California. Site planning and facilities design review and approval; environmental review procedures and approval (CEQA); health and safety policies review and approval; personnel policies and procedures; budget policies and procedures review, approval, and audit; program review; and review and approval of other administrative policies and procedures.
- California Environmental Protection Agency (Cal-EPA). Established in 1991 and coordinates integrated waste management, water resources control, air resources, toxic substances control, pesticide regulation, and environmental health and hazard assessment.
- Department of Health Services. Issues waste-handling-facility permits, reviews environmental reports for compliance with CEQA. Facility and permit requirements determine the capability, design, and operation of Berkeley Lab sanitary and waste-handling facilities.
- California Water Quality Control Board and Regional Water Quality Control Board. As an element of Cal-EPA, issues discharge permits and reviews environmental reports in compliance with NEPA or CEQA.
- California Air Resources Board. As an element of Cal-EPA, develops statewide air-quality policies and reviews environmental reports for NEPA or CEQA. Emissions regulations influence the costs of monitoring and emissions-control equipment.
- California Public Utilities Commission. Governs rate structures and intrastate acquisition of natural gas and electricity.
- Department of Emergency Services. Coordinates emergency response planning (local coordinating office in Contra Costa County).
- Water Resources Board. As an element of Cal-EPA, reviews environmental reports for NEPA and CEQA.

Local

- Bay Area Air Quality Management District. Issues emissions permits.
- East Bay Municipal Utilities District. Provides water supply, establishes water-use and sewer fees, approves and monitors discharges to the sanitary sewers.

- Alameda County Health Care Services Agency. Inspects sanitary facilities and food-handling operations, issues cafeteria operations permit.
- Cities of Berkeley and Oakland. Maintain surrounding city infrastructure, including roadways, local sewers, and public services; monitor compliance program for subsurface tanks and groundwater. The cities review NEPA/CEQA documents and conduct a dialog with Berkeley Lab and the University in planning, transportation, and environmental matters.

To implement programs consistent with applicable requirements established by these agencies, the Laboratory conducts a wide range of operational activities, including review, education, and report programs, for example: environmental, safety, and health educational programs and the control and monitoring of all effluents, emissions, and solid-waste-handling activities.

2. EXISTING CONDITIONS

CONTENTS

The Laboratory's research makes use of multidisciplinary collaboration and advanced engineering, computation, communications, fabrication, and other support facilities characteristic of a national laboratory. The Laboratory's facilities are planned, constructed, and maintained to support directly Berkeley Lab's research programs and scientific goals, while maintaining compatibility with the University community and the physical setting.

SUMMARY OF EXISTING ACTIVITIES

As recognized in DOE's Strategic Laboratory Missions Plan, Berkeley Lab has a primary role in fundamental sciences and a major contributing role to the DOE energy resources mission. Its specialized and distinctive capabilities in earth, environmental and biotechnology sciences provide a valuable resource to DOE's environmental quality mission.

The Office of Energy Research (OER) is the Laboratory's primary customer for its fundamental science mission. The Laboratory's research and facilities particularly support the following Office of Energy Research offices: Basic Energy Sciences, Computational and Technology Research, Biological and Environmental Research, Fusion Energy Sciences, and High Energy and Nuclear Physics. Berkeley Lab's well recognized energy efficiency programs, including Building Technologies, Utility Technologies, Industrial Technologies, and Transportation Technologies are aligned with the missions of the DOE's Office of Energy Efficiency and Renewable Energy.

Berkeley Lab's strong multidisciplinary program of interrelated geoscience and geological engineering research conducts basic research and contributes to technology and applied development research at DOE's Yucca Mountain project, as well as to international projects in cooperation with Sweden, Switzerland, Canada, and Japan under the mission of the Office of Civilian Radioactive Waste Management. In addition, other DOE offices such as the Office of Fossil Energy; Office of Policy, Planning and Analysis; Office of Environmental Management; Office of Environment, Safety, and Health; and Defense Programs are engaged with Laboratory scientists to further their missions.

Work for Others (WFO) supports about one-fifth of the Laboratory's programs. The success of the DOE biosciences and environmental sciences programs at Berkeley Lab has depended not only on DOE support but also on complementary National Institutes of Health (NIH), supported research that is closely coupled to these programs. The combination of Berkeley Lab's unique facilities and expertise and a growing interaction of DOE- and NIH-funded research will be important in pursuing new goals in biology and medicine.

The Department of Defense, National Aeronautics and Space Administration, Environmental Protection Agency, Department of Interior, and Agency for International Development also support research activities supportive of national goals at Berkeley Lab. In addition, State and private agencies sponsor work at Berkeley Lab. Among these are the California Air Resources Board, the Gas Research Institute, the Electric Power Research Institute, and the California Energy Commission.

This section summarizes current Berkeley Lab research programs including anticipated program trends. Berkeley Lab's scientific and technical programs are conducted under strengthened environmental, health, and safety guidelines for conduct of operations. Research facilities and programs are conducted to ensure the safety of all employees and the public, with environmental and safety management programs developed in close working relationships with OER.

PHYSICAL ENVIRONMENT

Topography and Aspect

Berkeley Lab is situated on the western slope of the Berkeley Hills at an elevation ranging from 150 to 335 meters (490 to 1100 feet) above sea level (Figure 2-1). The site curves along the hills to face mostly west toward San Francisco Bay or south into Strawberry Canyon.

The site has been developed consistent with the general principles prescribed by Frederick Law Olmsted for hills above the College of California. The roads and pathways generally follow the contours of the hillsides and connect the building sites. The building sites are situated upon those portions of the site where the topography affords the best opportunity for development. There are also steep slopes throughout the site. These steep slopes provide for dramatic

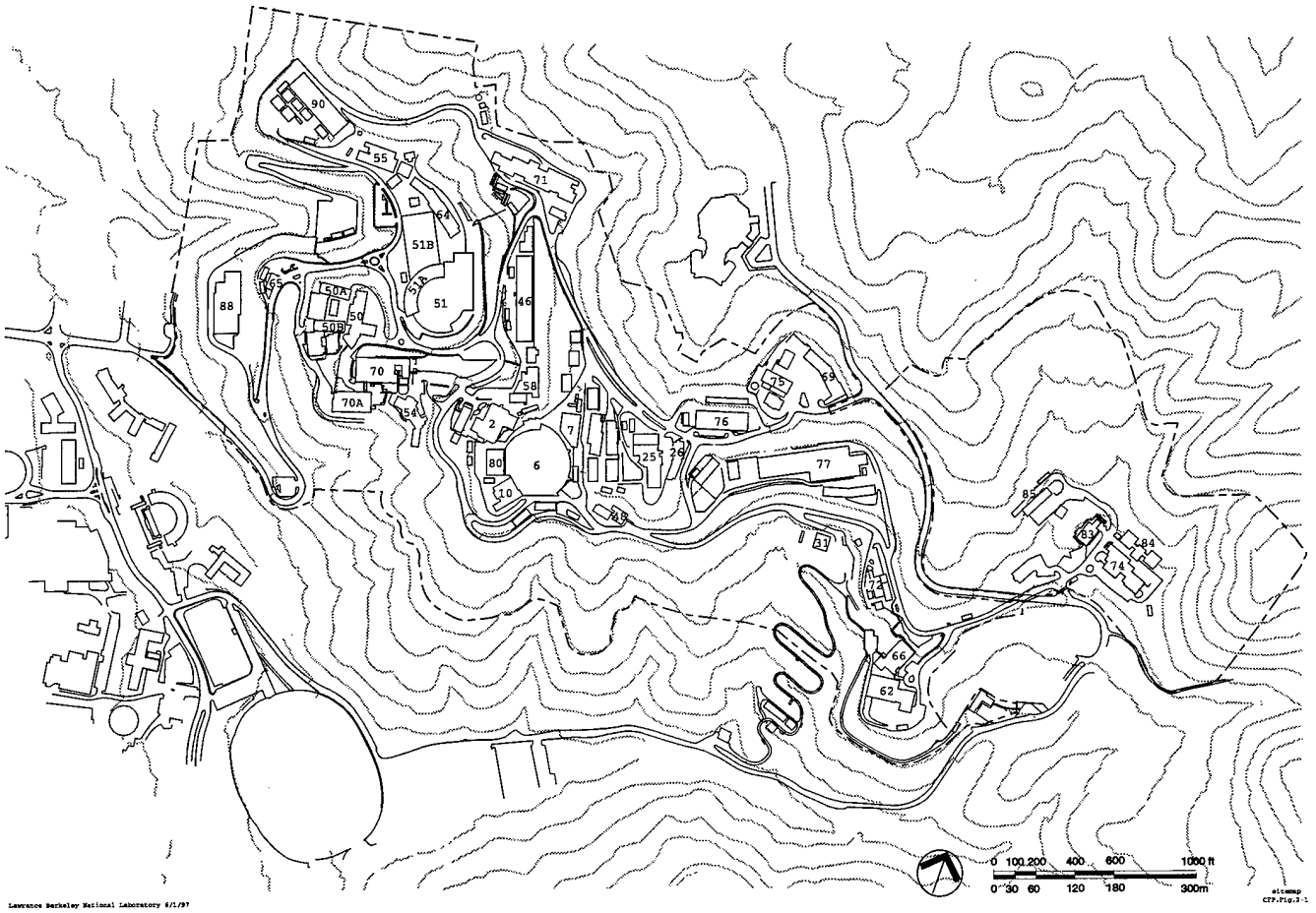


Figure 2-1. Topography.

views and ensure that the majority of the site will remain in a managed but generally undeveloped condition. About 60 percent of the total site has a slope greater than 25%. Over the years, slope stabilization projects have corrected serious landslide conditions. Remaining slide areas have been temporarily stabilized, and plans have been developed for permanent corrections (see Figure 2-2).

Geology

Most of the Laboratory site is underlain by complex sedimentary and volcanic rock that has been folded and faulted since Cretaceous time. In general, the bedrock has produced a colluvial cover a few feet thick. Natural rock outcrops are few, although there are many rock exposures in cut slopes.

The major geologic unit consists of sandstones, siltstones, claystones, and conglomerates of relatively low strength and hardness. These rock formations are blanketed by clay soils. The western and southern portions of the site are underlain by similar but moderately well-consolidated rock formations. Throughout most of the upper elevation of the site, a volcanic unit overlays and is inter-bedded with the upper layers of the major geologic unit.

Prehistoric landslide deposits have been encountered at numerous geologic locations within the Berkeley Lab site. Over the last 20 years the Laboratory has carried out a program of slope stabilization to reduce the risk of property damage due to both deep and surficial soil movement in these areas.

Seismicity

Berkeley Lab is located in a seismically active region (Figure 2-3). The seismically active Hayward Fault trends northwest-southeast along the base of the hills beyond the Laboratory's western edge. It has the potential to produce an earthquake of approximately 7.5 Richter magnitude. Analysis indicates no

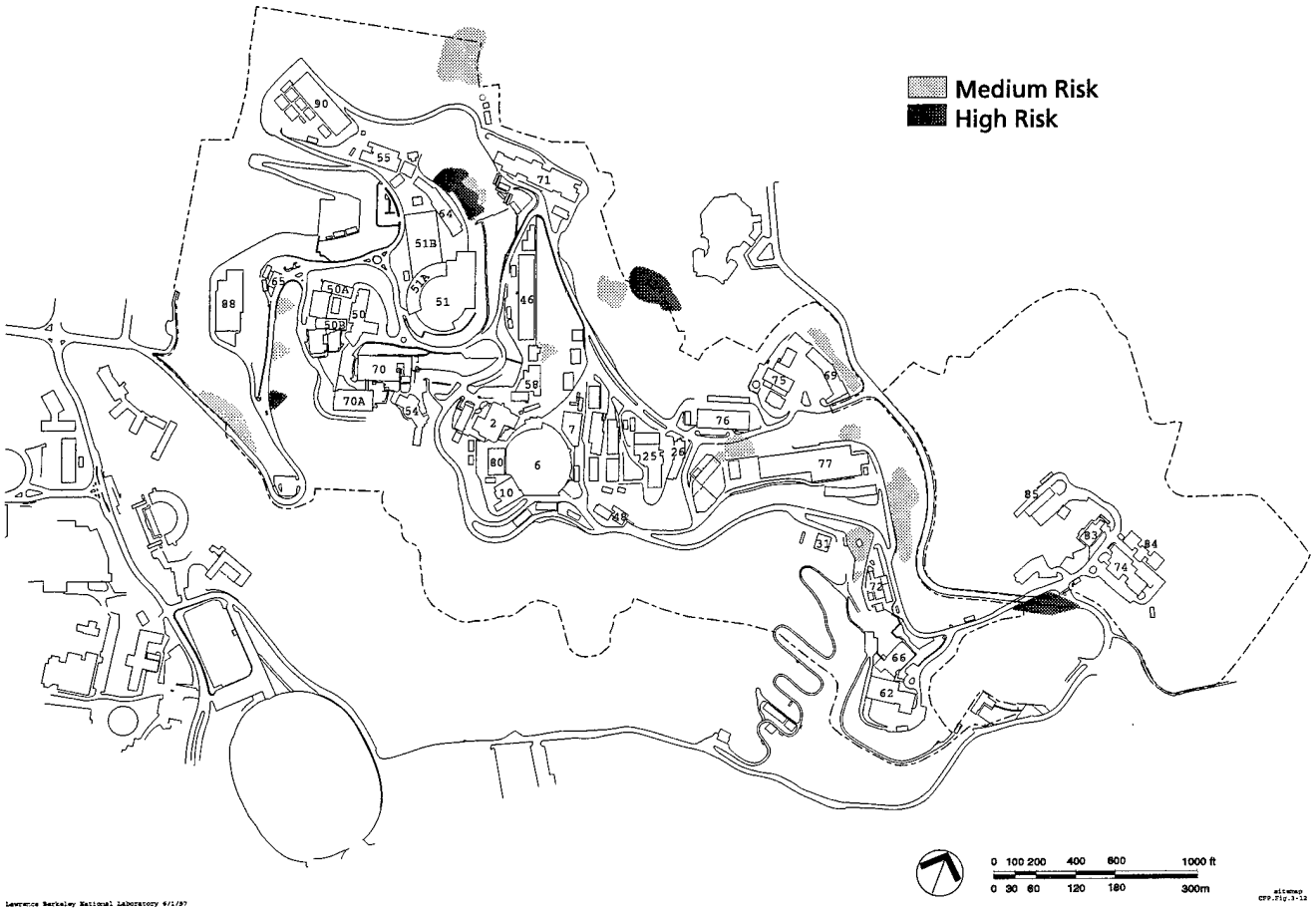


Figure 2-2. Slope stability.

evidence that any other fault is active in the immediate area.

The San Andreas Fault zone, having potential for a magnitude 8.3 earthquake, lies offshore about 20 miles west of Berkeley Lab beyond the Golden Gate. The Calaveras Fault, another branch of the San Andreas, lies about 15 miles east of Berkeley Lab. For an earthquake of any given magnitude, the Hayward Fault would produce the most intense ground shaking at Berkeley Lab because of its proximity.

To reduce the potential for damage from seismic activity, the Laboratory has carried out a comprehensive earthquake safety program since 1971. All new facilities have been designed and constructed to resist the maximum credible earthquake estimated for the site.

All existing Berkeley Lab buildings were reviewed by outside structural engineering consultants in the 1970s. All buildings were rated according to the UC seismic hazard evaluation system. The 35 buildings rated "poor" or "very poor" have been rehabilitated or demolished. The structural engineering staff reviews "lessons learned" from all seismic activity and applies it to the Laboratory. Although original survey findings are considered sound, new information has led to identification of three building areas requiring further life-safety work. These are the Building 88 Caves, Building 64 Highbay, and Building 51 dome area. In addition, the Laboratory has identified and prioritized work that will minimize structural damage and has begun strengthening these buildings.

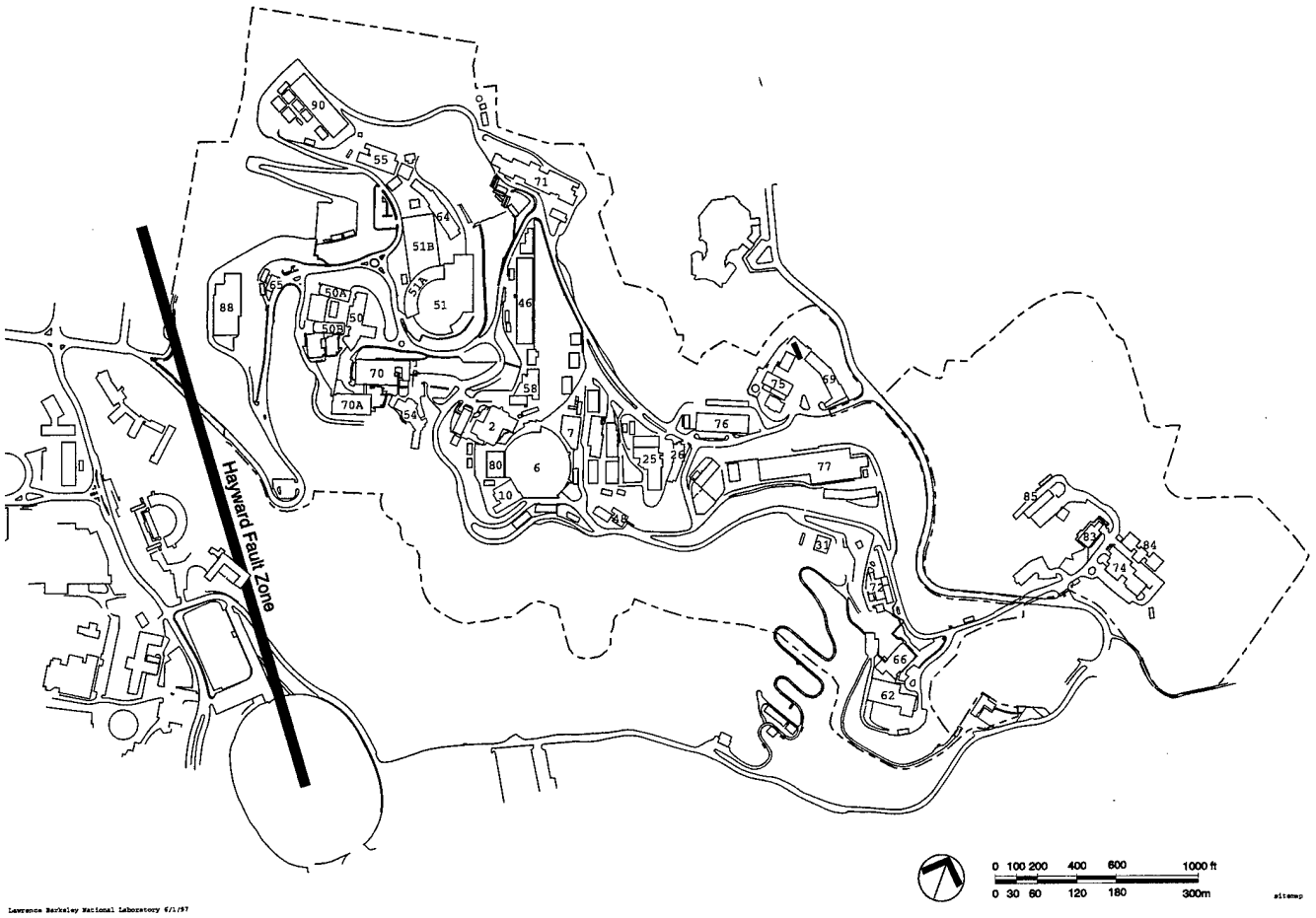


Figure 2-3. Earthquake faults.

Meteorology

Berkeley Lab has a Mediterranean climate with cool, dry summers and relatively warm, wet winters. The proximity of the Pacific Ocean and the maritime air that flows through the Golden Gate moderate local weather, keeping seasonal temperature variations small. The mean summer and winter temperatures are 62°F and 51°F, respectively (Table 2-1). Generally, comfortable outdoor conditions prevail throughout the year, although occasional hard freezes can occur mid-winter.

Relative humidity ranges from 85–90% in the early morning, when ocean fog often affects the site, to 65–75% in the afternoon. Annual insolation ranges from 65–75% of that theoretically available, and the average daytime cloudiness is about the same in summer and winter. Heating degree-days number about 2,600 and cooling degree-days about 150. Winds are generally cool and light, less than 10 mph, blowing from the east in the morning and from the west in the afternoon (Table 2-2). In late spring and summer ocean fog often flows across San Francisco Bay to

Table 2-1. Berkeley Lab Temperature Normals (°F) by Month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Max	56.1	59.5	61.1	63.3	66.4	69.2	69.5	69.6	71.7	69.6	62.9	57.0	64.7
Min	43.2	45.8	46.0	47.6	50.3	53.0	53.9	54.7	55.6	52.9	48.3	43.9	49.6
Mean	49.7	52.7	53.6	55.5	58.4	61.1	61.7	62.2	63.7	61.3	55.6	50.4	57.2

Table 2-2. Berkeley Lab Wind Data.

	Speed (MPH)				
Direction	1–3	4–10	11–21	22–27	%
N	0.59	0.97	0.05		1.61
NNE	0.61	0.61	.01		1.23
NE	0.89	1.10	0.20		2.19
ENE	1.10	1.52	.59	0.03	3.24
E	1.97	1.68	0.45	0.03	4.13
ESE	2.46	1.87	0.17		4.50
SE	3.31	3.53	0.39	0.01	7.24
SSE	3.59	4.76	1.13	0.01	9.49
S	3.12	4.44	0.70	0.01	8.27
SSW	3.36	3.86	0.18		7.40
SW	3.24	3.30	0.03		6.57
WSW	3.17	4.28	0.09		7.54
W	4.02	6.45	0.14		10.61
WNW	3.65	4.86	0.26		8.77
NW	3.33	3.19	0.13		6.65
NNW	1.64	2.24	0.08		3.96
CALM					6.60
TOTAL	40.05	48.66	4.60	0.09	100.00

envelop Berkeley Lab during morning and evening hours.

About 95% of the Lab's average annual rainfall of 25 inches occurs from October through April, the winter rainy season. Rainfall intensities are seldom greater than one-quarter inch per hour (Table 2-3), and thunderstorms, hail, or snow are rare. Drought periods of several years duration are not uncommon, and abnormally wet winters also occur. Overall, however, Berkeley Lab's climate provides generally favorable conditions for comfort control, energy efficiency, and outdoor activities.

Watershed and Hydrology

Berkeley Lab is situated within the Strawberry Creek watershed. The majority of the Laboratory site is within Strawberry Canyon while the northwestern portion of the Laboratory site is located in Blackberry Canyon. Blackberry Canyon contains the north fork of Strawberry Creek. A small portion of the northwestern portion of the Laboratory drains into Berkeley Creek, another tributary of Strawberry Creek.

Table 2-3. Rainfall Intensity and Probability.

Period (yr)	Intensity (in./hr)	24-Hour Duration (in.)
25	0.20	4.30
50	0.22	5.28
100	0.25	6.00

To control possible groundwater contamination, the Laboratory's Environmental Health and Safety Department (EH&S) has initiated a program that characterizes and remediates groundwater contaminants at outflow points. EH&S works with the Facilities Department to ensure that drain boxes are clean and clear.

Berkeley Lab storm drains can accommodate peak water runoff based on a 25-year storm and the intensity-duration data for seasonal rainfall (Table 2-3). Over the last 30 years the drainage system has been improved with large conduits, special inlet and exit structures, energy dissipaters, trash racks, and hardened channels. Successful system operation depends on regular removal of accumulated debris.

Across the site water table depths vary from 3 meters (10 feet) to more than 27 meters (90 feet) (Table 2-4).

Table 2-4. Water Table Depths.

Functional Area	Depth (ft)[a]
Blackberry Research Area	16–50
Central Research Area	>20
Grizzly Operations Support Area	65–100
Strawberry Research Area	10–30

[a]Depths represented as > X indicate existing borings have encountered no free water to that depth.

During the winter rainy season, groundwater levels and hydrostatic pressure increase. The Laboratory has installed an extensive system of monitoring wells and drainage lines (Figure 2-4) to maintain slope stability when the water table is higher than typical.

Vegetation

The natural vegetation can typically be characterized in one of three habitat types: grassland, scrubland or oak/bay woodland. Historically, the site and watershed has largely been grassland with a few stands of oaks and bays (particularly on north-facing slopes). The Ohlone are known to have used fire to maintain the grassland character in order to improve food production. Subsequently the Spanish introduced cattle grazing, which, combined with natural wildland fire, maintained the grassland as the predominant habitat type. Cattle grazing continued into the 1940s. At the same time cattle grazing ended, there was a concerted effort to fight wildland fires to reduce fire damage (such as the 1923 fire that burned a significant number of homes in Berkeley). Accordingly, brushlands have emerged on many portions of

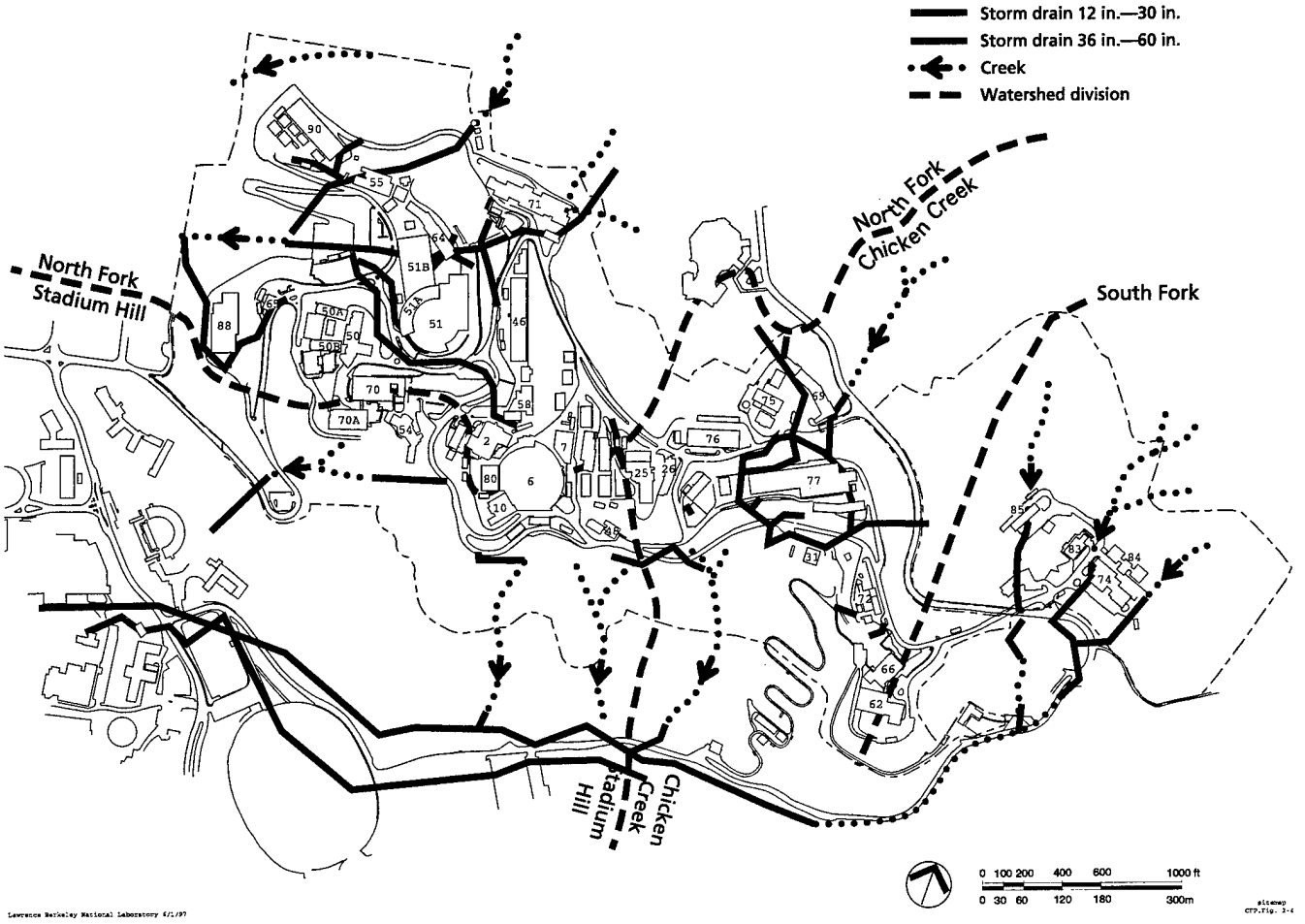


Figure 2-4. Hydrology and storm drainage.

the watershed and many of the brushlands are now successionally transitioning into oak/bay woodland.

In addition to native vegetation, there are two types of introduced vegetation at the site: abandoned tree plantations and invasive exotics. The tree plantations were planted by the University of California's Departments of Agriculture and Forestry prior to the establishment of the Laboratory. These experimental plots were used to test the possibilities of potential commercial species. After the initial growth was measured these plots were abandoned in place.

The introduced species include Eucalyptus and various species of trees native to the State, but not naturally occurring on the site, such as Monterey pine (Pinus radiata), knobcone pine (Pinus attenuata), Canary Island Pine (Pinus canariensis) and coast redwood (Sequoia sempervirens). The invasive exotics include a number of Mediterranean annual grasses, French and Scotch Broom, Artichoke Thistle, Yellow Star Thistle, and German Ivy. The annual grasses have displaced native perennials over most of the site; however, there are indications that the perennials can reestablish themselves with some assistance. The primary problem exotic is French Broom. Not only is this plant highly flammable, but it also displaces native vegetation and forms a monoculture that is devoid of most habitat values. Accordingly, the Laboratory is engaged in a French Broom management program.

Within the small portions of the Laboratory that have been landscaped for ornamental purposes, there are a variety of other introduced ornamental species of trees, shrubs, and perennials. Many are not Mediterranean-type species, and have therefore not evolved to handle a long annual dry season. These introduced species require regular supplemental irrigation to maintain health and appearance.

Wildlife

In general, the Laboratory site supports habitats and associated wildlife that are typical of disturbed portions of the near-urban portion of the Berkeley-Oakland hills. Approximately 79 species of birds, 20 mammal species, and 19 reptile and amphibian species, none rare or endangered, occur on or near the site.

The most significant wildlife habitat at Berkeley Lab occurs in lower Blackberry Canyon. The lower portion of Blackberry Canyon supports a relatively intact oak-bay woodland, but is completely surrounded by development, so the habitat is small and limited.

The grasslands provide cover and food for a variety of common reptiles and small mammals. They also provide nesting material for birds and a portion of the food for larger mammals.

The brushlands at Berkeley Lab provide cover, food, and breeding sites for a variety of common birds and mammals of the region, the dominant mammals being the raccoon and mule deer. The Laboratory's tree stands offer nesting sites for many bird species.

Landscape Management

It is particularly important that the developed Berkeley Lab landscape blend harmoniously with its surrounding hillside. On the western and northern edges of the Lab, adjacent land uses are urban and residential in character, consisting largely of natural grasslands or ornamental plantings. The general Laboratory landscaping is consistent with these adjacent landscapes. On the southern border is a mixture of residential and institutional developments separated by an intermix of undeveloped spaces, largely oak/bay woodland, scrub and grasslands common to previously disturbed hill areas.

Erosion Control. The steepness of much of the Laboratory site makes protection from wind and water erosion an important concern. Vegetation provides the best control of surficial erosion by reducing the impact of rain on soil as plant roots stabilize and hold topsoil. In 1992 Berkeley Lab initiated a hydroseed project to revegetate bare soil areas on the Laboratory site. This project has been successful and has been expanded in the current maintenance program. The seed mix now consists of native bunch grasses and native annual flowers.

Berkeley Lab also uses other means to control surficial erosion, including fabric mats, fallen trees, retaining walls, slope terracing, and paving of footpaths.

Wildland Fire Management. Vegetation throughout the Laboratory site is planted and maintained so as to reduce the impact that firebrands would have in expanding a wildland fire at or near the site. In addition, the Laboratory has developed (in conjunction with the City of Berkeley's Wildland Fire Commission) a "mid-canyon" fuel break of native grasses and oak/bay savannah to provide a location

for firefighters to stop a wildland fire front at the wildland interface on the Lab's eastern edge.

The Lab is proactively working with neighboring fire departments to fully integrate this suppression zone into pre-deployment and response planning. This planning element is critical because it affords the best opportunity to suppress a fire front before it enters the lower canyon, a mix of residential and institutional structures. The fuel break is coordinated with fuel reduction activities of the UC Animal Behavior Institute northeast of the Laboratory. Priority fuel management measures, including revegetation with appropriate native species, have been identified and defined in detail in the *Maintenance Plan for a Sustainable, Fire-Safe Landscape*.

A revegetation plan is currently being developed in order to assure long-term continuity in Berkeley Lab's landscape value. Both inappropriate species and declining trees need replacement.

Visibility

Berkeley Lab occupies a visible lower hillside in an urban setting. Berkeley Lab's landscape maintenance plan supports extensive tree cover which creates a pattern of foliage across much of the face of the Lab. These trees combine with natural grass areas indigenous to the East Bay hills. The dominant tree types are fast-growing evergreens planted on steep slopes below relatively low profile Berkeley Lab buildings. In combination with elevational differences between Berkeley Lab buildings, the tree plantations create tall screens that both separate and hide most buildings from urban and campus views below. When viewed from urban areas below and west of Berkeley Lab, the most prominent buildings on the entire hillside are the Lawrence Hall of Science and other (non-Laboratory) University buildings above the Laboratory site. Lower on the hillside, portions of several major Laboratory buildings can be seen; however, most of the Lab buildings blend harmoniously into the hillside due to their muted colors and partial screening by trees.

The eastern portion of the Laboratory has less screening. From UC's Memorial Stadium, some Strawberry Research Area buildings are highly visible. Public views into the Lab also occur along Centennial Drive, and from residences and the Lawrence Hall of Science above. Views from above look directly into "back" areas of the Lab and are softened only by bands of internal landscape buffers. It is difficult to screen for views from above; however, additional tree planting will eventually reduce Laboratory visibility from Centennial Drive.

Historical Resources

No prehistoric cultural resources have been identified within the Berkeley Lab management area. In 1987, a historical evaluation considered the original cyclotron building (Building 6) a "highly significant landmark," marking an important episode in scientific research and the development of the UC Berkeley campus. The report concluded that internal and external building changes could be made if the original visual quality of the building was retained. Reuse of the structure for the Advanced Light Source (ALS) followed the report's guidelines for modifications and retained the building's original visual character.

Buildings and Infrastructure

The majority of Berkeley Lab structures and infrastructure are adequate for their current mission purposes. With continued maintenance and periodic updating, these facilities will continue to serve the mission for many more decades. Still, Berkeley Lab has some buildings and infrastructure that date from the establishment of the Laboratory at its current site in 1939. Moreover, there are a number of "temporary" structures that have been added to the Laboratory over time and continue to be used–well past their intended use period. Because of the Laboratory's dynamic nature, space is at a premium, and these older inadequate buildings are pressed into continued service.

UTILITIES

The Laboratory's operations require a complex of utility systems. Utility lines are underground except for an aerial 115 kV electrical power line. The Laboratory does not prescribe easements for the various utility lines. Lines are clustered for ease of access, and some areas have been formally designated as utility corridors. Efforts are underway to transfer manually drawn utility maps to a computerized system.

Water System

The Laboratory's water is supplied continuously from two sources. The primary water source is the

East Bay Municipal Utilities District's (EBMUD) Shasta Reservoir, which supplies the Laboratory's high-pressure fire and domestic system. A secondary source is EBMUD's Berkeley View tank, [~11,350 m^3 (3.0 million gallons)], connected to Berkeley Lab by EBMUD piping.

Berkeley Lab's water distribution system contains several backup safety distribution loops and is valved to provide control in case of emergency. The system normally operates by gravity flow, requiring no pumps or energy consumption for operation within the Laboratory (Figure 2-5). The Laboratory has two 750-m^3 (200,000-gallon) fire protection storage tanks. One is located near Building 75 in the Grizzly Operations Support Area and the other near Building 71 in the Central Research Area. Automatically starting diesel-powered pumps will maintain a reliable flow for the fire protection system during emergencies. Two auto shutoff valves, associated with the storage tanks, are there to keep the fire pumps from emptying the tanks on the ground if there is a major break.

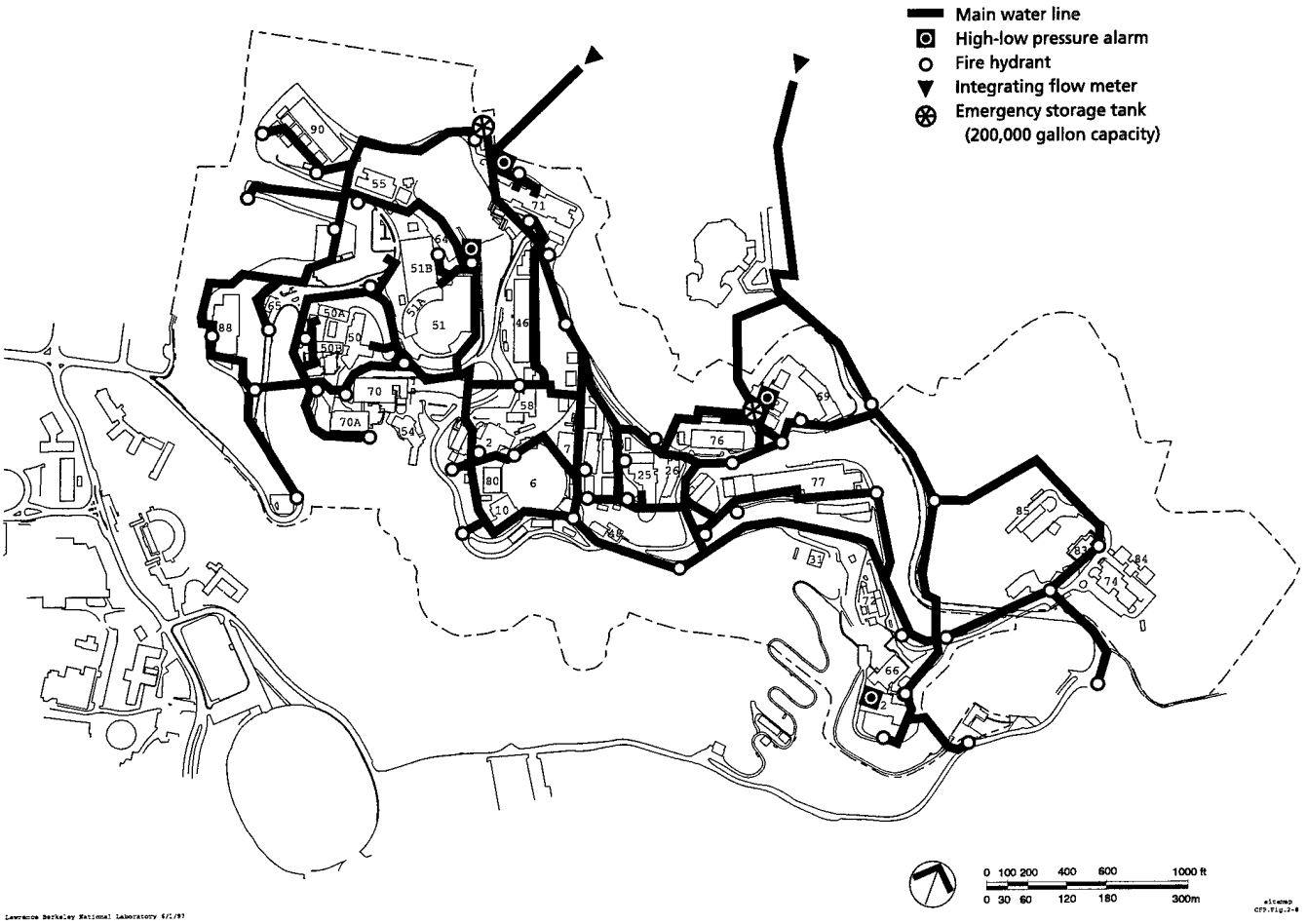


Figure 2-5. Water distribution system.

Sanitary Sewer System

The western portion of Berkeley Lab's sanitary sewer system (Figure 2-6) connects to the City of Berkeley sewer main on Hearst Avenue. South of the Lab, a second connection is made to the City of Berkeley system on Centennial Drive. The Laboratory monitors its discharges for the presence of certain chemicals and radioactivity. In 1996–97 this system was upgraded, weak points eliminated, and leaks sealed under a Line Item Project.

Natural Gas System

Natural gas to Berkeley Lab is supplied by the Defense Fuel Supply Center via Pacific Gas and Electric Company's distribution system (Figure 2-7). A 6-inch main on Hearst Avenue feeds the PG&E-owned meter station at the Laboratory's west entrance.

The Hearst Avenue meter station contains one meter for gas supplied at an interruptible rate. PG&E main pressure is about 40 psi, reduced to 13 psi at the Hearst Avenue meter station.

The 13-psi distribution pressure is further reduced at various regulator stations to serve either a group of buildings or in some cases a single building. Building pressure is in the range of 0.25 to 1.25 psi. Earthquake shutoff valves have been installed at the entrance main

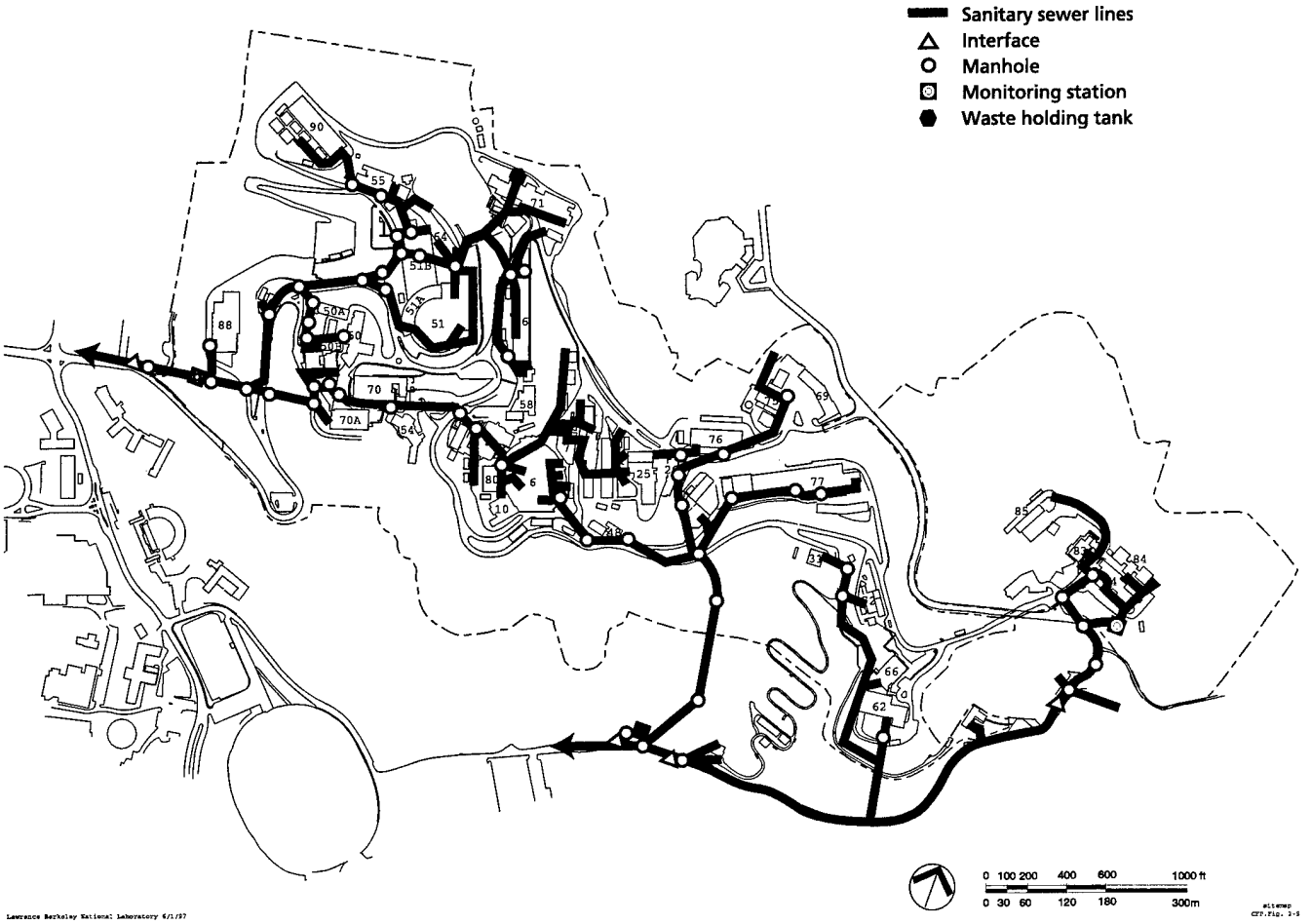


Figure 2-6. Sanitary sewer system.

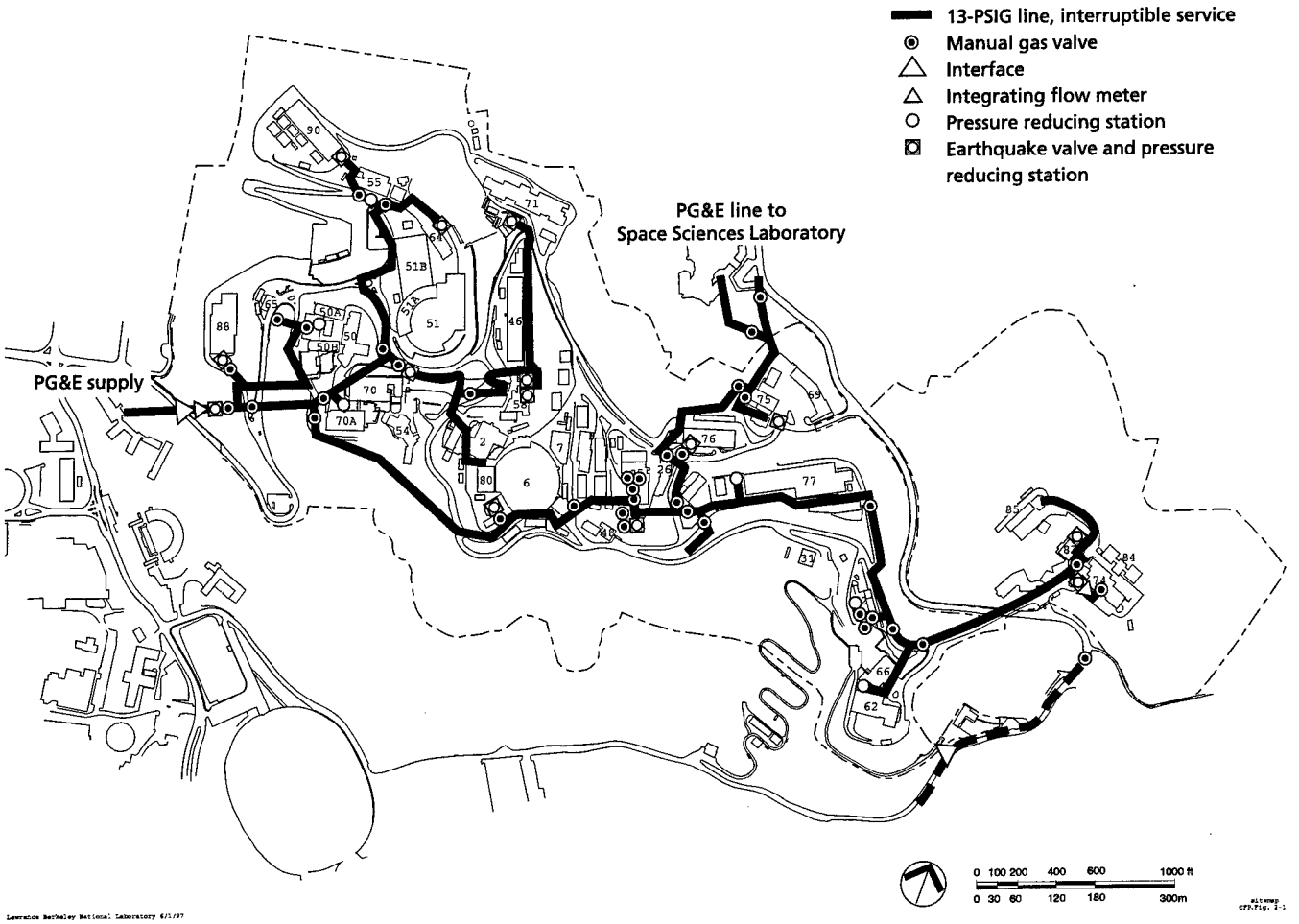


Figure 2-7. Natural gas system.

and outside major buildings to reduce the possibility of explosions following a quake. The natural gas is principally used for space and water heating; there is no central heating plant at Berkeley Lab.

Electrical Power System

Electrical power at the Laboratory is purchased from the Western Area Power Administration and delivered via Pacific Gas and Electric's transmission system. On-site electricity is distributed underground at 12 kV from the centrally located Grizzly main substation (Figure 2-8). Smaller substations supplying power at 480/277 V or 208/120 V are located at individual buildings or building clusters.

The PG&E supply system consists of two overhead 115-kV, 3-phase, 60-Hz transmission lines with a joint capacity of approximately 100 MW. Both transmission lines feed power from PG&E's Sobrante switching station to the Grizzly main substation on Berkeley Lab's site.

The 12-kV distribution circuits are arranged in radial and loop feed configuration, using oil- and gas-filled sectionalizing switches.

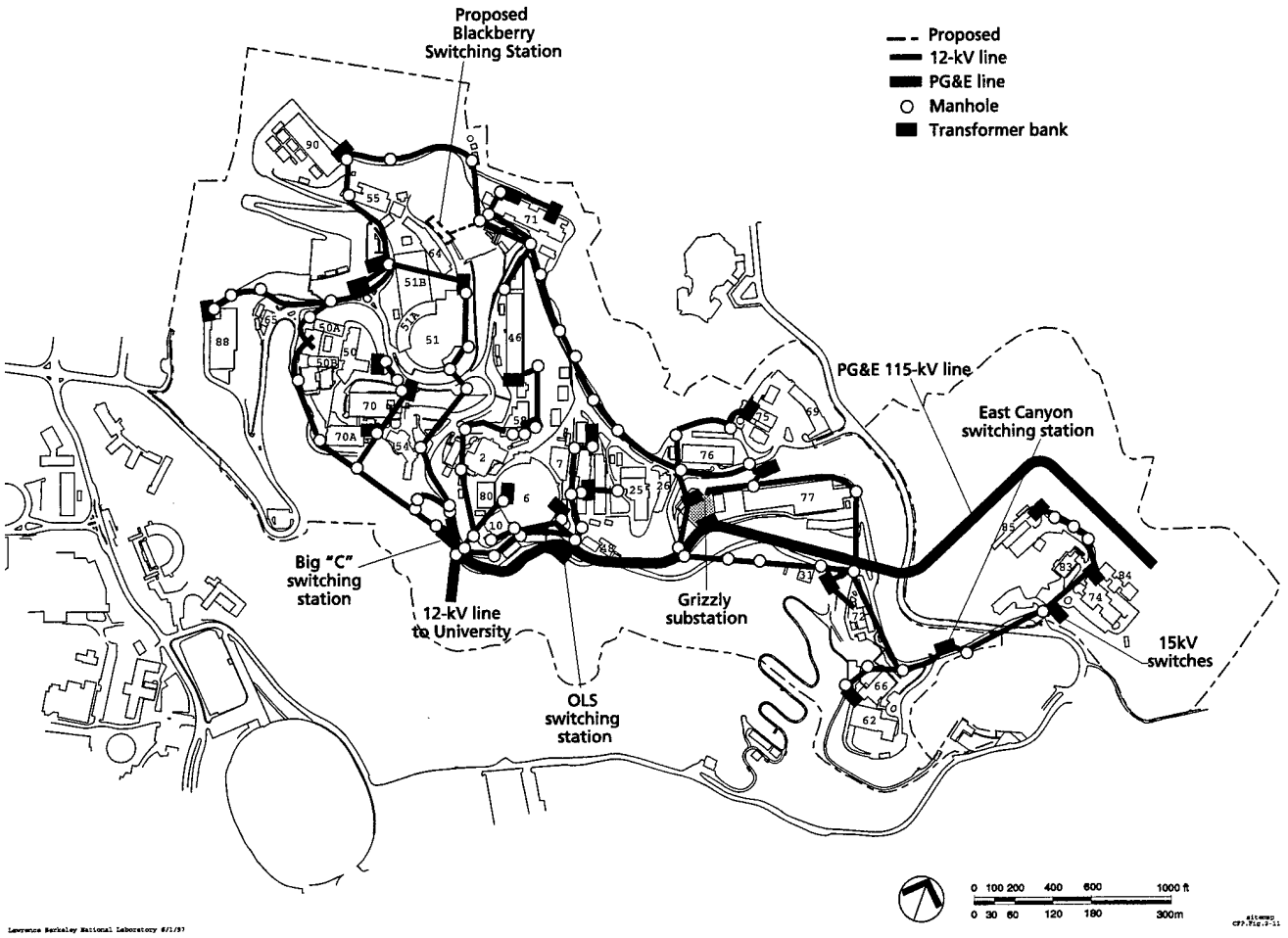


Figure 2-8. Electrical system.

COMMUNICATIONS

Telephone System

The Laboratory owns and operates an Integrated Communications System (ICS) that provides both telephone and switched data services. The ICS includes an extensive system of underground ducts (Figure 2-9), manholes, copper and fiber optic cables, building entries, distribution closets, and wiring. The underground duct system was significantly expanded as part of an ICS installation project that also included installation of an entirely new cable and wire plant. Although it is generally adequate, certain portions of the conduit system are inadequately sized to accommodate anticipated growth. Upgrade projects for these are proposed. Berkeley Lab's underground ducts now contain unused Pacific Bell cables that can be removed as necessary to free space in the ducts.

The ICS is based on an InteCom IBX S/80 digital switch that provides switched voice and data services and trunks to external networks, including Pacific Bell (the local telephone company), AT&T, and the Federal Telecommunications System (FTS 2000). The ICS supports a voice system that currently serves 4,500 stations with a capacity of 7,500 voice lines.

Computer Network

LBLnet is the Laboratory-wide computer network composed of underground fiber optic cables, coaxial and wire systems in buildings, and active components in buildings. LBLnet is connected through gateways to external networks, including HEPnet, NSFnet, BARRNet, ESnet, DARTnet and the UCB Campus network. LBLnet currently supports more than 3,000 attached computers, workstations, and printers using various networking protocol suites, including the

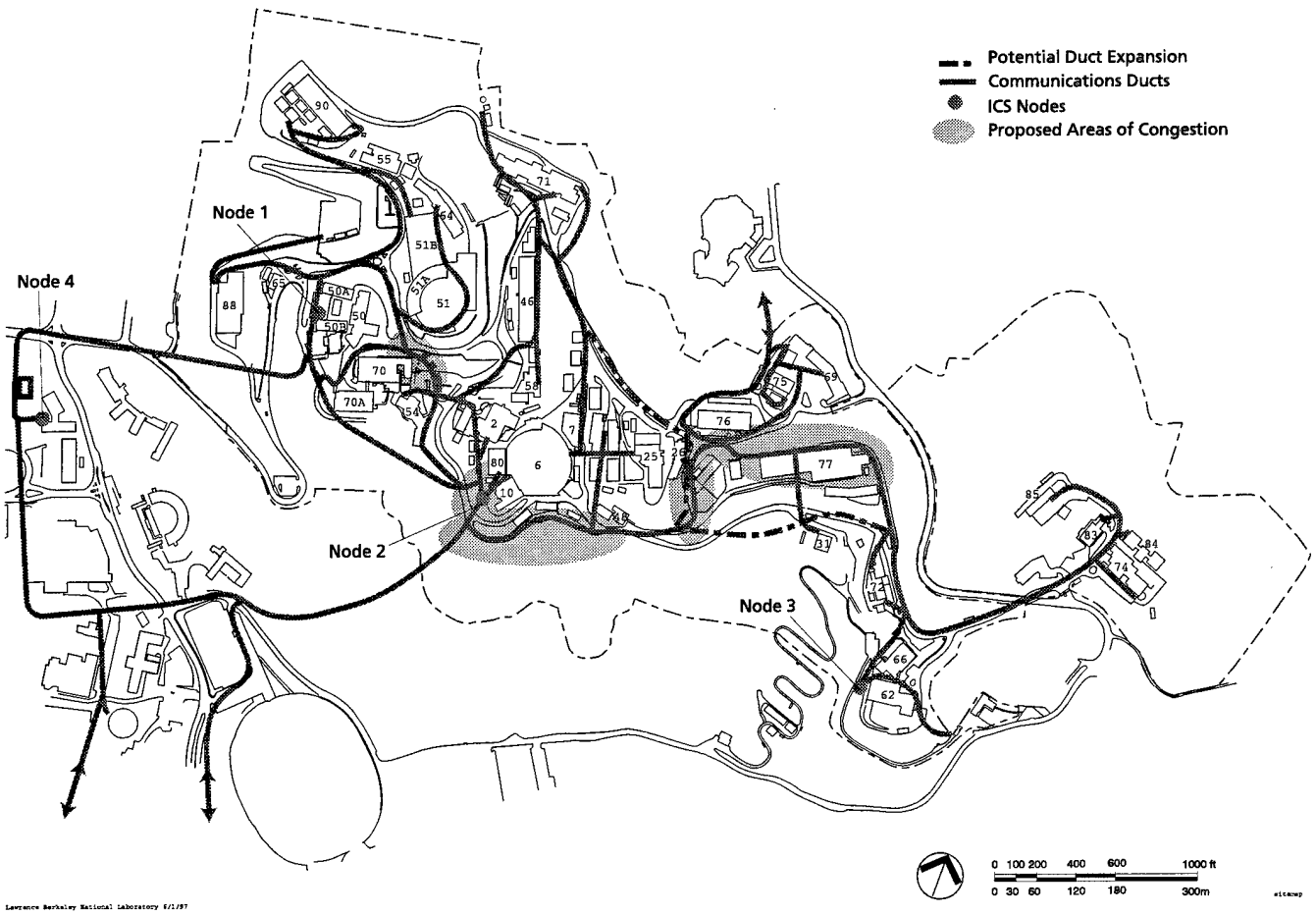


Figure 2-9. Integrated communications system.

Internet, DECnet, Xerox Network Services, and IPX protocols.

Videoconferencing

Berkeley Lab participates in the successful Energy Resources Videoconferencing Network (ERVN) project that originally linked Berkeley Lab, Fermilab National Accelerator Laboratory (FNAL), Surface Science and Catalysis Laboratory (SSCL) and several universities using ESnet communications bandwidth. Now ERVN has a central dialup hub that supports 17 DOE and university sites. Berkeley Lab is adding communications facilities that will allow any Berkeley Lab videoconference room to place direct-dial video calls anywhere within reach of the FTS 2000 network.

Radio, Television, and Wide-Band Communications

The Laboratory has radio and wide-band communications systems operating on eight VHF channels and on two microwave channels. There are over 500 fixed and portable radio units serving off-site and on-site transportation, a repeater link to Lawrence Livermore National Laboratory (LLNL), the University Police Department, Fire Department, Laboratory maintenance staff, individual radio paging, Director's

Office, and Building Managers' Emergency Command Center. A 7 GHz link provides full motion video from Stanford Linear Accelerator Center (SLAC)'s conference room to Berkeley Lab. A 23-GHz microwave link has been installed to provide telephone and LBLnet service to the off-site leased Promenade Building 938, and a 2.73-mile, 23-GHz link has been installed to the off-site leased Dymo Building 934.

Public-Address System

A Laboratory-owned public address system links the entire Berkeley Lab area, providing paging for Laboratory-wide announcements. This system is expanded to each newly constructed building and facility through rigid conduits in underground raceways installed at the time of construction.

SECURITY SYSTEMS

Fire Alarm System

The Berkeley Lab fire alarm system completed in 1985 uses solid-state programmable equipment and two main looped trunk lines with redundant paths. The looped trunk lines feed alarm information to the central supervising station in the Fire Station. A drop from a main trunk loop serves each building. Both Loop #1 and Loop #2 serve the entire Laboratory area. The Berkeley Lab-occupied buildings on the UCB campus are served by an isolated trunk from the Fire Station and by the UCB campus fire alarm system. The Fire Station console consists of a prioritized CRT alarm display, logging printer, a backup annunciation system, and a computer-aided dispatch system. The multialarm system monitors 1,650 points.

All major buildings and most minor buildings have local alarm (bell) evacuation systems. High-value areas have special protection systems with ionization-type smoke detectors as the primary detection means. Improvement of bell systems and smoke detection in several buildings is planned.

Card-Key System

A proximity card-key system monitors entry into some Laboratory buildings and limits access to rooms or areas for reasons of security, health, or safety. This system is being expanded to include all Laboratory buildings over the next five years.

LAND USE

Topography has influenced development of the Berkeley Lab's 82 hectare (200 acre) site. About 31 hectares (77 acres) have been developed with buildings, roads, parking, and other improvements or are reserved for building expansion. Another 27 hectares (11 acres) in the southeast are designated as potential building sites in the UCB Long Range Development Plan (LRDP) that guides Lab land use decisions. Because of important features and physical considerations, the balance of the Laboratory site is designated as open space, natural areas (potential use and/or development), or ecological study areas (no construction permitted). The relatively compact nature of the Laboratory promotes a close-knit research community and interaction among support services and scientific staff.

Functional Planning Areas

For efficiency and planning, the Laboratory groups related facilities and activities into functional planning areas (Figure 2-10). In concept, each core area is composed of a cluster of buildings whose perimeter provides traffic and service access and parking, and is connected to other areas by a network of pedestrian paths and walkways.

Social/Recreational

"People places" are an important part of Laboratory life for visitors and employees. The site offers the incomparable amenity of numerous views west to San Francisco Bay and the area's cities, hills, and bridges. Several buildings and outdoor places provide exceptional vistas.

The site cannot easily accommodate large recreational spaces, but playing fields at the adjacent University campus are used for softball and other activities. Moreover, University swimming pools and recreational gyms are available to Lab employees at a reduced cost. Onsite, employees at several locations have initiated sports opportunities in the form of basketball hoops (5), volleyball (1), archery (1), and table tennis (2). Joggers, walkers, and bicyclists use the pathways, walkways, and roads for lunch time and after work exercise. Berkeley Lab also provides showers in, or near, all major buildings.

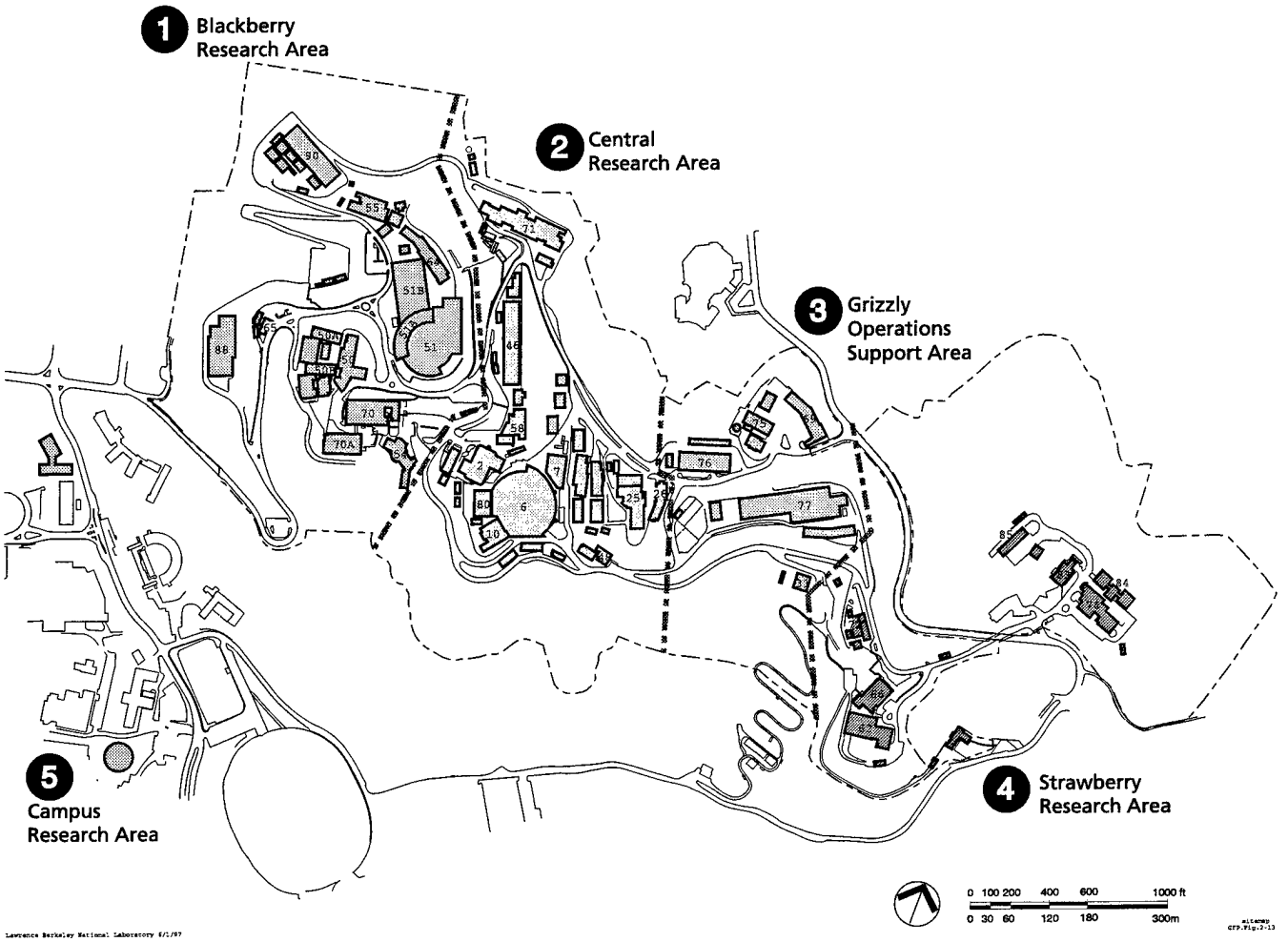


Figure 2-10. Functional planning areas.

Overall, the Laboratory currently lacks any sizable outdoor gathering space and has few attractive smaller ones. The Laboratory allows opportunities for small-scale social and passive recreational activities (Figure 2-11) with a variety of informal picnic tables. A number of outdoor places such as 'Seaborg Glen' offer special and appealing qualities appropriate for "people places." Relatively minor improvements to most of the site's outdoor use areas will support usage and provide an attractive amenity for employees and visitors. The Landscape Master Plan has identified additional areas that should be developed for outdoor use (see Chapter 4, Figure 4-3) .

Circulation

Berkeley Lab's roads and walkways provide for movement of personnel and materials. The primary circulation system is a pedestrian-oriented network of paths and walkways. As parking is not provided adjacent to most buildings, the network and the Laboratory shuttle bus system provide the backbone of the circulation system. In older areas of the Laboratory the road system is substandard, with narrow, indirect, and confusing access. Redevelopment of older areas will eventually allow route reconfiguration. Inadequate and variable signage is part of the problem, and improvements are being implemented.

Approximately one-quarter of Laboratory employees reside within the City of Berkeley. These individuals enjoy optimal flexibility in commuting. The Laboratory has installed pedestrian gates at a number of locations. These gates afford employees access to the site from a number of residential streets. The Laboratory has worked with UCB to publish a

street map identifying the slope of streets and the presence of walkways between streets. Laboratory shuttle buses stop adjacent to nearby residential neighborhoods. Employees living in these areas can walk to the shuttle stops. Those living some distance away can ride bikes to the shuttlebus stop, place their bikes on special racks, and ride the shuttle up to the Lab.

Moreover, the Laboratory has worked to provide alternative commuting options for employees who live some distance away. In addition to endorsing and supporting car and van pooling arrangements through a local organization, the Lab has integrated its off-site shuttle bus system with the local and regional mass transit systems. The Berkeley Lab shuttle bus serves both east bay BART lines—serving the Shattuck Station on the Richmond-Fremont/Pleasanton Line, and the Rockridge Station on the Contra Costa County–San Francisco Line. The shuttle bus stops have also been coordinated with all AC Transit Bus lines serving downtown Berkeley.

Pedestrian Circulation. Due to the compact nature of the site, many buildings are within walking distance of each other (Figure 2-11).

Vehicular Circulation. The Berkeley Lab site is served by an east-west traffic circulation system (Figure 2-12) that generally conforms to the contours of the site's topography. Vehicles can enter Berkeley Lab through three gates, attended by security personnel when open and accessible using a card access system when the gates are closed.

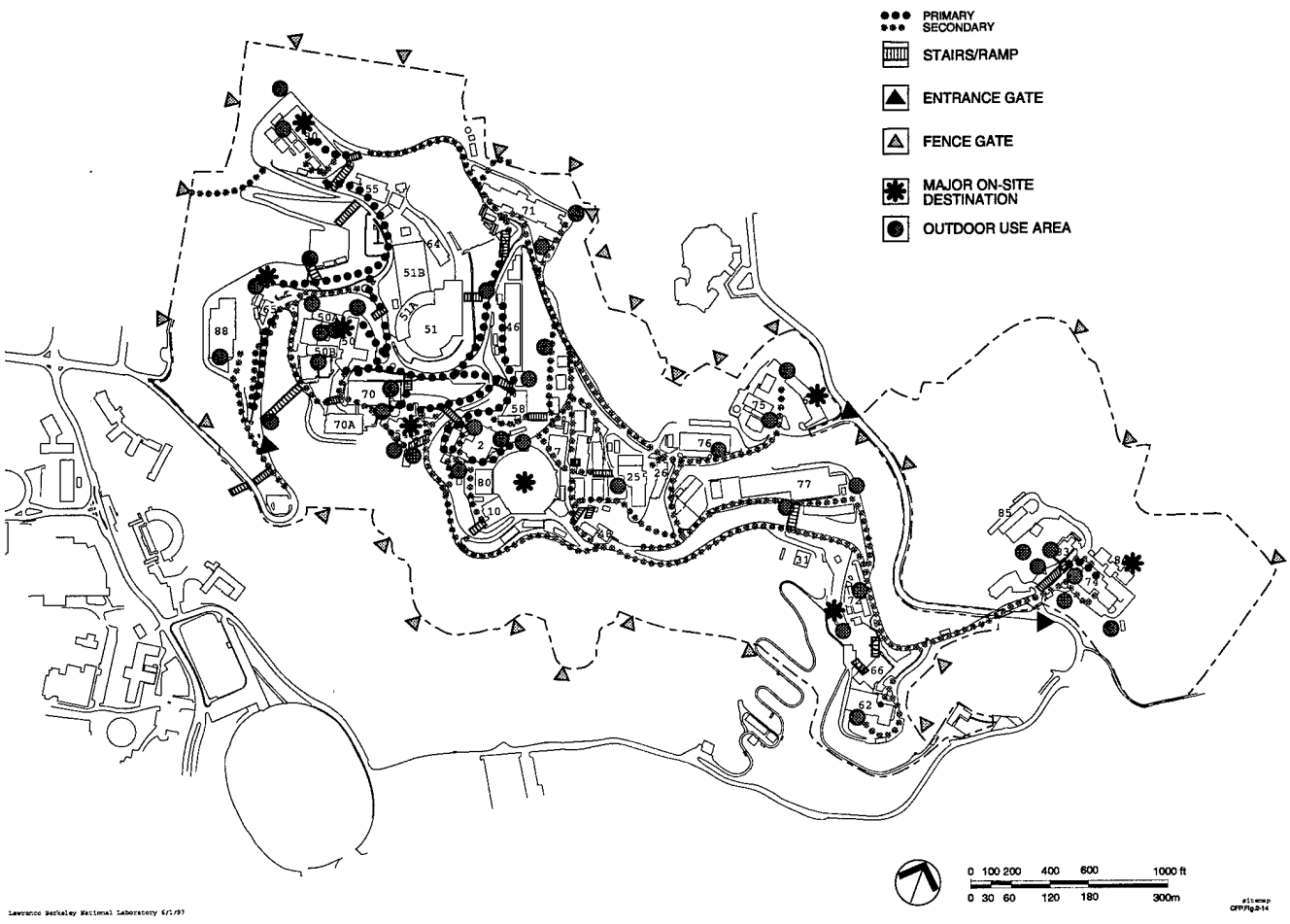


Figure 2-11. Pedestrian circulation.

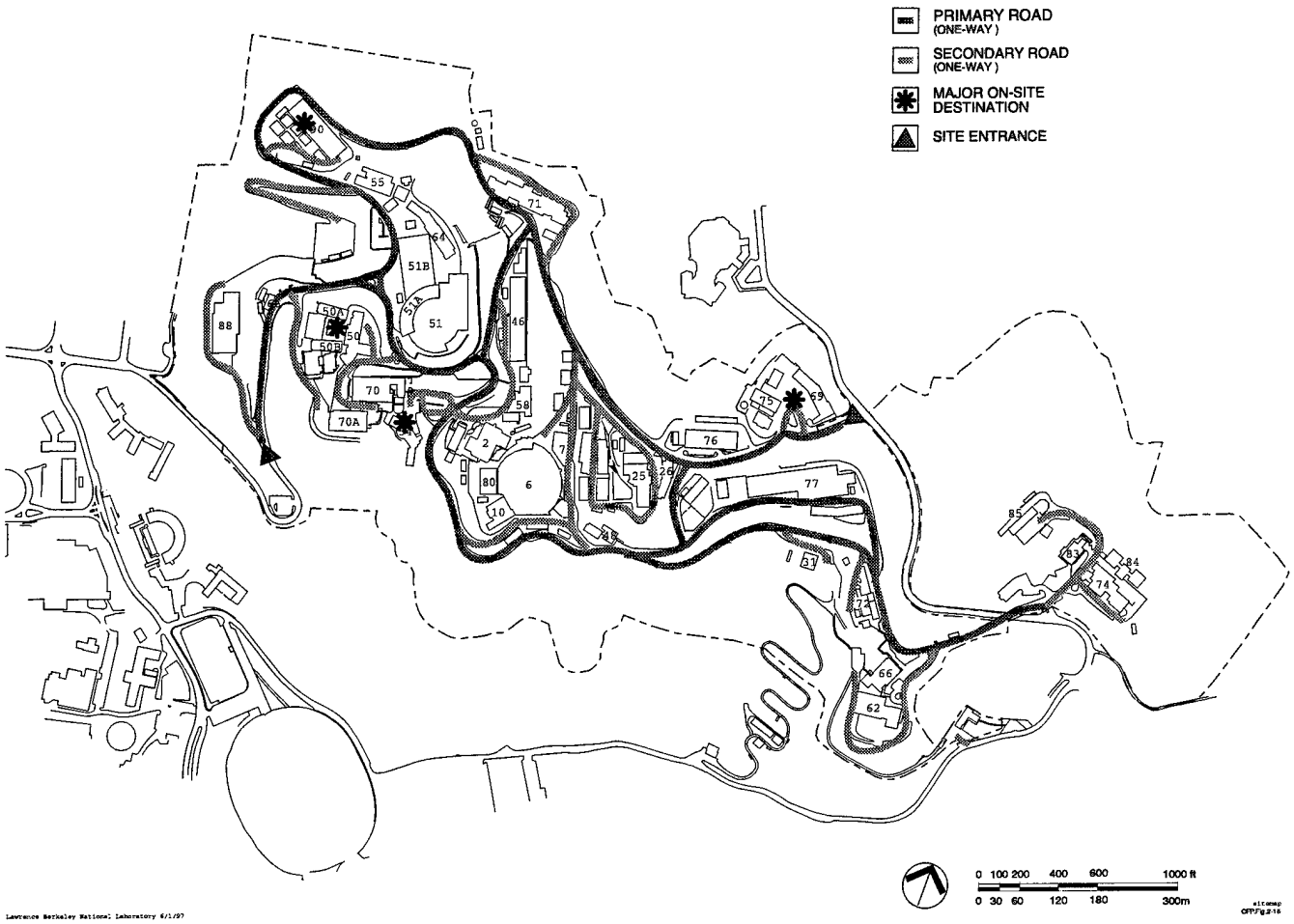


Figure 2-12. Vehicular circulation.

The Laboratory's primary vehicle routes are two-way except for three sections where roadside parking reduces traffic lanes, permitting only one-way travel. The one-way portions can be confusing for the uninitiated, and cause additional difficulties and expense for construction projects.

Service Circulation. The primary delivery route passes through the length of the site (Figure 2-12) along the east-west circulation axis from the Main Gate to the distribution center at Building 69.

Shuttle Bus. Berkeley Lab operates a free shuttle service for Laboratory users, providing both on-site and off-site routes (Figure 2-13). The system facilitates circulation and access, minimizes the use of personal vehicles, and supports use of mass transit. The bus service reduces on-site traffic, yet allows access to every building on the site within a reasonable amount of time. The off-site shuttle serves downtown Berkeley, connecting with BART and AC Transit stops.

The shuttles make 98 on-site trips and 70 off-site trips per day. Plans call for increasing service commensurate with population increases.

Parking

Parking at Berkeley Lab is located in small surface lots (some with a stacked configuration) and along roads (Table 2-5). Trailers serving as temporary office and storage space have been placed in parking lots, reducing available parking space.

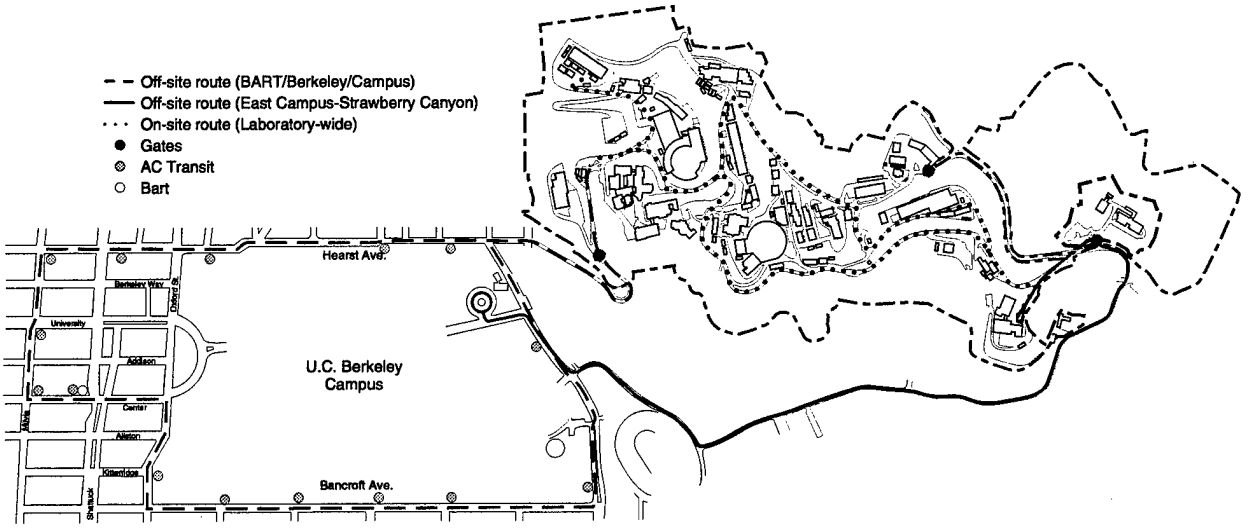


Figure 2-13. On- and off-site bus service.

Table 2-5. Parking.

	Parking Spaces
General	1584
Blue Triangle	311
Government	254
Director's	34
Disabled	38
Loading Zone	28
Motorcycle	19
Time Limit	17
Visitor	12
Emergency	5
	2302

Berkeley Lab provides parking space for 2,048 vehicles and 254 government-owned vehicles stored on-site for day use. Berkeley Lab's persons per parking space ratio is 1.8:1, with a goal of 1.7. Berkeley Lab has implemented a comprehensive trip management program to encourage the use of bicycles, public transportation, free shuttle buses, carpools, and other measures designed to reduce employee-related vehicle trips. Van pooling and car pooling are encouraged by providing reserved parking for "pool" vehicles.

BUILDINGS AND OTHER STRUCTURES

The Berkeley Lab space inventory includes many types of facilities, including on-site permanent buildings, trailers and miscellaneous structures, off-site leased building space, and UCB Campus space assigned to Berkeley Lab.

The Laboratory's on-site space (about 84% of the gross) consists of approximately 156,850 gsm (1,688,400 gsf). It has an approximate 72% efficiency, yielding about 109,800 m^2 (1,181,900 SF) of net usable on-site space. About 4–5% of the on-site space consists of trailers and other temporary structures.

The Lab's Life Sciences and Structural Biology Divisions have substantial amounts of their space on the UCB campus. Together, these two divisions occupy about 3,900 net m^2 (42,000 net sq ft) on Campus. The Lab occupies space in additional Campus buildings, leased space in the cities of Berkeley and Walnut Creek, and space at the Stanford Linear Accelerator Center (SLAC).

Of the main site's 154,000 gsm (1.7 million gsf), about 18% is considered Adequate, 75% is Functional, Can Be Economically Upgraded, and 7% is Substandard, Cannot Be Economically Upgraded (Table 3-5 and Appendix C).

ENVIRONMENT, HEALTH, AND SAFETY POLICIES

Berkeley Lab is committed to environment, health and safety protection for all employees, visiting scientists, customers, neighbors, and others who may be affected by Berkeley Lab research and related activities. Berkeley Lab policies are founded on sound management principles that ensure full compliance with all applicable laws and regulations. The Environment, Health and Safety (EH&S) Division is committed to working with line management to meet five basic environment, health, and safety principles:

- To provide Berkeley Lab employees with a safe workplace
- To provide technical support in the design and operation of Berkeley Lab facilities and research activities to minimize adverse impact on public health and the environment
- To oversee production and use of materials, to ensure safe disposal and minimal impact on the environment, and to minimize waste
- To promptly communicate to affected persons the known hazards of Berkeley Lab activities and the related methods necessary for safety and health protection
- To provide guidance on the use of available technology, engineered safeguards and responsible science to mitigate significant risks arising from Berkeley Lab research and related activities.

Health and Safety Programs

All Berkeley Lab facilities establish and maintain industrial hygiene, safety, fire protection, and medical programs that meet or exceed standards of good professional practice.

The Berkeley Lab Industrial Hygiene Program provides for the recognition, evaluation, and control of occupational health hazards. The program includes reliable measurement and documentation of potentially hazardous workplace exposures, and disclosure to affected employees of all potential hazards. Programs provide for the use of appropriate engineering controls, protective practices, and personal protective equipment.

The Berkeley Lab Safety Program provides for employee personal safety, facility security, fire protection, and process safety. Berkeley Lab establishes local exposure limits or complies with established regulatory standards to protect the health and safety of its employees and visitors, and of local communities and other groups affected by Berkeley Lab activity.

The Berkeley Lab Fire Protection Program maintains a fire protection staff adequate to identify, evaluate, and control potential fire and life safety hazards. The program ensures that fire will not cause an unacceptable onsite or offsite release of hazardous materials that would threaten public health and safety or the environment. In addition, the program is aimed at minimizing the potential for fire or related perils that might impact the Laboratory or DOE missions.

Berkeley Lab provides employees with a mandatory pre-employment physical examination and with voluntary periodic physical examinations thereafter. Examinations may be required for employees potentially exposed to specific hazards. Employees with occupational injuries or illnesses are evaluated and treated promptly, with emphasis on rehabilitation and return to work at the earliest time compatible with job safety and the employee's health. The Medical Clinic staff and Employee Assistance Program staff provide counseling and education to employees on health matters.

All Berkeley Lab employees with potentially hazardous occupational exposures are offered a health monitoring program.

Berkeley Lab maintains records of all workplace accidents, illnesses and injuries for the purpose of measuring Lab-wide and system-wide safety performance. All significant accidents are reported and investigated promptly by the appropriate line management unit.

Protecting the Environment and Public

Berkeley Lab conducts process safety analysis on all potentially hazardous facilities and operations and evaluates potential releases to determine their possible effect on the environment and local community. Where significant hazards are identified, appropriate control strategies are implemented to ensure protection of the public.

Each Berkeley Lab division establishes safety procedures to provide for environment, health, and

safety assurance of existing processes and activities, significant new uses of materials, or process changes.

Berkeley Lab keeps its spill plans and emergency response plans current. Berkeley Lab also keeps the local community informed of potential hazards associated with its operations, and conducts joint emergency response planning and exercises with the community through the Community Awareness and Emergency Response (CAER) Program.

Air emissions, waste water discharges, and solid wastes are evaluated to identify any potential effect on public health or the environment. Berkeley Lab complies with the requirements of the Clean Air Act, Clean Water Act, RCRA, TSCA, and other applicable environmental laws, as well as with DOE Orders in reference to these laws. Exposure limits are established, and appropriate waste management strategies are implemented to prevent any significant adverse impact.

Berkeley Lab complies with all environment, health, and safety requirements. Where past activities have resulted in risks to the public or the environment, Berkeley Lab acts to minimize or remove those risks and cooperates fully with regulatory agencies and other interested groups.

Waste Disposal and Minimization

All waste disposal meets the highest current standards for safety, health, and minimal environmental impact. Berkeley Lab minimizes the production of hazardous, mixed, and radioactive wastes in all forms, including air emissions, waste water releases, and solid wastes. Each Berkeley Lab division provides for setting exposure limits for raw materials, intermediates, wastes, or other environmental releases.

For each of its materials, each division prepares or obtains a material safety data sheet (MSDS) that effectively communicates accurate environment, health, and safety information. MSDSs are provided or made available to all affected employees, customers, carriers, local communities, and emergency response personnel. Reagents, products, and other materials are packaged and transported safely.

Hazard Communication

Berkeley Lab communicates to employees industrial hygiene monitoring data, the results of health studies, significant new toxicity data, safe handling techniques, workplace and environmental hazards, and results of employees' personal medical tests.

Appropriate environment, health, and safety information is communicated to visiting scientists, students, contractors, carriers, members of the public, regulatory authorities, and emergency response authorities.

Berkeley Lab divisions or facilities promptly notify the EH&S Division when they are involved in a reportable occurrence.

Risk Management

Each Division uses EH&S guidance to perform documented risk assessments to identify, characterize, and mitigate potential hazards arising from their activities.

To the extent possible, risk assessment and risk management are performed as separate functions. Risk management includes selection and implementation of the appropriate risk reduction methods, including training, formal procedures, environmental monitoring techniques and frequency, and design and application of engineered safeguards.

From time to time, Berkeley Lab conducts, sponsors, or participates in appropriate studies to develop new data as needed for risk assessment and reduction, such as an interactive MSDS and chemical inventory, labels, and other environment, health and safety needs.

Human and Animal Health Effect Research

Berkeley Lab follows established Department of Energy (DOE) and Department of Health and Human Services (DHHS) principles and regulations to safeguard the welfare, privacy, and rights of human research subjects and ensure the humane treatment and proper care of animals used in research. All research involving human subjects and animal subjects is reviewed and approved by the appropriate Berkeley Lab committees and, for protocols using human subjects, by the U.C. Berkeley Committee for Protection of Human Subjects.

Implementation of Policies

Each Division Director ensures that environment, health, and safety policies are implemented, as established by EH&S and set forth in the Ernest Orlando

Lawrence Berkeley National Laboratory Health and Safety Manual, PUB-3000.

Assessment is conducted periodically to assure compliance with applicable laws and regulations and with Berkeley Lab policy. Significant findings are reported promptly to senior management.

Each Berkeley Lab Division performs a self assessment that documents achievement of EH&S policies and goals.

Berkeley Lab is committed to active participation in the regulatory process. Together with other national labs, trade associations, and other groups, Berkeley Lab maintains a continuing dialogue with interested parties and seeks reasonable solutions for society's environment, health, and safety concerns.

In compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), Berkeley Lab ensures that governmental decision makers and the public are informed about the potential significant environmental effects of Berkeley Lab's proposed activities—before actions are taken—and identifies ways that environmental damage can be avoided or significantly reduced.

Environmental Evaluation and Status

Environmental monitoring (air, water, and land) is conducted by Berkeley Lab's EH&S Division personnel. Monitoring stations for each component are identified in Berkeley Lab's Site Environmental Report. Off-site sampling is conducted to provide information regarding public safety. For a listing of regulatory agencies that govern environmental compliance see Chapter 1, Regulations and Planning Requirements.

Air

Potential air pollution consists of chemicals and radionuclides released from laboratory vents. Each building is actively monitored for compliance with applicable air quality standards, and present release levels meet these safety standards. Experiments that could generate noxious fumes or vapors are confined to fume hoods. Airborne wastes are minimal due to the small amounts of chemicals involved in the research.

Processes with a potential for pollution are reviewed during conceptual stages to identify those that require "Permits to Construct" from the Bay Area Air Quality Management District.

Water

In chemical laboratories, small amounts of water soluble chemical wastes are allowed to be discharged to sanitary sewer drains, following guidelines published in the Ernest Orlando Lawrence Berkeley National Laboratory Health and Safety Manual, PUB-3000. Wastes from plating or metal cleaning shops and laboratory acid wastes are collected and pretreated before discharge to sanitary drains. In accordance with Berkeley Lab policy, non-water soluble chemical wastes are collected at their points of generation, segregated into compatible groups, placed in approved shipping containers, and transported to a DOE site for burial or recycling.

Chemical wastes are not discharged to storm drains or streams. Other potential water pollution sources are from contaminated soils, discussed in the following section. As noted below, Berkeley Lab is conducting a Labwide characterization study of water and soil contamination.

Land

Sources of potential soil pollution are accidental spills from routine operations, transportation of materials, or leaking underground tanks. Solvents, fuels, and other hazardous liquids are controlled through EH&S Division procedures and training. Improvements include construction of new storage containers, the installation of overflow/leak containment, and the use of impervious materials.

Collection and processing of hazardous wastes are performed in a specially designed Hazardous Waste Handling Facility (B85) that includes the proper equipment and configuration as defined by regulating authorities. Hazardous waste is consolidated and packaged to meet U.S. Department of Transportation regulations and then trucked to approved disposal sites. Nonhazardous wastes are regularly collected at Berkeley Lab and transported to a recycling company, where 90% of the volume is recycled.

Environmental Restoration and Waste Management

Berkeley Lab environmental management site projects are directed toward restoring environmental

conditions at the Laboratory and to improving the management of waste handling operations in support of DOE's national environmental objectives. The corrective actions achieve and maintain required low exposure and risk levels. The environmental restoration program includes the assessment and characterization of contamination, and closure of the existing Hazardous Waste Handling Facility (B75A).

These programs provide for compliance with DOE and other Federal regulations and for meeting requirements established by state and local agencies. The Environmental Management (EM) 5-year plan is focused on three Environmental EM programs for restoration and management activities:

- Environmental Restoration. Assessment, characterization, and remediation of chemical contamination of soils and ground water and closure of the existing Berkeley Lab Hazardous Waste Handling Facility and decontamination and decommissioning of the Bevalac.
- Corrective Activities. Corrective actions to achieve compliance with environmental regulations that protect soils, ground water, and air and also prevent chemical discharges to sewers. Essential corrections are to laboratory ventilation systems, deionization systems, sanitary sewer systems, chemical storage tanks, and wastewater treatment units.
- Waste Management. Waste management program for continuity of hazardous and radioactive waste handling operations, disposal, waste minimization, and planning. Additional funding of waste management operations will be necessary to meet mandatory program requirements.

The Laboratory's systematic and prioritized input to the EM Five-Year Plan supports DOE's national environmental restoration and waste management goals. The plan responds to specific environmental conditions at the Laboratory and includes facilities and operating programs for managing those conditions to maintain air quality, surface water quality, and ground water quality.

Operational Safety

No significant radiation levels are expected in accelerator experimental areas. Accidental exposure of personnel is limited primarily by passive systems (shielding) and by active engineering and administrative controls, such as electrical interlock systems to prevent access to radiation areas, audible and visible warnings, and surveillance of experimental operations. Radiation levels at the fence line are not expected to increase as a result of Berkeley Lab operations.

Continuing reviews during the conceptual and design stages and preparation of an Activity Hazard Document (AHD) are mandatory for all potentially hazardous experiments. The AHDs are reviewed by the Berkeley Lab EH&S Division's technical staff of professionals. As a standard procedure of the Berkeley Lab safety program, all areas are regularly inspected for compliance with Federal Occupational Safety and Health Administration (OSHA), DOE, and Berkeley Lab standards. Routine design review of equipment and laboratory facilities and review of experimental procedures are expected to reduce all hazards to a "low-hazard" classification.

Environment, Safety, and Health Five-Year Plan

The Laboratory has developed a prioritized five-year plan for environment, safety and health activities that includes the existing core program of environment, safety and health services and activities, additional core support, and specific projects needed to fully meet all Berkeley Lab and DOE safety and health goals. Berkeley Lab planning has contributed to the development of the ER prioritization system to allocate and rank necessary activities based on quantitative risk reduction criteria. GPP and MEL-FS projects included in this CFP address the ES&H five-year plan needs.

Waste Minimization Plan

Berkeley Lab's waste minimization program is an organized, comprehensive, and continual effort to systematically reduce hazardous, radioactive, and mixed waste generation. The Waste Minimization and Pollution Prevention Awareness Programs are designed to eliminate or minimize pollutant releases to all environmental media from all aspects of the site's operations. These efforts offer increased protection of public health and the environment. They will yield the following additional benefits: reduce waste man-

agement and compliance costs; reduce resource usage; reduce or eliminate inventories and releases of hazardous chemicals; and reduce or eliminate civil and criminal liabilities under environmental laws.

OTHER IMPROVEMENT PROGRAMS AND ASSESSMENTS

The Laboratory has implemented a long-range plan to improve the condition of the physical plant and operations with respect to maintenance, repair, safety, and the environment. Highlights of these improvements are described below. Specific implementation over a five-year planning period is described in Chapter 5.

Seismic Safety

All physical plant facilities have been reviewed for seismic safety (Appendix A). Since 1971, over 35 buildings with significant seismic deficiencies have been strengthened to meet the new standards. Other improvements in earthquake-resistant facilities and emergency preparedness include the following:

- Two on-site water storage and emergency pumping stations have been constructed to provide water for fire protection if public supplies are lost.
- An emergency command center has been established and hardened for earthquake safety.
- Standby electrical generators, communication systems, medical facilities, the firehouse, and other life-line systems have been obtained or strengthened for use following an earthquake.
- Earthquake shutoff valves have been installed on all natural gas mains.
- An emergency telephone system has been installed.

Underground Utilities Improvements

Nearly three-quarters of all exterior sewer lines have been videotaped and inspected to determine preventive maintenance and replacement tasks for short- and long-term funding. A FY1996 Line Item Project has corrected the identified deficiencies and improved system functionality. Recently completed construction projects replaced a portion of the underground utilities (potable water, low-conductivity water, compressed air, natural gas, storm drainage, treated water, and sanitary sewer systems) as well as above-ground cooling towers in central portion of the Laboratory. Rehabilitation of all older 12-kV cables and substations is entering its final phase, a proposed FY1997 Line Item project to upgrade the electrical distribution system in the Building 51 area.

Energy Management Improvements

Berkeley Lab energy use has been reduced over the last several years by improvements in operations and building design. Energy metering throughout the site includes 100 electric meters and 50 gas meters. Meters are read regularly, and a database has been established.

Utility service management continues to be an important aspect of the Berkeley Lab energy management program. Berkeley Lab now purchases most of its electrical power from the Western Area Power Administration (WAPA), thereby saving approximately $1 million annually. Berkeley Lab purchases natural gas from the Defense Fuel Supply Center (DFSC), saving approximately $100,000 annually.

Berkeley Lab works in conjunction with the DOE/OAK Office to negotiate utility contracts. Goals for utility acquisition are shown below.

- Monitor continuously evolving utility rate structures to seek the best power mix for Berkeley Lab programs.
- Monitor the posture of WAPA and work in concert with DOE/OAK and special consultants for increased allocation as needed.
- Seek other unused or set-aside portions of WAPA power, as Berkeley Lab has successfully done in the past.
- Monitor natural gas purchasing options to ensure lowest rates.

Fire Protection Improvements

Major buildings are being upgraded to meet the latest fire protection and life safety standards, since building use has changed over the years. Sprinkler systems have been installed in all buildings. Specialized equipment, such as computers, fume hoods, and

experimental apparatus is provided with appropriate fire suppression systems.

Barrier Reduction for Handicapped Persons

Improved access for physically disabled persons has been provided to the Berkeley Lab auditorium, medical clinic, cafeteria, central research laboratories, Director's Offices, and main administrative offices. Suitable toilet facilities have also been provided for handicapped persons.

Maintenance

The goal of Berkeley Lab's maintenance program is to provide a safe and reliable physical plant for Berkeley Lab's research programs. Past budget constraints have resulted in curtailed maintenance, repairs, and replacements.

Berkeley Lab carries out a formalized maintenance management program, and includes a computerized scheduled maintenance system. Budget requests are based upon inspections by Berkeley Lab's Facilities Department and consulting firms in specialized areas, such as cranes, elevators, boilers and pressure vessels, fire protection, slope stability, storm drainage, seismic safety, underground utilities photography, and energy use, with review by the Facilities Department.

Plant operations and surveillance are carried out by the Maintenance Shops 24 hours a day, 7 days a week, under an area maintenance concept.

Site Deficiencies Summary

The older original area of the Berkeley Lab site was developed in the 1940s, making it one of the oldest laboratory complexes in the DOE system. With few exceptions, most of these older facilities are substandard or obsolete. Vehicle and pedestrian circulation routes are generally narrow, indirect, and substandard. Electrical and mechanical utility systems and load centers in the area have ample capacity but are aged, inflexible, and unreliable. Portions of these systems—water, electrical, gas, sewers, and compressed air—have already exceeded their useful lives. Rehabilitation, modernization, or replacement is now necessary. Communication systems have been upgraded by the ICS Project and will only require extension to new facilities.

Shortages of both laboratory and office space at Berkeley Lab have remained acute over the last 10 years, impeding the effective and efficient conduct of scientific research and adding significant operational costs.

FACILITIES DECOMMISSIONING PLAN

The Laboratory conducts periodic reviews of facilities that may become inactive. No facilities are slated to become inactive. Space needs generally require that any underutilized space be re-assigned to meet pressing needs for space in other units.

3. FACILITIES AND ASSET PLANNING PROCESS

CONTENTS

BERKELEY LAB PLANNING PROCESS AND ORGANIZATION

The Laboratory maintains both strategic/institutional and capital/infrastructure planning initiatives regarding its facilities. Strategic/institutional planning initiatives are led by the Office of Planning and Communications, while capital/infrastructure planning initiatives are led by the Facilities Department. These interrelated planning processes are documented in three primary documents; the Institutional Plan, the CFP, and the Maintenance Plan.

The Office of Planning and Communications (see Figure 3-1) is responsible for preparation of the Laboratory's Institutional Plan. It is through the Institutional Plan that the Laboratory's strategic goals and objectives are refined and communicated to the broader laboratory community.

Facilities Planning is responsible for preparing the CFP, which includes Laboratory capital asset/infrastructure planning. To ensure that this planning is both inclusive and accurate, the Facilities Department coordinates with both scientific and resource divisions (Resource divisions include Environment, Health & Safety and Engineering, as well as the Facilities Department.) This planning process is documented in the CFP and the Maintenance Plan. The Office of Planning and Communications and Facilities Planning meet regularly to discuss topics of mutual interest and concern.

CAPITAL ASSET/INFRASTRUCTURE PLAN

Capital asset/infrastructure needs are identified through an annual "Unified Call" for construction projects. It is the primary method of project

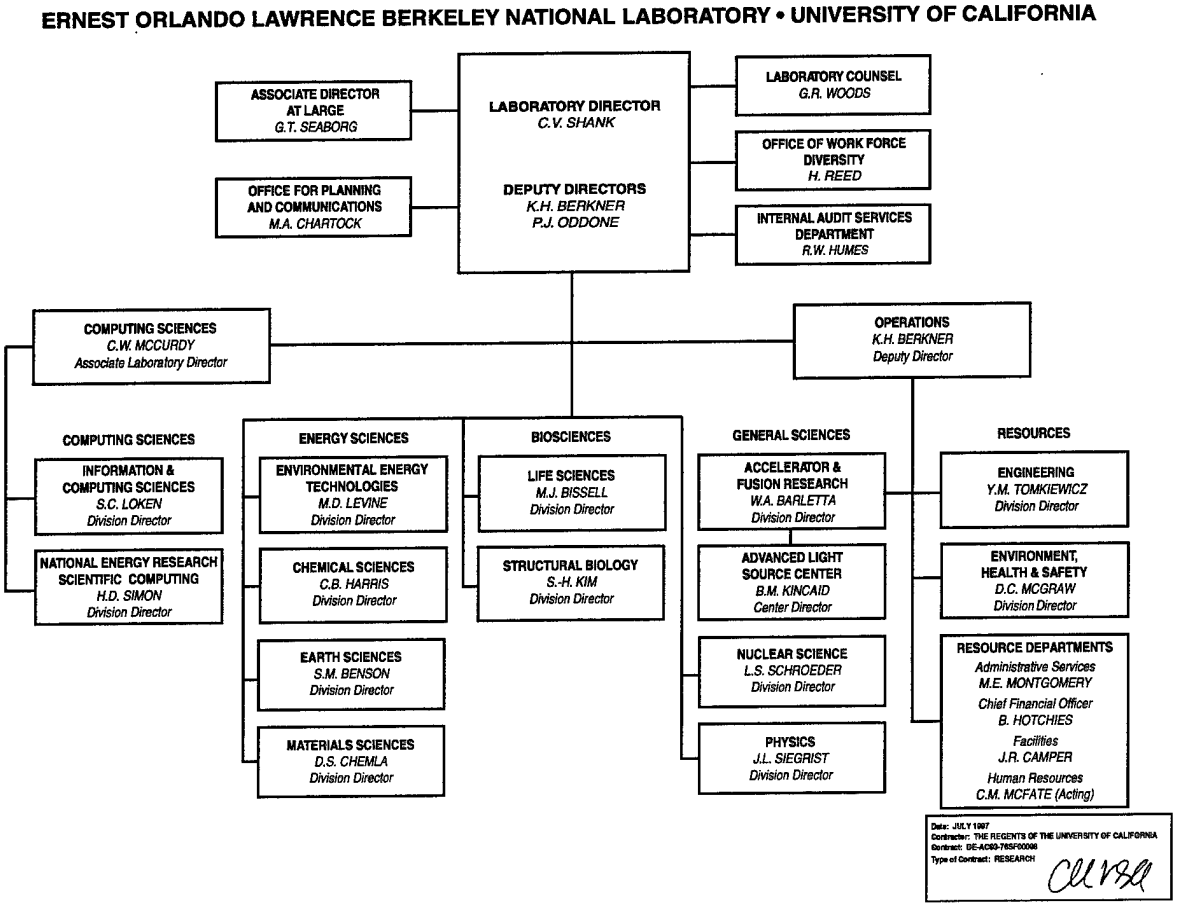


Figure 3-1. Berkeley Lab organization chart.

identification at the Laboratory. The "Unified Call" for construction projects (Non-Capital Alterations through Line Item Projects) is issued annually to all scientific and resource divisions. (To ensure an open and inclusive planning process, the Facilities Department also accepts new construction project ideas through its Work Request Center. Any member of the Laboratory community can initiate a project request through the Work Request Center. When a proposed project could affect the relative ranking of any project on a scientific or resource division's "Call Response List," the project proposal is reviewed with the division involved.)

The Facilities Department evaluates and prioritizes each of the project requests identified through the "Call," rating each using both the Capital Asset Management Process (CAMP) and Risk-Based Priority Matrix (RPM) rating systems. Project proposals are also reviewed for consistency with the Institutional Plan, the CFP, and the Sitewide Environmental Impact Report (SEIR). Items that are not consistent with existing plans are noted. (These notes are considered both during the project prioritization process and during the next revision process for the respective plan.) The Facilities Department then breaks the list into sub-lists according to their funding category (e.g., Non-Capital Alterations, General Plant Project, General Plant Equipment, and Line Item Project). These sublists become the "Planning Lists" noted in Figure 3-2. Each funding category list is then reviewed by the Project Coordination Committee.

The Project Coordination Committee is facilitated by the Facilities Department and consists of representatives from each of the Laboratory's resource divisions and the Office of Planning and Communications. The Committee performs two functions: (1) it informs all resource divisions of upcoming projects and allows for advance coordination when required, and (2) it provides a broad-based review of CAMP and RPM ratings. The Project Coordination Committee may bring forth new information regarding any project, or request further examination to ensure each project is appropriately rated. From the Committee review, a recommended list of prioritized projects is compiled. This in turn is submitted for collective review to the Facilities Manager and the Director of the Environment, Health and Safety Division, who in turn advise the Deputy Laboratory Director for Operations regarding preparation of a final list. The final list is submitted to the Directors Action Committee for final review and approval. All lists include a "below-the-line" listing of high priority items for which funds are not available. If additional funds become available (e.g., projects may be completed at a cost below budget), then the highest ranked project(s) on the "below the line" list is moved up and funded. Projects that are not funded are periodically reviewed with the proposing division during the year, and may be resubmitted for funding during the next "Unified Call" process.

The "Call" also provides the Laboratory with insight regarding future space and building requirements. All proposed projects are reviewed for space needs or building requirements. Space needs are more formally identified in periodic meetings with division heads. Each division has prepared a five-year

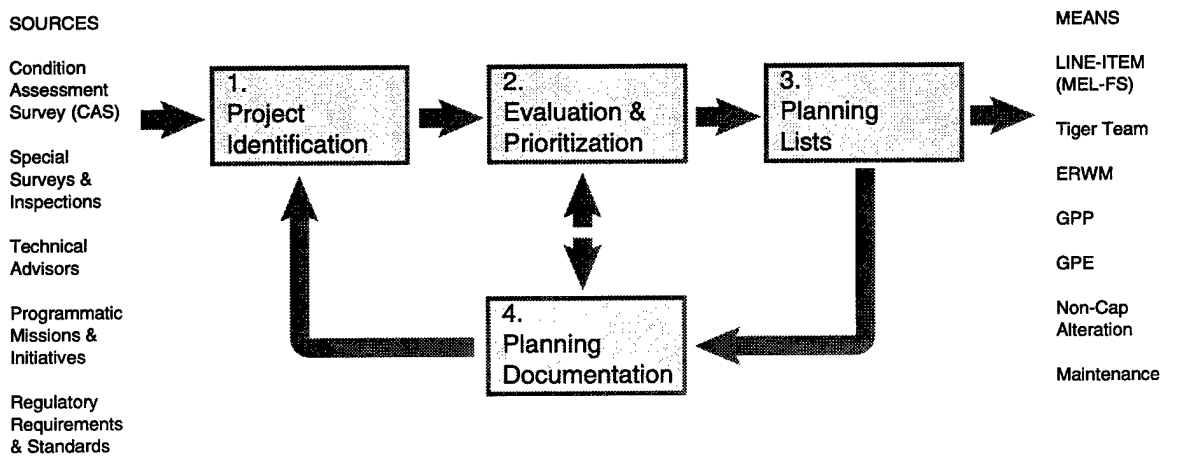


Figure 3-2. Project planning process.

space-needs plan. These plans have been consolidated by Facilities Planning into an overall Laboratory space needs and allocation plan. This information is reviewed when the Laboratory's planning documents (i.e., the Institutional Plan and the CFP) are updated.

STRATEGIC/INSTITUTIONAL PLAN

Strategic Planning

Berkeley Lab operates an ongoing strategic planning process to assess its programmatic and operating context, refine its mission and vision, and address specific issues and program objectives. The Laboratory has undertaken these activities while also working with other national laboratories to enhance a mutual R&D role in support of the nation's R&D and technological infrastructure. The outcome of these planning activities is incorporated in the Institutional Plan and CFP. More information regarding its strategic/institutional planning process may be found in the Institutional Plan.

Resource Projections

Resource projections for the next 5 years are found in the Institutional Plan.

SITE ASSESSMENT—EXISTING CONDITIONS

Background

Berkeley Lab's facility-related problems stem from the obsolete design of its oldest buildings, deteriorating utilities, and the changes in scientific needs since 1940. Many laboratories and shops were originally designed for temporary service during World War II. Figure 3-3 shows the age distribution of main-site buildings. In addition, some buildings constructed during 1940–1960 are not adequate for today's highly technological scientific demands.

Berkeley Lab has developed site assessment planning programs to identify building needs and to integrate facility maintenance and improvement projects. Berkeley Lab evaluates its projects using planning criteria and performs assessments of facilities.

The shop and support facilities that provide services such as environmental control (e.g., airborne particle concentrations) and utilities, must be appropriate to current research programs. An analysis of building conditions by type of space is presented in Figure 3-4.

As described in Chapter 4, the Laboratory has developed a rehabilitation and replacement program with a long-range schedule. Other projects include environmental and health projects, roadway safety improvements, and slope stabilization.

Multiprogram Energy Laboratory Facilities Support (MEL-FS)

The MEL-FS program is vital for rehabilitating the Laboratory's deteriorated utility system and for modernizing, upgrading, and replacing obsolete facilities. MEL-FS project priorities and schedule are prepared following careful planning and review by Laboratory management.

General Plant Projects (GPP)

The GPP program provides an essential and timely mechanism to fund priority projects; however, the amount of funds received have been inadequate to meet the Lab's needs. Progress in increasing GPP funds is important to the success of the Laboratory's rehabilitation program.

Utility Needs

Many of the Laboratory's utility systems have the capacity to fulfill present and future electrical, gas, water, cooling, and waste requirements. However, many segments and load centers in the utility systems are aged and require rehabilitation to improve flexibility and reliability. The utility systems that are undergoing rehabilitation include natural gas, potable water, cooling water, low-conductivity water, electrical power, sanitary sewers, compressed air, storm drains, standby electricity, and alarm and security.

The Berkeley Lab electrical distribution system must be able to cope with power interruptions while providing standby power to those Berkeley Lab

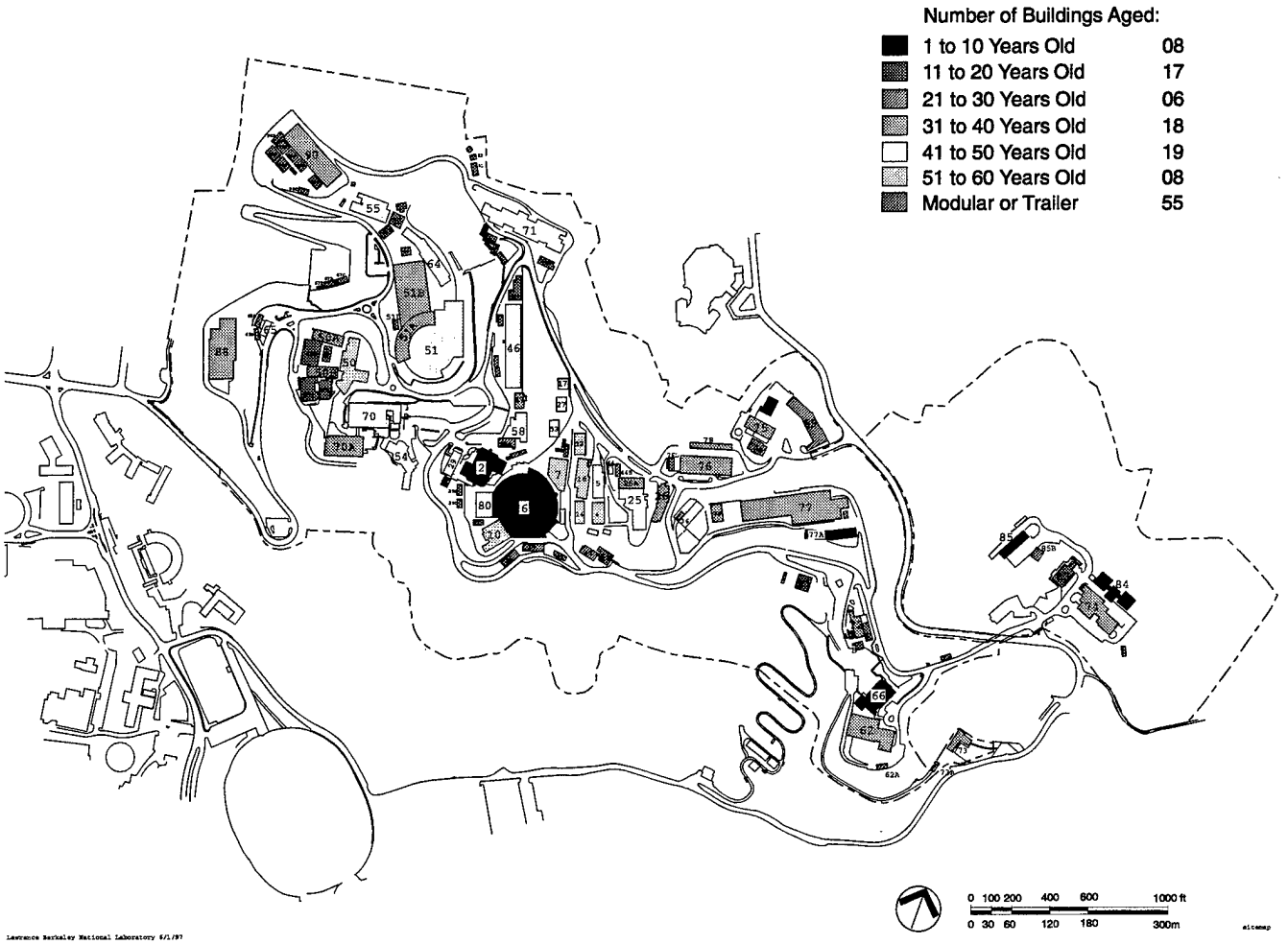


Figure 3-3. Age distribution of main site buildings.

facilities that cannot tolerate interruptions. The basic elements for a flexible and reliable Berkeley Lab distribution system exist already, and a cost-effective rehabilitation can be accomplished at a fraction of the existing system's replacement value.

The multiphase rehabilitation program of the 12-kV electrical power distribution system involves replacement of aging and hazardous switching equipment and distribution cables and is now entering its final phase with the proposed FY 1998 Line Item Project start.

Maintenance Needs

The Laboratory is formulating integrated plans for long-range capital improvements and operating expenditures.

The operating expenses for maintenance include physical plant maintenance and noncapital alterations related to maintenance. Maintenance can be effectively managed by establishing priorities for maintenance projects and by replacing obsolete and high maintenance-cost facilities with modern facilities and equipment. Laboratory management is directing

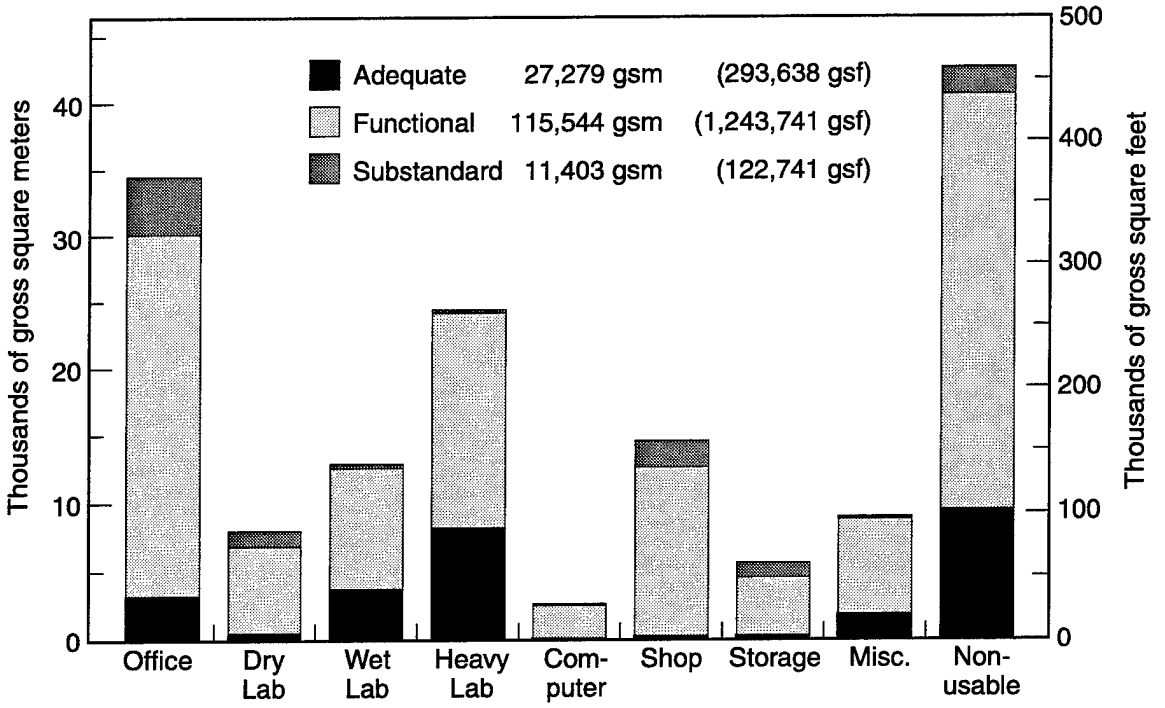


Figure 3-4. Use and condition of Laboratory space.

its efforts toward rehabilitation of buildings with MEL-FS funds. Increased DOE support would allow the maintenance and infrastructure backlogs to be effectively reduced within the next 10 years. The use of noncapital funds could then be efficiently allocated to maintain essential building and equipment investments.

SITE ASSESSMENT—FUTURE DEVELOPMENT

Planning is vital to the Laboratory's programs because of the need to use land efficiently, to replace obsolete facilities, and to plan for new construction within a realistic economic framework. In addition to program needs, land use decisions at Berkeley Lab involve consideration of a wide range of factors such as:

- Pedestrian and vehicular circulation
- Development scale and visibility
- Landscape context
- Social/recreational aspects
- Environmental factors
- Views
- Fire and erosion control
- Surface and ground water drainage
- Proximity to related activities
- Maintenance resources

Future Needs

Shortages of both laboratory and office space at Berkeley Lab are acute, impeding the progress of scientific research and adding significant operational costs for interim solutions to these shortages. Planning for improved operational efficiency and significant future growth of the Laboratory focuses on three functional planning areas:

- Redevelopment of the original laboratory site now known as the Central Research Area (Planning Area 2).
- Offices and support facilities for Berkeley Lab infrastructure primarily in the Grizzly Operations Support Area (Planning Area 3).
- Expansion in the Strawberry Research Area (Planning Area 4).

Planning Area 2. The Central Research Area presents great potential for significant growth through redevelopment. The site has a central location, good geotechnical qualities, and natural topography suited to building sites for high-technology facilities.

Most of Area 2's existing buildings are old, inefficient, one-story structures. Some vehicle and pedestrian routes in the Area are also substandard, being narrow, indirect, and, in several places, hazardous. Although utility systems and load centers have ample capacity, they are generally aged and inflexible. The pressing need to replace or rehabilitate much of the existing infrastructure in Planning Area 2, coupled with physical attributes and central location, makes the Area a prime candidate for redevelopment.

Planning Area 3. The Grizzly Operations Support Area provides inadequate support space for current EH&S and Facilities Department functions. Trailers and other temporary structures could be replaced with larger permanent structures to remedy this problem.

Planning Area 4. Consultant studies indicate that the Strawberry Research Area has potential for significant additional development. Expansion in biotechnology programs can be accommodated in this Area while also maintaining outdoor environmental quality and providing sufficient parking. Certain buildings in this Area are in need of upgrade and modernization. These have been prioritized and are listed in Chapter 5.

Development Considerations and Opportunities

Considerations. Most of Berkeley Lab's site has particular design sensitivities that limit development opportunities. The factors involved include topography, important views of the Bay, geology, hydrology, and valuable vegetation.

A recent study of potential development sites at Berkeley Lab mapped the constraints imposed by such environmental sensitivities. Utility "corridors" encompassing three or more utility lines are included as a constraint to future development because of the significant expense involved in rerouting. Where site constraints overlap, the difficulty of development increases. As no currently undeveloped area of the site is without constraints, planning for future growth must involve carefully evaluating development proposals in light of Berkeley Lab's site concepts, objectives, and guidelines.

Opportunities. A mapping of areas most suitable for development (Figure 3-5) illustrates a number of areas where development might best be undertaken consistent with the general planning guidelines. Existing development areas are least constrained, indicating that redevelopment of substandard buildings offers opportunity for Laboratory rehabilitation/renewal and growth. Several other areas also offer potential for development.

Needs and Site Capabilities

An analysis of the considerations and opportunities for future development and redevelopment of the Berkeley Lab site has focused long-range planning on site potential (or build-out) for comparison with long-range program needs. Sub portions of the site with potential for cost-effective development (or redevelopment) have been targeted for study in greater detail.

Comprehensive site use studies have been made to ensure the most efficient and most cost-effective use of available sites. In parallel, the Laboratory has studied the need for additional facilities beyond the 5-year institutional planning period on the basis of potential program initiatives.

Construction of all the projects represented in this plan would result in a net increase of approximately 37,600 gsm (405,000 gsf) of buildings in the main Laboratory site, for a total of 190,000 gsm (2,045,090 gsf). For comparison, the 1997 total is 156,850 gsm (1,688,363 gsf) (see Appendix C).

This increased need results from the increased development of programs in energy sciences, computing sciences, earth sciences, life sciences, materials science, and chemistry, that were not a part of the Laboratory's mission in the early 1960s.

In addition, the specialized research facilities and program expansion in the physical sciences and the life sciences, such as electron microscopy and molecular genetics, and the Advanced Light Source,

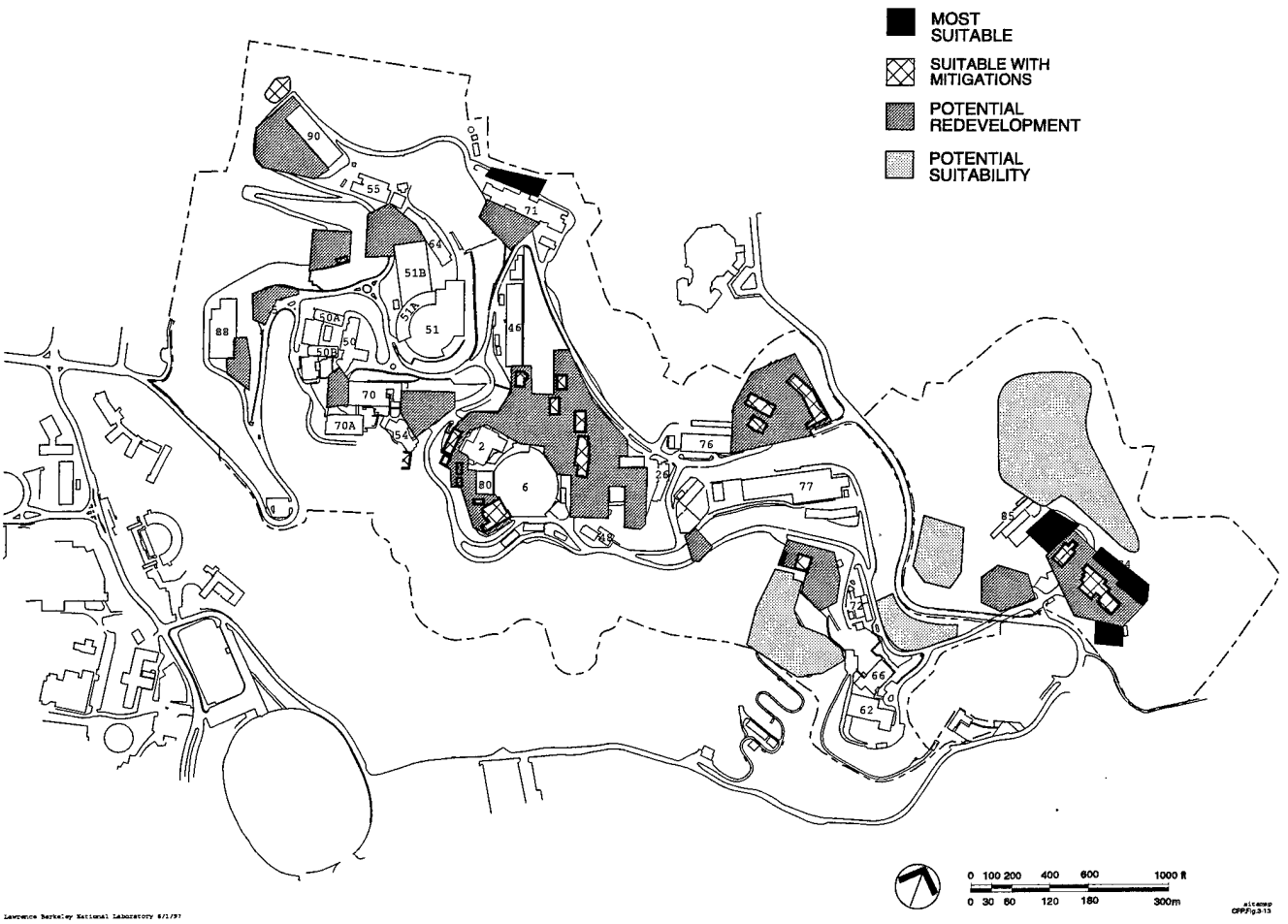


Figure 3-5. Development suitability.

were not anticipated in the 1960s and have required, or will require, new buildings or additions to existing buildings.

The CFP also emphasizes utility rehabilitation, improved parking and traffic circulation, and landscaping that unifies the site and provides compatibility with the surrounding hillside. The major site-development proposals are (1) improve infrastructure and space for support functions (2) redevelop the original Laboratory site to replace obsolete buildings and enhance the open space, (3) where growth is not best accommodated through redevelopment, use those sites with constraints that can be reasonably addressed in the design, and (4) eliminate the use of 60,000 gsf of trailers.

Conclusions

The environmental consequences of development have been studied, including cumulative effects related to traffic and parking. Because there is room for physical alternatives in the long term, care has been taken to establish and preserve areas adjacent to existing facilities to permit future development.

Solutions incorporated into the redevelopment plan are designed for mission-oriented functional relationships, but the plan also preserves a character appropriate to the hillside area. Proposed building sizes and locations for research initiatives yet unknown have been selected to enhance modular development and flexibility.

Site and facility requirements to carry out program goals and related multiprogram support activities have been developed in conceptual designs for individual projects. New construction, renovations, removals, corrections, and other means to fulfill projected program activities are translated into funding requirements.

Background studies and plans that have been carried out in support of this planning analysis are listed in Appendix A.

Berkeley Lab has a special ability to respond quickly and effectively to new national priorities in basic research and applied sciences. This ability is attributable not only to its multiprogram base, but also to its proximity and interactive relationship with the University of California at Berkeley. Major planning objectives for future development of the Berkeley Lab site are to rehabilitate and upgrade existing facilities if it is cost effective to do so, and to replace old, obsolete and maintenance-intensive facilities that can't be upgraded economically. Future development at Berkeley Lab is based on redevelopment of the older, Laboratory area constructed in the 1940s and the rehabilitation and upgrading of facilities constructed during the 1960s and 70s. In keeping with this plan, the availability of heavy laboratory buildings and related support systems that have housed the Bevalac accelerators will provide exceptional opportunities for very cost effective programmatic initiatives in the national interest.

ALTERNATIVES—DEVELOPMENT

To evaluate the potential of the site, the Laboratory has commissioned a number of site-use studies (Appendix A). These studies have been used to create a site development plan based on optimal functional relationships. Efficiency of operating and building capital resources to strengthen the Laboratory's ability to carry out the DOE responsibilities guide the development of the plan. The grouping of like functions, renovation, and replacement of obsolete or inadequate research facilities and infrastructure, and the improvement of circulation for people and materials among work areas, are cornerstones.

ALTERNATIVES—EVALUATION

Restrict Growth

The Laboratory considers the restriction of growth in selected areas to be a normal part of management and operation. As discussed under Planning Process in Chapter 2, the Laboratory carefully reviews proposed research activities to ensure that existing capabilities will support the proposed activities and that they are consistent with the Laboratory mission. This policy has resulted in moderate growth during most of the Laboratory's history. As space utilization rates increase to record levels, new work is closely scrutinized to ensure that it does not unduly burden the Laboratory's performance capabilities.

Satellite Locations

Off-site, or satellite, facilities for support functions and research programs are used when decentralized locations are appropriate. The warehousing and receiving support functions were moved in 1980 and continue to function very well in their off-site locations. Moving these functions to industrial areas near major freeways eliminated much of the Berkeley Lab heavy-truck traffic that had added to the traffic congestion of Berkeley streets. The Laboratory has leased 2,273 gsm (24,475 gsf) of office space in downtown Berkeley to house support functions beginning in the winter of 1989.

Berkeley Lab research programs also use off-site locations. The Joint Genome Institute maintains a production plant known as the Production Sequencing Facility, a unique DNA sequencing factory in Walnut Creek. The Engineering Division monitors particle decay in a low-cosmic-radiation-background environment at the Oroville Dam powerhouse. In addition, other research programs are located in short-term leased buildings when temporary space is required or when cost effective facilities are not available at the main site.

Berkeley Lab will continue to evaluate its needs for support services and for research facilities with respect to their appropriateness to the main site. Those needs that are characterized as being well suited to decentralization will be placed off-site when suitable space is available.

Intensify Use

To maximize the use of each building site, building massing has become increasingly important. Although low-rise development is less expensive, the land constraints that face Berkeley Lab require that multistory buildings be constructed (including possible multistory parking structures).

In addition, the plan calls for removal of most of the temporary structures built in the 1940s and all of the trailers. This will provide many of the building sites. Details of this reuse are in Chapters 4 and 5.

ACCOMMODATION FOR CHANGES IN DIRECTION

The planning concepts and guidelines presented in this plan result in a functional-area arrangement that ensures that planning practices are exercised while allowing flexibility of use. Improvements to infrastructure (mechanical and electrical utilities, communications, traffic circulation, and support services) allow for multiple uses over the long term. This arrangement and the appropriate use of satellite and temporary space form the basis for accommodating changes in direction. Berkeley Lab has responded quickly and efficiently to changes in national research directions in the past and will continue to do so in the future, if necessary. Planning guidelines and concepts include specialized research facility zones in proximity to major research facilities. Berkeley Lab does not rely solely on any one of the broadly based alternatives described above. Rather, its response to decisions on development and redevelopment involves the judicious use of an appropriate mix of alternatives. Satellite locations are used for certain support functions because they need not be close to scientific, technical, and research staff. Consolidation of other support services, such as Environmental Health and Safety and maintenance and repair units on the main site, makes immediately available the skilled personnel required to support and safeguard research programs.

4. TWENTY-YEAR MASTER PLAN

CONTENTS

FUTURE LAND USE

Although plans call for the volume of building to increase, future building footprints will be more compact and designed in accordance with landscape plans. Therefore, although the total amount of open space will decrease, the sizes of landscape areas between buildings will increase, making the Laboratory more attractive to the research community and the community at large.

Buildings are utilized with approximately 70% net efficiency. The building utilization efficiency is not projected to change significantly, although the efficiency of land use is expected to improve by replacing obsolete single- and two-story buildings with three- to five-story structures, and construction of smaller structures and additions adjacent to current buildings. Figures 4-1a, b, and c illustrate potential building sites for a range of funding scenarios. In addition, a number of older buildings are candidates for demolition. Their sites would be redesigned for new construction.

LANDSCAPE PLAN

Berkeley Lab has recently completed the initial phases of a Landscape Plan that provides a comprehensive framework to guide future land use decisions. The Plan includes concepts and recommendations for a variety of site functions including vehicular and pedestrian circulation, parking, outdoor use areas, and vegetation management (Figure 4-2).

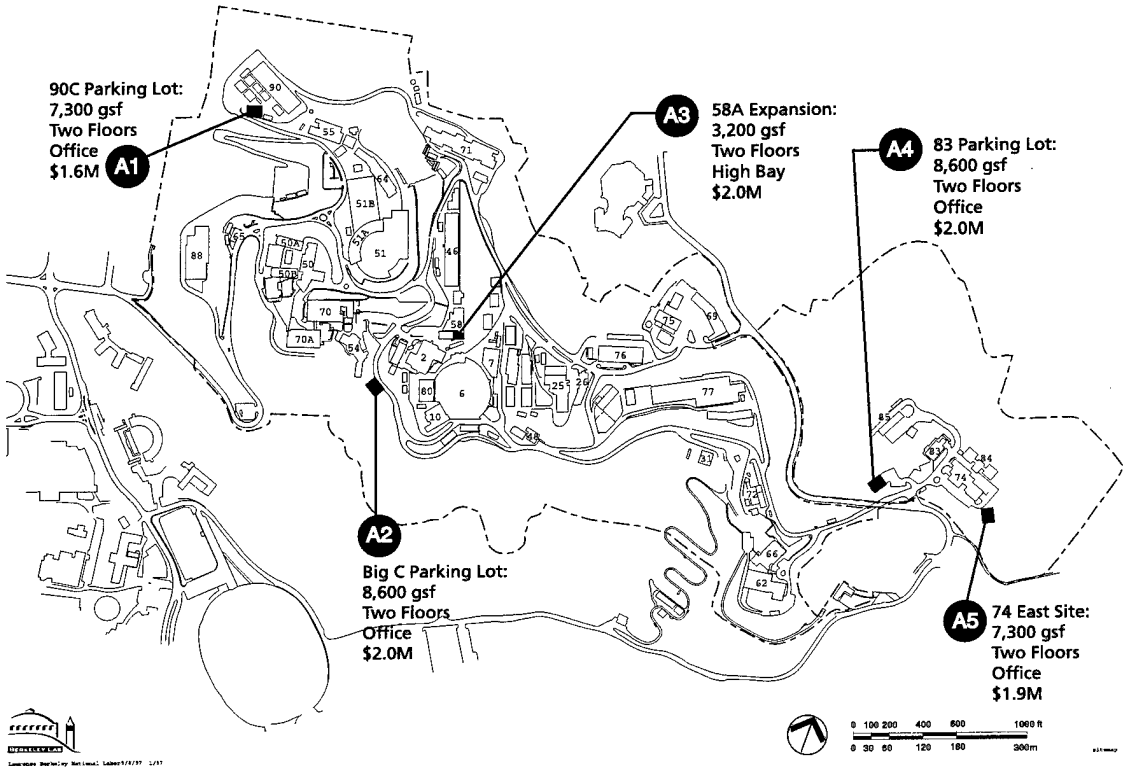


Figure 4-1a. Illustrative potential building sites ($2M).

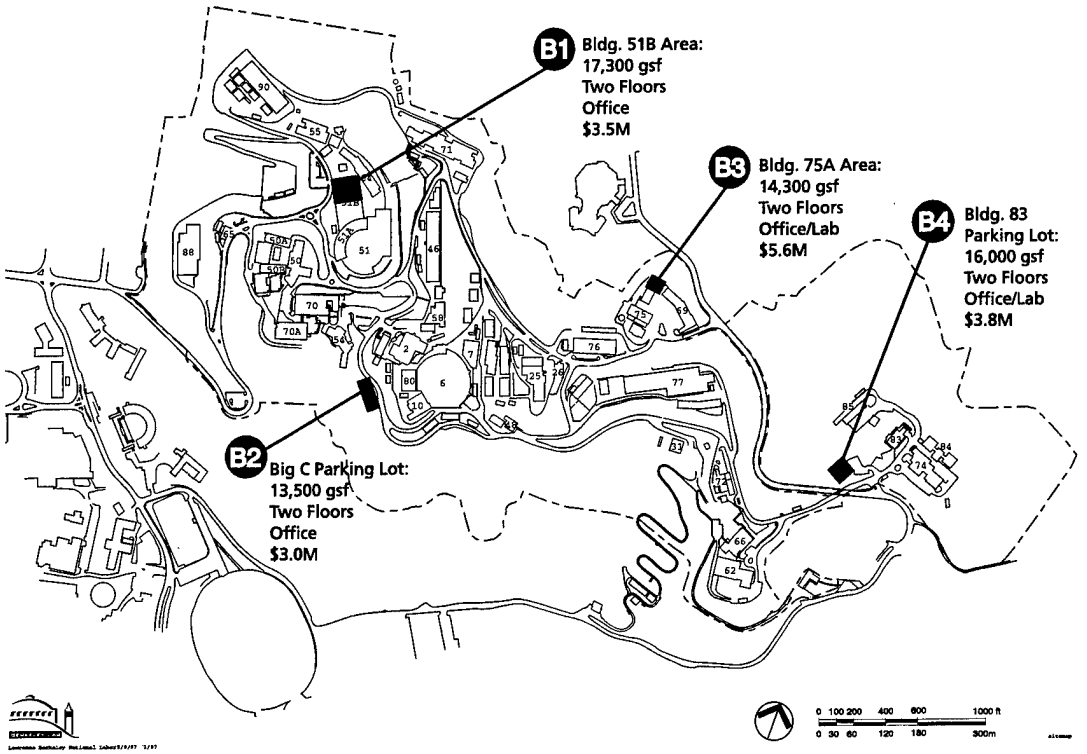


Figure 4-1b. Illustrative potential building sites ($5M).

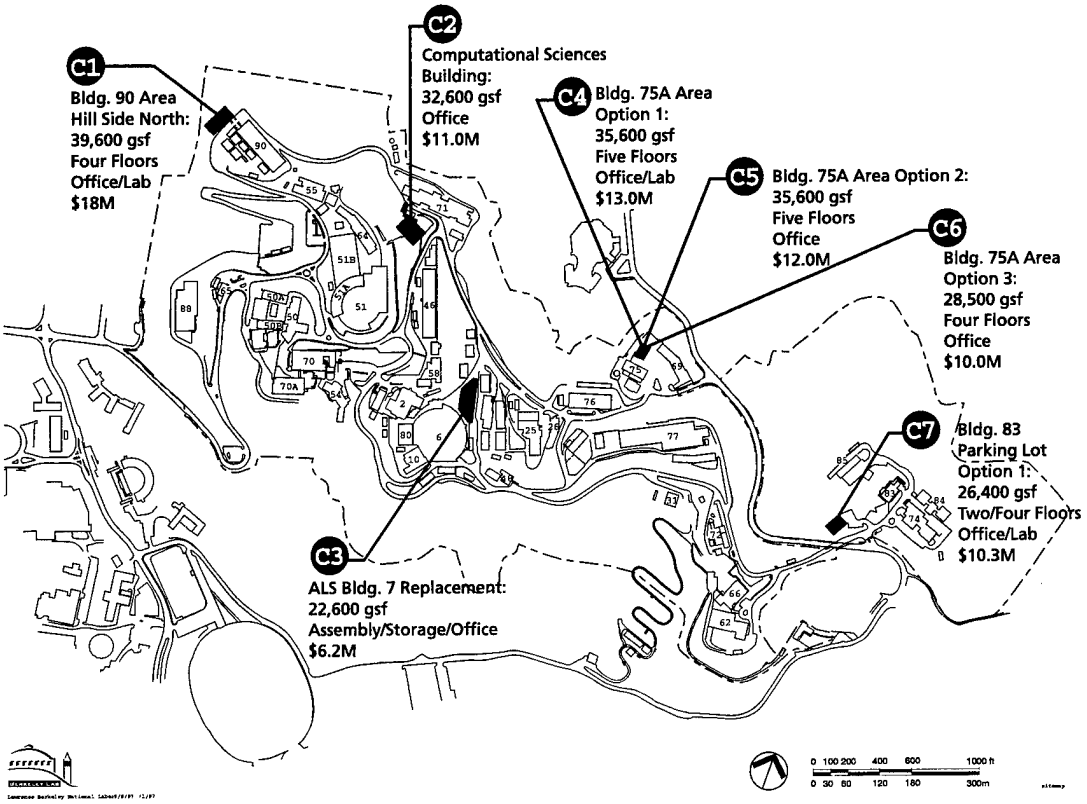


Figure 4-1c. Illustrative potential building sites ($6–15M).

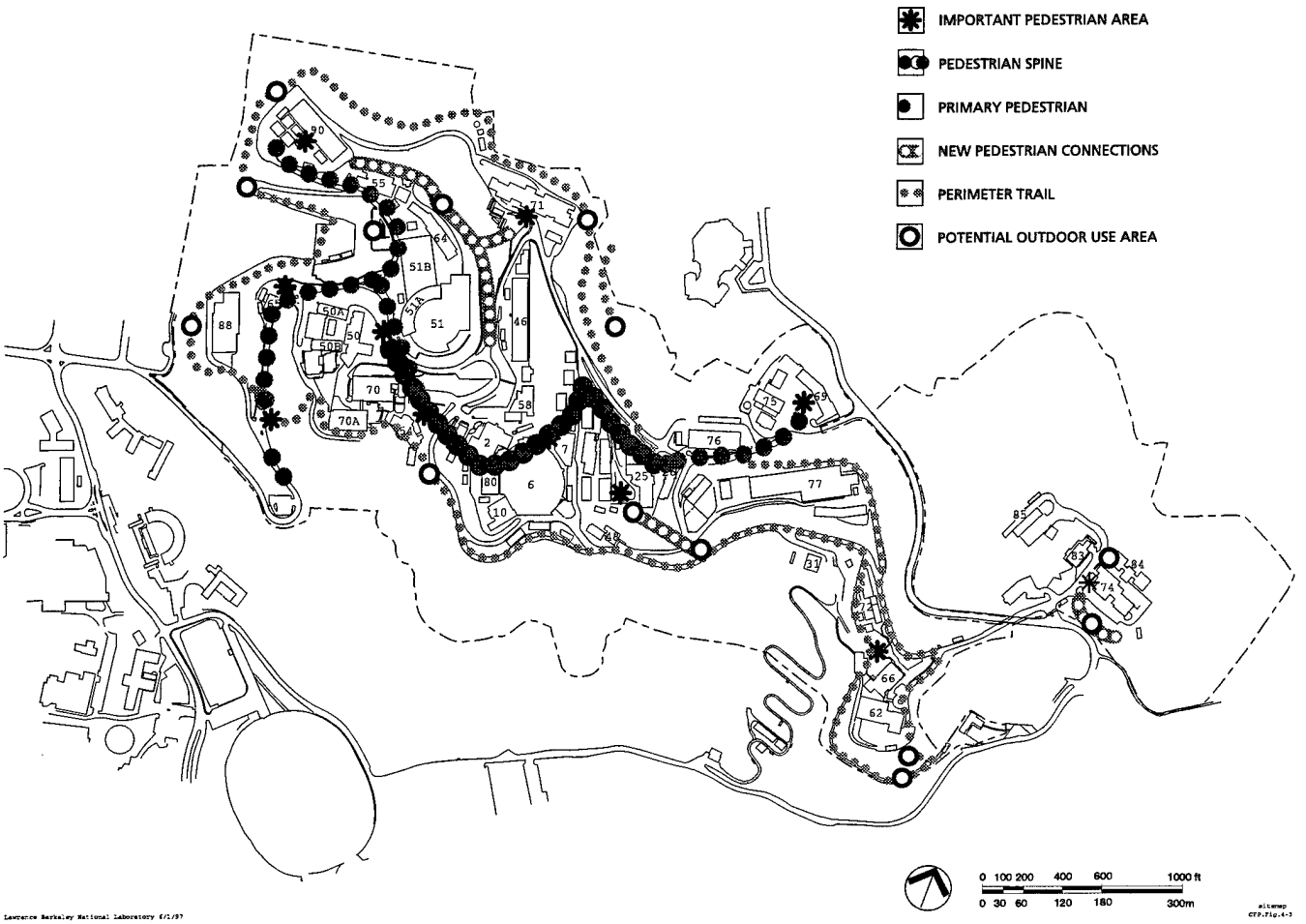


Figure 4-2. Landscape plan.

Circulation

The site circulation concepts address roadway (bicycle, shuttle bus, and automobile) safety and efficiency as well as pedestrian circulation needs. Recommendations in the Landscape Plan include:

- Development of a two-way primary road system, eliminating existing one-way sections and choke points
- Development of a comprehensive signage system that supports way-finding
- Creation of a central pedestrian spine linking the site's major destinations and population centers, along with spurs to all buildings and the major pedestrian gates
- Completion of important secondary pedestrian linkages and a perimeter walk/trail

Parking

Solutions to Berkeley Lab's parking needs incorporate a multi-pronged approach involving the shuttlebus system, bicycle accommodations, pedestrian trails, transportation management programs, flexible work hours, changes to the parking permit system, and additional parking capacity. Provision of new parking is necessary to alleviate existing insufficiencies and to allow growth of the Laboratory. However, there is no suitable land available for expansion of surface parking, and conditions will worsen if existing lots are displaced by future building development. To provide flexibility in resolving this difficult issue, the Landscape Plan proposes options which can be implemented incrementally.

District Parking. This approach would provide a number of one to three level parking structures dispersed throughout the Laboratory site according to

planning area needs. The structures may be freestanding or could occur as lower levels of new buildings. Surface parking would remain where feasible and not in conflict with circulation or building development needs.

Peripheral Parking. This approach develops new parking structures only at or near site entrances. Such locations will reduce through-site trips and traffic congestion, and require increased shuttle service and pedestrian path improvements.

Parking Policies and Transportation Management. Berkeley Lab will continue to monitor and refine parking policies and transportation management programs. The Laboratory encourages and facilitates use of the shuttle and public transit linkages, carpooling, vanpooling, and bicycles.

Outdoor Use Areas

The Landscape Plan emphasizes the value of outdoor use areas that create an image and sense of campus as well as provide amenities for employees and visitors. Outdoor places are an important element of a mature and comprehensive campus, contributing valuable and necessary environmental relief from the workplace. They also can offer alternative space for meetings, gatherings, and lunch in good weather. Specific recommendations include:

- Creation of a central, landscaped pedestrian corridor or spine as the heart of the Laboratory site and linking major site destinations
- Development/improvement of secondary outdoor areas for social and recreational uses in each planning area, with attention to favorable microclimatic conditions
- Provision of quality spaces at major building entrances
- Development/improvement of pedestrian linkages to outdoor use areas

It is expected that implementation of these proposals will occur incrementally in association with site maintenance and adjacent new construction.

Vegetation Management

The Laboratory's vegetation is managed consistent with the goals and direction expressed in the *Maintenance Plan for a Sustainable and Fire-Safe Landscape*. A major safety concern is the seasonal high risk of fire, particularly in areas where large groves of eucalyptus and Monterey pine trees or French Broom bushes predominate. Berkeley Lab has developed a program to address vegetation/fire management needs and requirements. Existing trees are being managed for fire hazard by judicious pruning to avoid building contact or overhang and to prevent "laddering" of fire into canopies. Other initial priority measures have been completed, and a vegetation maintenance program will be formulated for the less-developed areas of the site. A revegetation plan is now under preparation. It will incorporate selective replacement of more flammable species and the use of "mosaic" fire breaks.

A comprehensive vegetation plan to ensure long term continuity of Berkeley Lab's landscape values will include a thoughtful reforestation program. Replacement trees should be selected for important characteristics such as height, long life, and fire resistance, and located with future growth in mind.

Many of the Laboratory's tree stands are single-age groups planted more than 50 years ago. Reforestation plans will encompass selective removal and replacement needs as the trees begin to decline. In addition, because of the long lead time involved in attaining tree growth, the forestation needs of future building sites will be incorporated into the plan.

FUNCTIONAL PLANNING AREAS

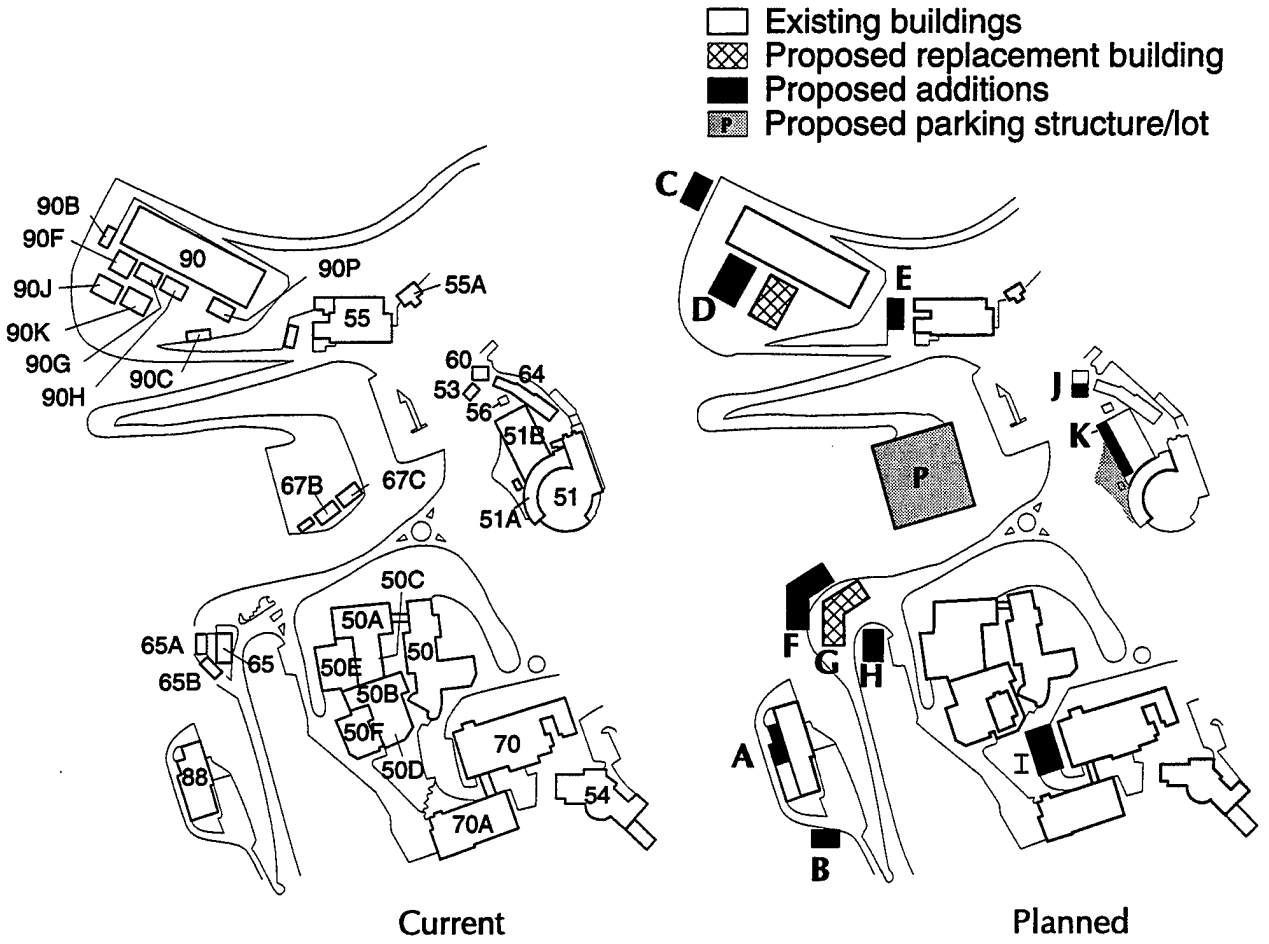
The following section describes the plan changes anticipated for the Laboratory's five functional planning areas. Simplified site plans for the five functional planning areas show the current and planned uses for each area, possible new parking structures, and important outdoor areas. An accompanying Table shows the associated potential increases in gross square meters (footage) and summarizes such changes for each area.

Area 1—Blackberry Research Area

Planning Area 1 has significantly changed since the last Comprehensive Facilities Plan was prepared. Area 1 now includes the area and buildings of two previous Planning Areas—the former 88-inch Cyclotron Area and the former Central Research and Administration Area. These two areas were merged in recognition of their geographic associations and to eliminate the small 88-inch Cyclotron Planning Area that consisted of only one primary building. The new Blackberry Research area now comprises all portions of the Laboratory that are within the mid and lower elevations of the Blackberry Canyon watershed. (The buildings in the upper portion of this watershed are included within Functional Planning Area 2, due to their elevational associations with the balance of the buildings and functions of the Central Research Area.) Planning Area 1 currently includes buildings totaling 68,709 gsm (739,598 gsf). This area houses the Berkeley Lab Director's Offices and the main offices for Computing Sciences, Environmental Energy Technologies, Earth Sciences, Nuclear Sciences, and Physics, Blackberry Canyon divides the area topographically into two components at similar elevations, the Building 50–70 complex and the Building 90 complex. The majority of Berkeley Lab's light laboratories and support offices, as well as the cafeteria and reception center, are included within these complexes. Area 1 includes the 88-Inch Cyclotron at a lower elevation immediately below the Building 50 complex. Area 1 also includes the former Bevatron, Building 51. There is a potential for further adaptive reuse of the Building 51 complex, and a roof-top addition at Building 88, as well as a number of sites suitable for building additions and new structures in this functional planning area. The existing parking lot in Blackberry Canyon is also a proposed site for a future parking structure.

Category/Project	Area (gsf)
Existing Buildings	739,598
Additions/Replacements:	168,700
A Future 2nd Fl. Addition	
B Future Building Site	
C Future Building Site	
D Future Building SIte	
E Future Building Addition	
F Future Reception Center	
G Future Building Replacement	
H Future Building Site	
I Future Conference Center	
J Future Building Replacement	
K Future Building site	
Net Total	**908,298**

Note: Area plans are for general estimating purposes only.



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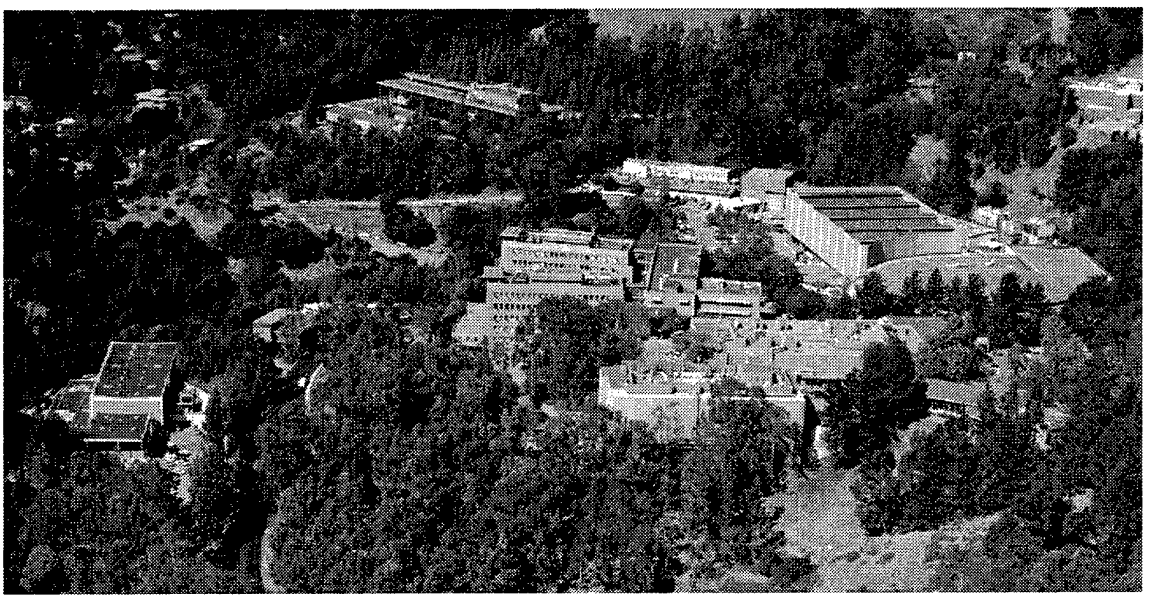


Area 1 – Blackberry Research Area

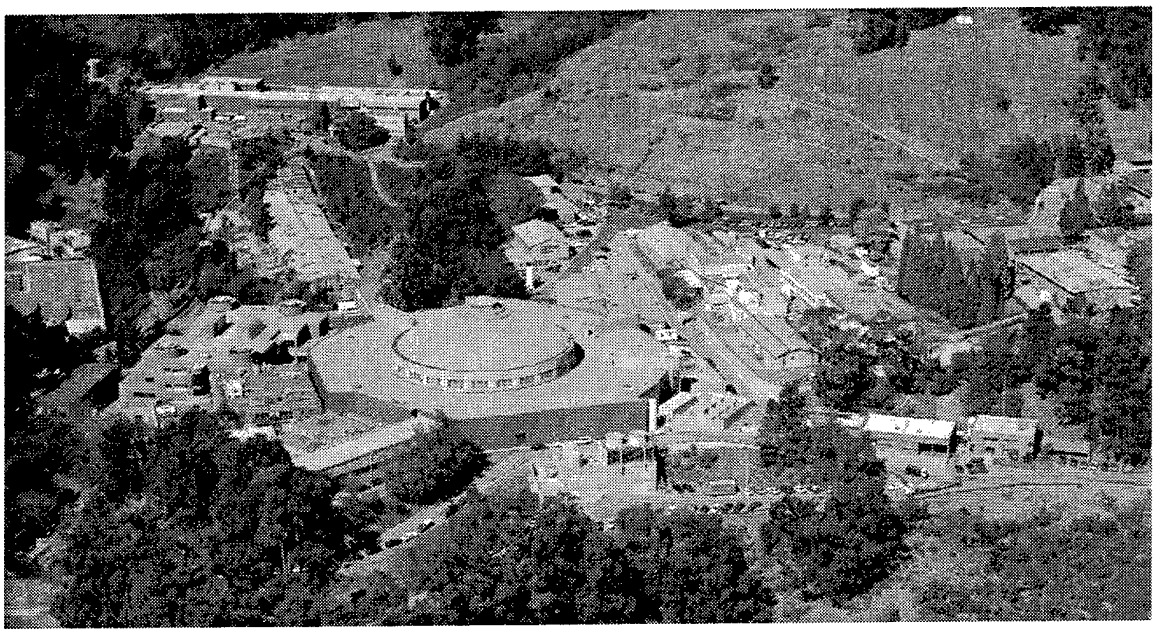
Area 2—Central Research and Administration Area

Currently, the Central Research Area has a total of 53,898 gsm (580,170 gsf) in building space. This area is the original laboratory site and location of the original 184-Inch Cyclotron (Building 6). The building is a landmark remodeled to house the ALS. A special research facility zone has been established around the perimeter of the ALS to reserve areas for programs requiring the use of the ALS photon beams. Many of the remaining buildings within this planning area were built in the 1940's and are obsolete; however, the high demand for space requires that they continue to be used pending replacement. Current plans call for the removal and replacement of several World War II vintage buildings, including Buildings 29, 25, 16, 14, and 7. These replacements will provide further support for the ALS and allow for the consolidation of current research initiatives.

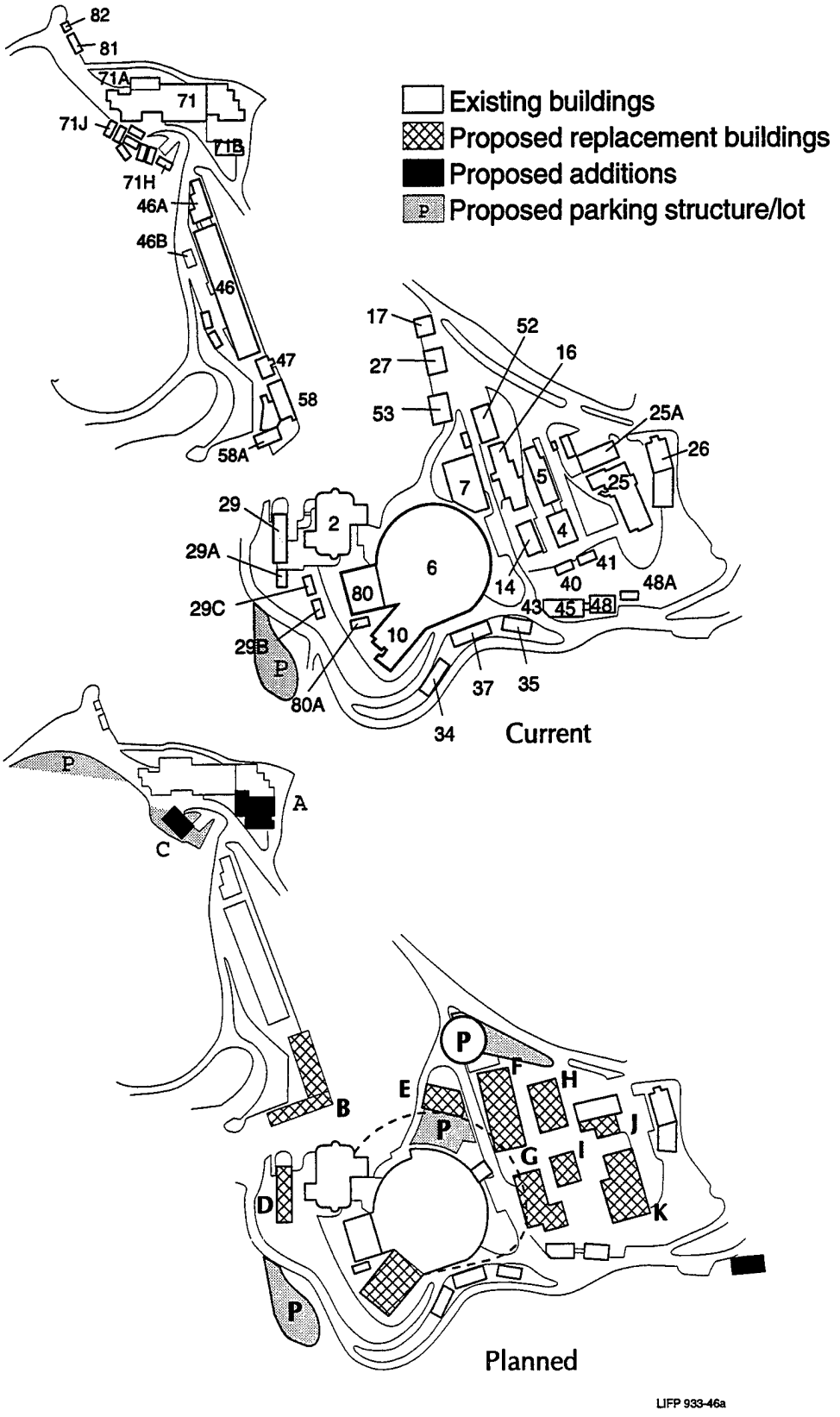
An important consideration in determining new building siting in the area is an existing grove of redwoods that stands west of Building 25. These trees should be preserved as an important artifact of early Laboratory development and included as part of a central outdoor space. Also important is the preservation of views to the Building 6 dome, particularly where this landmark is visible from adjacent urbanized areas.

Category/Project	Area (gsf)
Existing Buildings	580,170
Additions/Replacements:	321,900
A Future Building Addition	
B Future Building Addition	
C Future Building Site	
D Future Building Replacement	
E Future Building Replacement	
F Future Building Replacement	
G Future Building Replacement	
H Future Building Replacement	
I Future Building Replacement	
J Future Building Replacement	
K Future Building Replacement	
Planned Removals	135,200
Net Total	**766,870**

Note: Area plans are for general estimating purposes only.



Area 2 – Central Research and Administration Area



Area 2 – Central Research and Administration Area

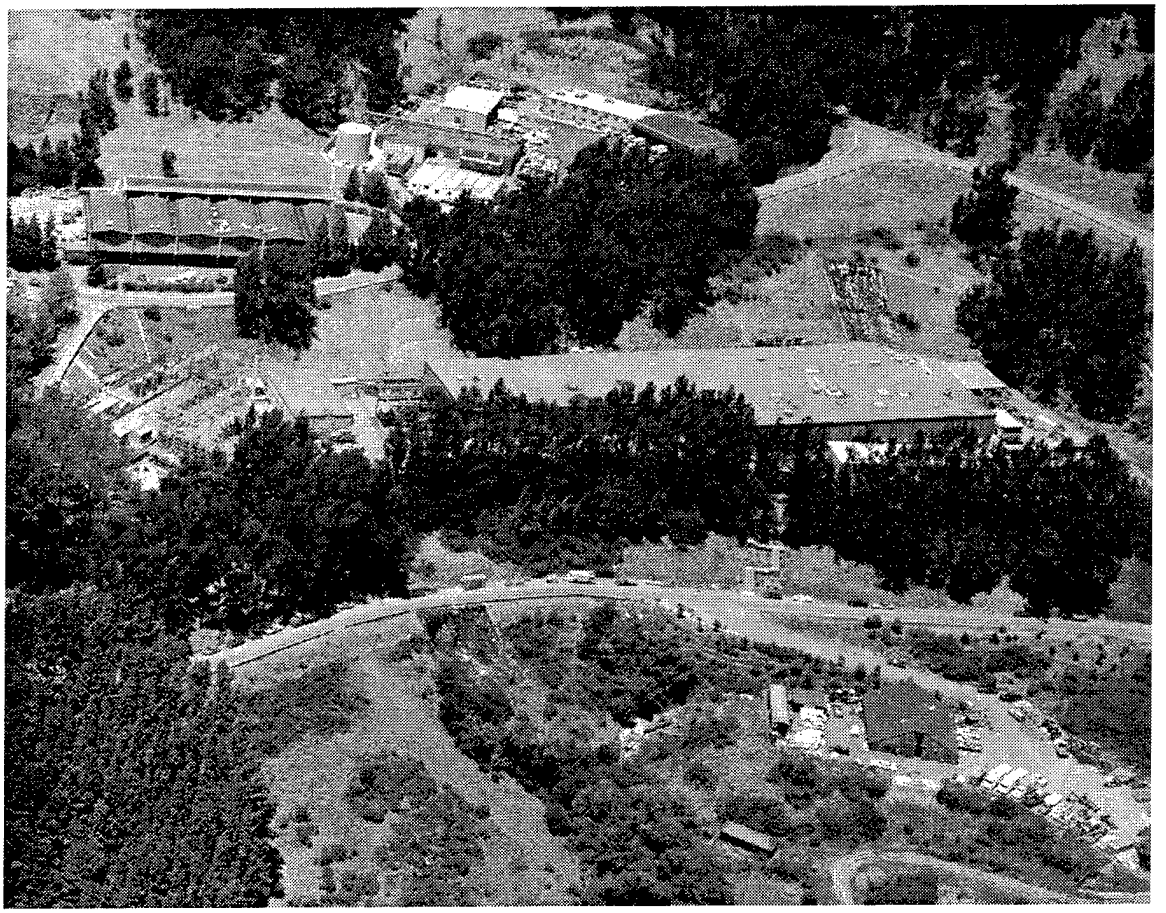
Area 3—Grizzly Operations Support Area

Planning Area 3 currently includes 15,979 gsm (172,005 gsf) of building space in an area adjacent to the Laboratory's Grizzly Gate entrance. Uses currently include Craft, Construction, and Maintenance Shops, Supply Shops, Supply Services, Transportation and Motor Pool, Mechanical Shops, the Environment, Health and Safety Division, and the National Tritium Labeling Facility.

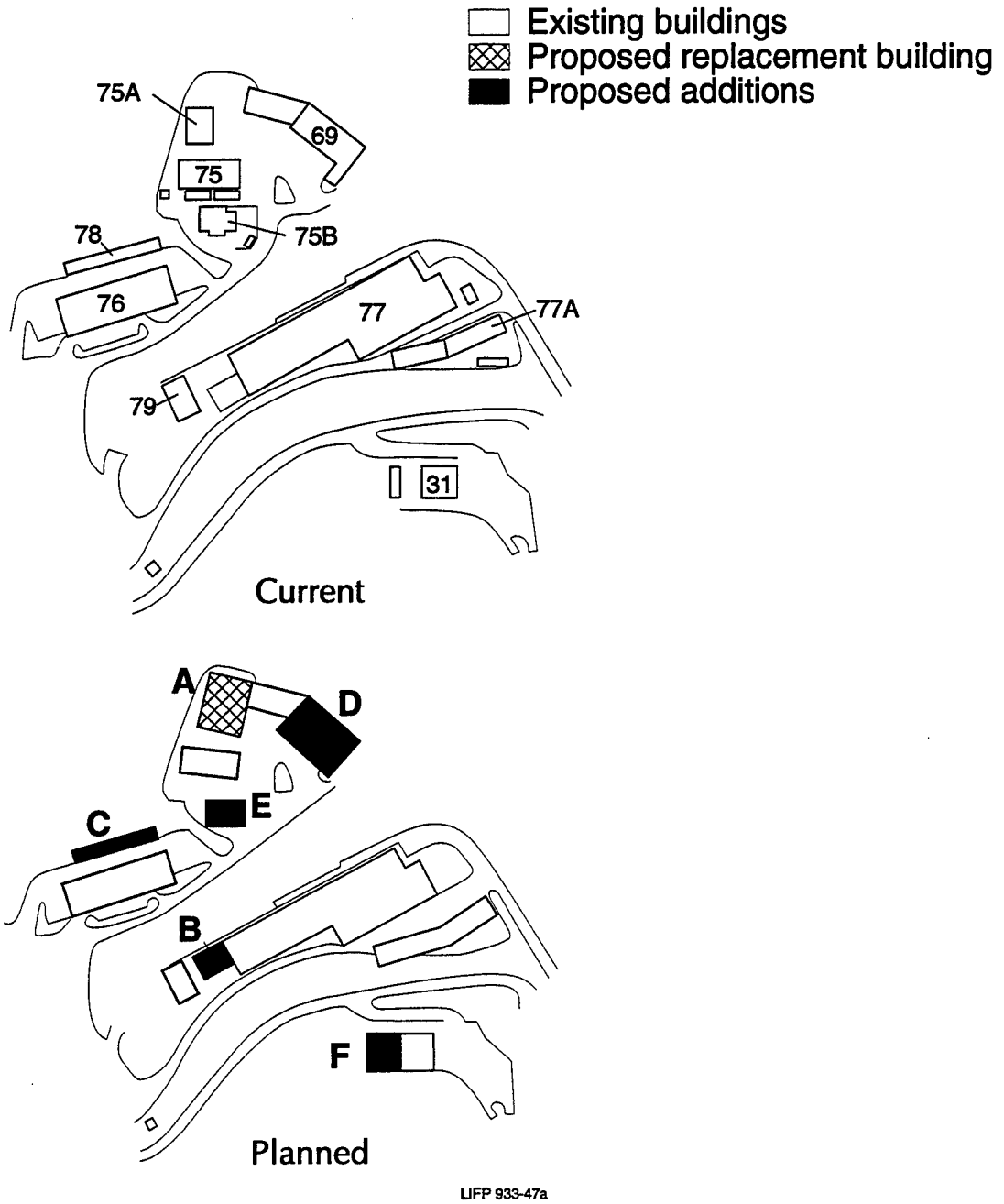
Consolidation of support facilities will continue. New building development must take account of public visibility from Centennial Road.

Category/Project	Area (gsf)
Existing Buildings	172,005
Additions/Replacements:	123,300
A Future Building Addition	
B Future Building Addition	
C Future Building Replacement	
D Future Building Replacement	
E Future Replacement Building	
F Future Building Addition	
Planned Removals	14,500
Net Total	**280,805**

Note: Area plans are for general estimating purposes only



Area 3 – Grizzly Operations support Area



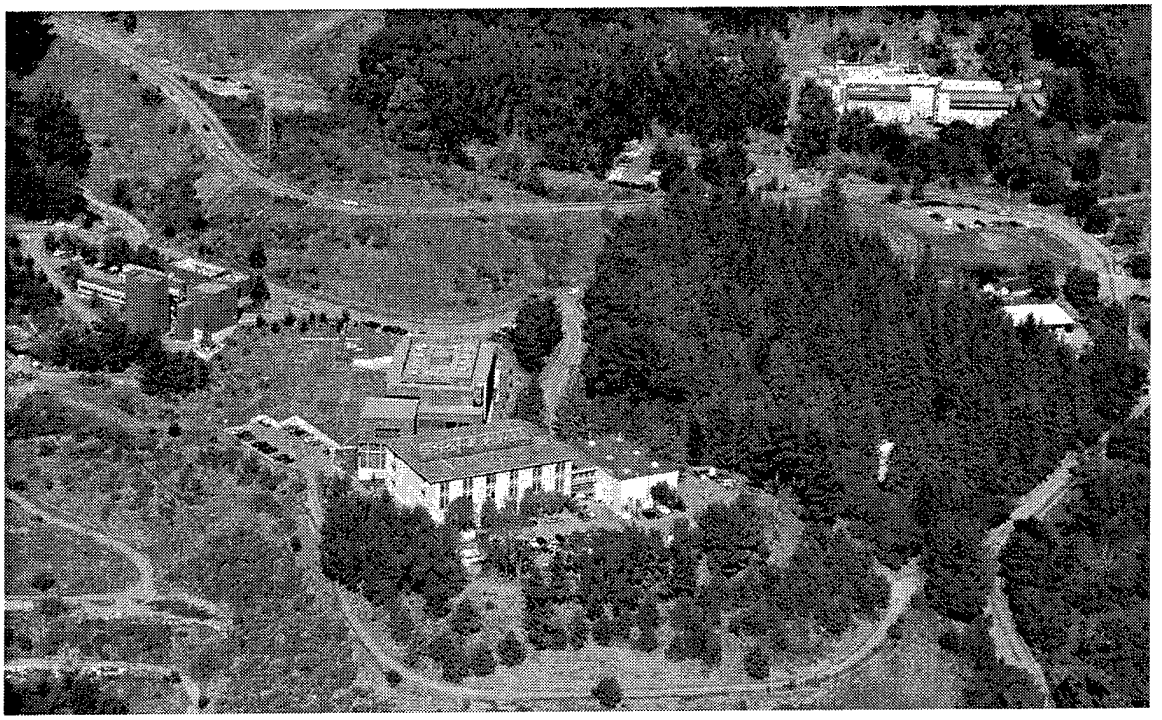
Area 3 – Grizzly Operations Support Area

Area 4—Strawberry Research Area

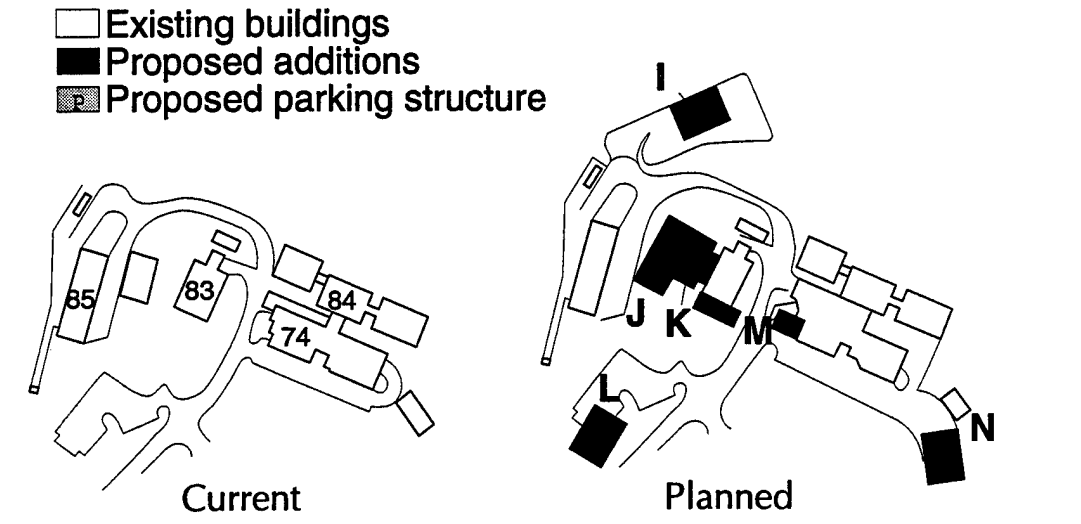
Planning Area 4 includes the Human Genome Laboratory, Materials and Molecular Research Laboratory, the National Center for Electron Microscopy, the Surface Science and Catalysis Laboratory, Cell and Molecular Biology Laboratory, the Laboratory for Cell Biology, and the new Hazardous Waste Handling Facility. Current building area totals 156,850 gsm (1,688,363 gsf). Plans include upgrades to the National Center for Electron Microscopy and the need for additional office and laboratory space in this area. Development in the Building 62 area must take into account the visibility of this area from campus locations, including Strawberry Canyon below. Several "people places" and possible parking structure locations have also been identified in this area. Moreover, there is an effort to further expand the Laboratory's pathway system in this area so as to better integrate it with the balance of the network, and to serve a larger portion of this area. The paths serve both transportation and recreational purposes in this area. Screening of development from public visibility along Centennial Road and retention of an existing grove of native oak have been identified as important objectives.

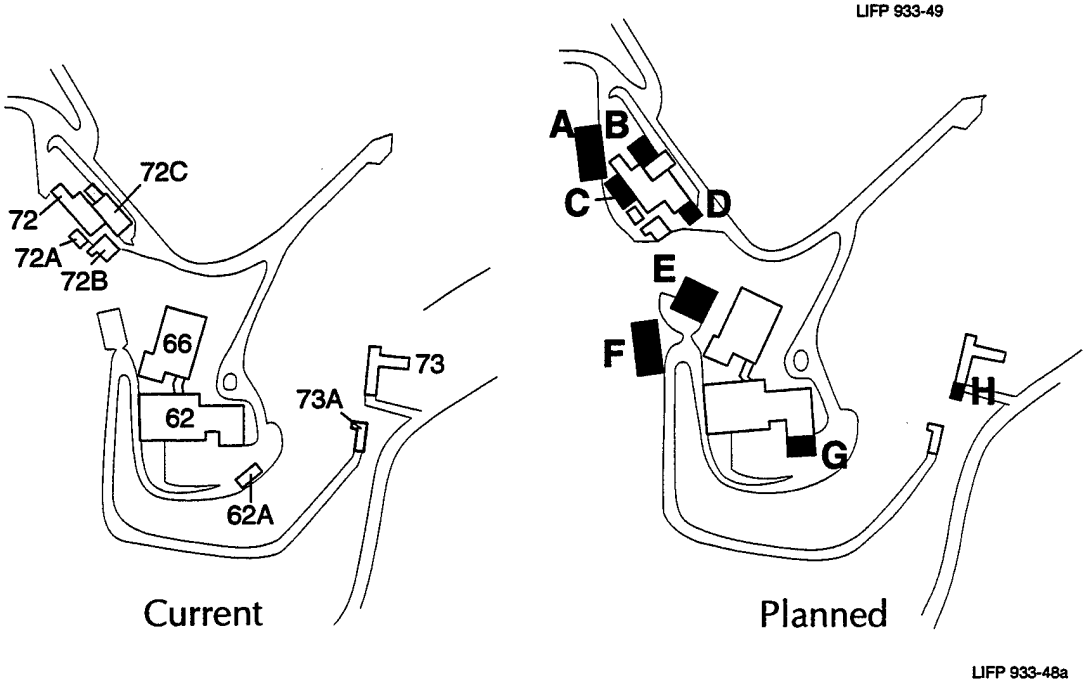
Category/Project	Area (gsf)
Existing Buildings	1,688,363
Additions/Replacements:	476,700
A Future Building Site	
B Future Building Addition	
C Future Building Addition	
D Future Building Addition	
E Future Building Site	
F Future Building Site	
G Future Building Addition	
H Future Building Addition	
I Future Building Site	
J Future Building Addition	
K Future Building Addition	
L Future Building Site	
M Future Building Addition	
N Future Building Site	
Planned Removals	1,900
Net Total	**2,161,163**

Note: Area plans are for general estimating purposes only.



Area 4 – Strawberry Research Area





Area 4 – Strawberry Research Area

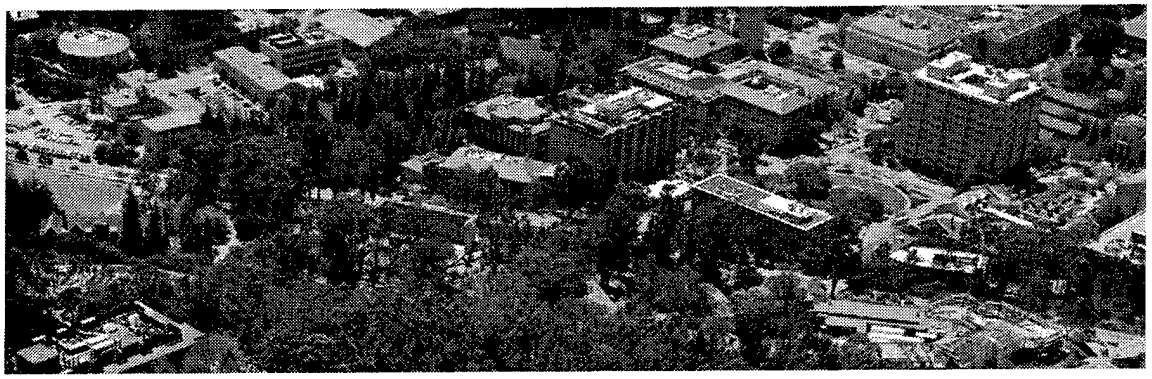
Area 5—Campus Research Area

Planning Area 5 includes two Laboratory buildings, Donner Laboratory and Calvin Laboratory, with a total 17,995 gsm (193,698 gsf). Donner Laboratory is an original Laboratory building and has been dedicated to life sciences research for over 40-years. Calvin Laboratory was constructed to consolidate and build upon the structural biology work of Laboratory Nobelist Melvin Calvin and continues to serve in this capacity.

There are no current plans to expand these buildings, which serve structural biology and life sciences laboratories.

Category/Project	Area (gsf)
Existing Buildings	193,698
Additions/Replacements:	0
Planned Removals	0
Net Total	**193,698**

Note: Area plans are for general estimating purposes only.



Area 5 – Campus Research Area

5. FIVE-YEAR PLAN

CONTENTS

PLANNING ASSUMPTIONS AND RATIONALE

The Master Plan described in Chapter 4 provides the institutional and strategic planning framework for making informed decisions for the long term. Chapter 5 describes near-term facilities needs based on current assessment of requirements. Resources, and the resulting patterns of construction and development dependent on these resources, may vary from year to year, and priorities are adjusted accordingly. Specific construction projects, improvements, and demolitions and removals are described below.

Site and facilities planning for the 5-year period is based on the Ernest Orlando Lawrence Berkeley National Laboratory Institutional Plan. Projects are derived from the Laboratory's response to DOE's national program plans and represent either important new facilities or the rebuilding of existing infrastructure to accommodate research and support activities.

To address critical needs, the Laboratory analyzes projects identified by both research and support staff as having environmental, health, and safety implications and/or as having the potential to interrupt research programs. The current funds from all sources are inadequate to fill all of the identified needs within a single fiscal year or even within the five-year planning period. Priorities are reviewed by the Project Coordination Committee and confirmed by the Director's Action Committee and coordinated with the DOE Oakland Operations Office.

The Five-Year Plan is based primarily on capital funding from programmatic, MEL-FS, GPP, and GPE sources. A detailed analysis of needs has been completed by Laboratory staff for each of these funding categories. Needs for GPE and GPP far exceed the expected funding. MEL-FS needs and funding resources have similar disparities. To maximize the strategic investment in plant and equipment, the Laboratory's MEL-FS and GPE needs have been categorized and prioritized.

FIVE-YEAR PROGRAMMATIC AND MEL-FS PLANS

Table 5-1 lists the capital funding profiles for individual projects through 2002. Figure 5-1 shows the proposed changes to the site for this period. Actual project starts are subject to funding constraints and subsequent changes in priority. The Five-Year Plan is in concert with the Master Plan in that incremental additions, replacements, or improvements are all tested for conformance to the established Site Planning Concepts and Guidelines.

Sitewide Programmatic Project

ALS Roadmap. The Advanced Light Source (ALS) provides the world's brightest light in the soft x-ray and vacuum-ultraviolet range of the spectrum. This national users' facility is used for basic and industry research and development across a broad spectrum of the physical, chemical, life, and environmental sciences, as well as in such technological areas as materials analysis, microstructure fabrication, and macromolecular crystallography. To ensure full utilization of this synchrotron-radiation source, the Laboratory has developed a roadmap that will address emerging needs of users from industry, academia, and government laboratories. The ALS Roadmap provides for installation of the full complement of insertion devices (undulators and wigglers) in the ALS storage ring, full instrumentation of the insertion-device beamlines, and a substantial number of front ends for high performance but cost effective application-specific bend-magnet beamlines to be developed by the user community. The intent is to arrive at a complete facility that can serve a wide community over a broad spectral range, and do it in a balanced way.

Sitewide MEL-FS Projects

Electrical Systems Rehabilitation, Phase IV—Blackberry Switching Station Replacement. The fourth and final phase in the upgrade of the Berkeley Lab electrical power system, the project will replace the 12-kV Blackberry Canyon service area power system, using circuit breakers provided in the FY 1987 improvements to the Grizzly Peak main substation, and correct deficiencies in the Blackberry Canyon service area power distribution system. It will also replace electrical equipment that is old, unreliable, inadequately rated, difficult to maintain and unsafe to operate, allow the retirement of the obsolete Big C switching station, and result in improved operational flexibility, reliability, maintainability, and safety.

Table 5.1. Major Construction Projects, Berkeley Lab , FY 1997 – FY 2003.

Plan for programmatic and general purpose facilities, including funded, budgeted, and proposed construction (FY BA, $M)

Project	TEC	Prior†	1997	1998	1999	2000	2001	2002	2003
FUNDED PROGRAM-RELATED PROJECTS:									
Human Genome Laboratory (KP) 3,809 gsm (41,000 gsf)	24.7	23.6	1.1						
SUBTOTAL - FUNDED PROGRAM RELATED	**24.7**	**23.6**	**1.1**						
FUNDED MEL-FS PROJECTS (KG):									
Sanitary Sewer Restoration, Phase 1 1,036 m (3,400 ft)	2.4	2.4							
SUBTOTAL - FUNDED MEL-FS PROJECTS	**2.4**	**2.4**							
TOTAL FUNDED	**27.1**	**26.0**	**1.1**						

Project	TEC	1997	1998	1999	2000	2001	2002	2003
PROPOSED PROGRAM-RELATED PROJECTS:								
ALS Roadmap (KC) 1,877 gsm (20,200 gsf)	39.5			9.2	16.5	9.2	4.6	
TOTAL - PROPOSED PROGRAM RELATED	**39.5**			**9.2**	**16.5**	**9.2**	**4.6**	
PROPOSED MEL-FS PROJECTS:								
Elect. System Rehab, Ph. IV	6.5		2.4	4.1				
Rehab Struct. Support and Operating Sys. - B 77	8.0			1.0	6.3	0.7		
Rehab Building Operating Systems - B 74	7.5			1.0	6.3	0.2		
Rehab Building Operating Systems - B 62	4.6				0.6	1.8	2.2	
Water Utility Upgrade	4.1				0.7	2.5	0.9	
Rehab Building Operating Sys. - B 70 Complex	4.6*					0.9	1.9	1.8
Replace B 29	12.4*					0.9	2.0	9.5
Rehab Building Operating Sys - B 50 Complex	3.2*						1.2	2.0
Operations Building Replacement	2.7*						0.7	2.0
Rehab Building Operating Systems - B 83	0.9*							0.9
Upgrade Low Conductivity Water System	0.8*							0.8
SUBTOTAL - PROPOSED MEL-FS PROJECTS	**55.4**	**0.0**	**2.4**	**6.1**	**13.9**	**7.0**	**8.9**	**17.0**
TOTAL PROPOSED	**94.9**	**0.0**	**2.4**	**15.3**	**38.9**	**23.2**	**14.5**	**16.9**
TOTAL FUND, BUDGET & PROP MEL-FS PROJECTS (Excludes Program and Hazardous Waste Handling Facility Related Projects)	**122.0**	**1.1**	**2.4**	**15.3**	**38.9**	**23.2**	**14.5**	**16.9**

*TEC to 2003 only; additional outyear funding projected.

†Prior costs for previous years.

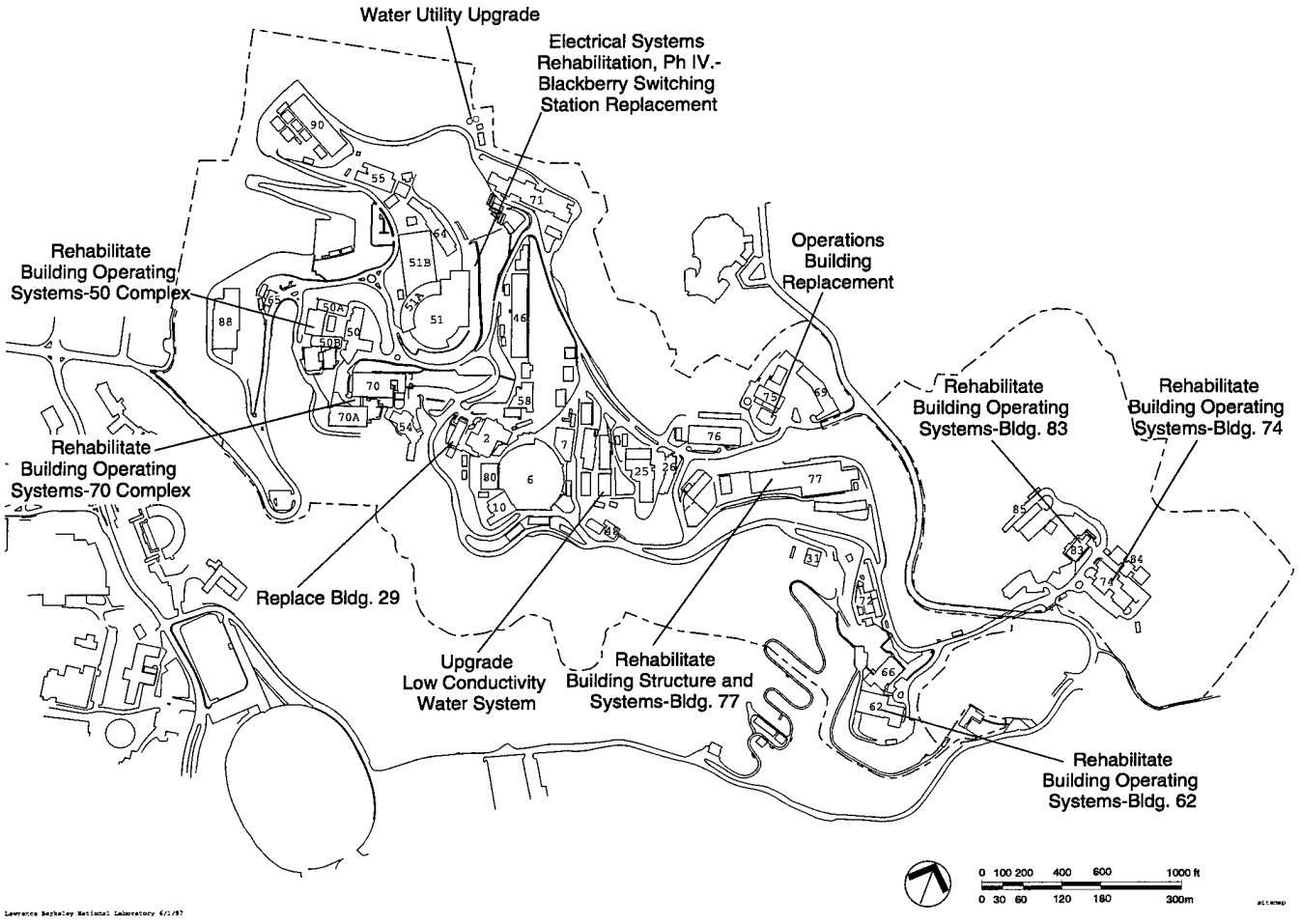


Figure 5-1. Proposed major construction projects FY 1998–2002.

Rehab Building Structure and Systems—Building 77. Long-term differential settlement caused by soil conditions under the building has stressed the buildings shell X-bracing past the yield point. The building is incapable of resisting the forces that will be generated by a major earthquake. Even without an earthquake, engineering projections indicate that the load-carrying capacity of the building's moment frames will eventually be seriously impaired if the settlement continues at the historic rate. Loss of Building 77 would impact all DOE missions currently supported by the building. Building 77 houses the Berkeley Lab Engineering Center. The Center's custom design, engineering, fabrication, assembly, and testing services are in high demand by the DOE research and development community (Berkeley Lab, Brookhaven, SLAC, the Human Genome Laboratory, Fermilab, and CERN at this time) and cannot be readily obtained from commercial vendors. This project will rehabilitate the buildings structural system to restore lateral force resistance and arrest differential foundation settlement, and will modernize architectural, mechanical, and electrical systems. These upgrades will restore the building to acceptable seismic performance, provide environmental controls appropriate to precision fabrication processes, increase the reliability and maintainability of building systems, bring the building envelope and HVAC system into compliance with state and federal energy codes, and extend the life of the building by 40+ years.

Rehab Building Operating Systems—Building 74. The incremental development of the Building 74 research facilities has resulted in a complicated and poorly integrated building infrastructure that is undercapacity, inefficient, failure-prone, and contains numerous health and safety risks. This project will

improve the lateral-force resistance system in portions of the buildings that cannot currently resist 100 lb/ft^2 (the current code requirements), as well as eliminate a deficient life safety exit corridor that is in excess of 100 feet and exits onto a narrow walkway adjacent to unprotected window openings. In addition, this project will systematically upgrade the building's mechanical systems and integrate these major systems in a manner that ensures that the pressure differential between laboratories and corridors continues to be maintained and is monitored systematically. The project will also upgrade the electrical supply system to eliminate overloads.

Rehab Building Operating Systems—Building 62. This project will upgrade the laboratories on each of the building's four floors to ensure that all have proper fume hoods and similar ventilation enclosures and that the laboratory support systems and utilities operate in a manner that ensures the health and safety of all researchers and support personnel. The hood and central service corridor exhaust ventilation systems will be upgraded and modern hoods installed in each laboratory space. Additional seismic reinforcing will also be installed at this time. In addition, the building's chilled water and other core utilities will also be upgraded.

Water Utility Upgrade. The Laboratory's domestic and fire water supply system will be upgraded to conform with current codes and standards. Portions of the distribution system that are prone to failure in the near future will be replaced, the two emergency water storage tanks will be seismically upgraded, and a third tank added at the eastern end of the site (to complement the other two, located in the western and central portions of the site). Furthermore, a new fire hydrant line and access road will be installed at the wildland interface line in order to allow urban firefighters to use standard urban fire fighting equipment at the wildland interface and further reduce the risk of structural damage to the west of the interface.

Rehab Building Operating Systems—Building 70 Complex. The supply air systems of the Building 70 Complex (Buildings 70 and 70A) have reached their maximum capacity. The lack of further supply air capacity inhibits full utilization of these two Laboratory buildings. This project will modify the supply air system to permit installation of fume hoods in each Laboratory space and remove the majority of the aged and generally unused glove box exhaust system.

Replace Building 29. Building 29 is a World War II barracks structure (approximately 11,000 sq ft) that has been adapted for office and laboratory use. This wooden structure has life safety and seismic deficiencies that are being mitigated through administrative measures, but that cannot otherwise be mitigated in the current structure. This project will construct a replacement structure (approx. 15,000 sq ft) on an adjacent parcel and demolish the present Building 29.

Rehab Building Operating Systems—Building 50 Complex. The Building 50 Complex has ventilation and communications deficiencies in some areas and antiquated spatial arrangements in both offices and assembly spaces. The ventilation and configuration problems interact so as not to allow the implementation of simple remedies—the typically simple remedies would introduce life safety risks and violations of the Uniform Fire Code. This project will make modifications to the ventilation and spacial arrangements to cure the present problems in a manner consistent with all codes and standards.

Operations Building. The Operations Building will be a two-story building with 25,000 gsf of office space. It will be near existing Buildings 75 and 69, with access from Centennial Drive and Cyclotron Road. The Operations Building will provide office space for Facilities; Environmental, Health and Safety; and individuals from other Operations Division units. The building design meets B-2 occupancy requirements defined in the Uniform Building Code, as well as current seismic standards and fire and life safety codes.

Rehab Building Operating Systems—Building 83. The mechanical and interior structural systems of this building will be upgraded to eliminate deficiencies. The interior partitions are not adequately secured to the balance of the building structure and can fail during seismic action. The HVAC system was designed for uses that are not present in the building and is poorly matched to the current office and wet laboratory uses. This project will improve operating effectiveness and eliminate deficiencies.

Upgrade Low Conductivity Water System. This project will upgrade the Low Conductivity Water system to meet anticipated mission requirements in this time period.

GENERAL PLANT PROJECTS

GPP funds have been provided by DOE. The GPP backlog is growing each year. Facilities plans recognize this situation and the Laboratory's inability to meet the pressing (highly rated using DOE's CAMP and RPM ranking systems) needs with a $3.5 M GPP budget. Funding to date has been inadequate to meet the Laboratory needs in a timely schedule. This program has a significant backlog of projects, approximately $35 M. Roughly one-quarter of this backlog is for environment, health, and safety needs, and one-half is for general improvements and replacements. Increasing GPP funding to $7 M annually would ensure the success of the Laboratory's safety rehabilitation program and help reduce the current backlog of projects over the next five years. Such a funding level need has been recognized as important in addressing similar needs at other DOE facilities.

General Purpose Equipment

Essential support equipment has been funded through DOE. Berkeley Lab's Five-Year GPE Plan identifies needs based on a range of criteria, including environment, safety, and health; legal requirements; failed, worn, inefficient, or obsolete equipment; substandard performance; or increased workload and demand. The current funding level of $1.9 M/year is minimally adequate to meet the Laboratory needs. Currently, there is an $18-M equipment backlog for environmental monitoring and fire safety, physical-plant, transportation, and data processing and communications.

MAINTENANCE PLANS

Maintenance plans and budgets are developed annually within an overall ten-year management strategy. The Laboratory has improved its current maintenance scheduling system. Requirements are identified by periodic reviews and inspections, and new priorities are developed during the fiscal year.

The operating expenses for maintenance include physical-plant maintenance, mobile-equipment maintenance, and noncapital alterations related to maintenance. In addition, specialized maintenance related to shop, computer, and telecommunications facilities is also performed.

SITE MAINTENANCE PLAN

The Berkeley Lab Maintenance Policy outlines the basis for maintenance of all laboratory property as required by DOE. Maintenance is defined as the predictive, preventive, and corrective activities required to keep facilities and equipment in a condition suitable for the intended use.

The Berkeley Lab Facilities Department is responsible for the maintenance of real property and installed equipment. This maintenance includes operation, restoration, and replacement of the physical plant grounds and exterior facilities, utilities, buildings, and building equipment, as well as of the tools, equipment, and information systems directly supporting these activities. Fixed and portable research apparatus and supporting tools, instruments, and equipment are not included. Maintenance operations are based on the graded approach.

INFORMATION RESOURCES MANAGEMENT

A foundation of the Berkeley Lab long-range computing strategy is the development and operation of a distributed computing network offering access to a large-scale, interactive, high-speed computing resource, shared archival mass storage, satellite computers, and workstations. The internal Berkeley Lab computer network (LBLnet) is supplemented by national and international networks. Berkeley Lab's external strategies include enhancing the Berkeley Lab work environment and corporate information, and providing quality and timely information and records. Resources and initiatives to support these strategies include advanced high-speed networking, computing upgrade, visualization, video, technical information, and other initiatives and infrastructure investments.

APPENDIX A. BIBLIOGRAPHY

ARCHITECTURAL STUDIES

1–2 GeV Synchrotron Radiation Source, Conceptual Design Report, Lawrence Berkeley Laboratory, July 1986.

1–2 GeV Synchrotron Radiation Source, Conceptual Design Report, Supplement A: Conventional Facilities Details, Lawrence Berkeley Laboratory, July 1986.

1–2 GeV Synchrotron Radiation Source, Conceptual Design Report, Supplement B: Cost Estimate Details, Lawrence Berkeley Laboratory, July 1986.

ALS Beamlines, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

ALS Structural Biology Support Facilities, Conceptual Design Report, Lawrence Berkeley Laboratory, April 1992.

Building 74–Rehabilitation of Building Operating Systems, Conceptual Design Report, Lawrence Berkeley National Laboratory, February 1997.

Building 77–Rehabilitation of Building Structure and Systems, Conceptual Design Report, Lawrence Berkeley National Laboratory, February 1997.

Building 77 Seismic and Settlement Rehabilitation, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Building 90 Seismic Rehabilitation, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1990.

Chemical Dynamics Research Laboratory, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Elise, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Electrical Systems, Rehabilitation, Phase IV–Blackberry Switching Station Replacement, Conceptual Design Report, Lawrence Berkeley National Laboratory, February 1996.

Electron Beam Microcharacterization Facility, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Environmental Monitoring and Industrial Hygiene Building, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1992.

Facilities Building, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1993.

Hazardous Waste Handling Facility, Conceptual Design Report, Lawrence Berkeley Laboratory, April 1990.

Human Genome Laboratory, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1992.

Induction Linac Systems Experiment, Conceptual Design Report, Lawrence Berkeley Laboratory, March 1993.

Instrumentation Support Laboratory Rehabilitation, Conceptual Design Report, Lawrence Berkeley Laboratory, January 1989.

Mechanical Equipment Replacement, Phase 1, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Mechanical Systems Modernization, Phase I, Conceptual Design Report, Lawrence Berkeley National Laboratory, February 1996.

Medical Services Asbestos Abatement and Rehabilitation, Conceptual Design Reportt, Lawrence Berkeley Laboratory, February 1993.

Radio Communications System Upgrade Project, Conceptual Design Report, Lawrence Berkeley National Laboratory, April 1996.

Roadway Safety and Stabilization Project, Phase 1, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Roof Replacements, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1990.

Safety & Support Services Facility, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

Sanitary Sewer Restoration, Phase 1, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1993.

Upgrade of Site Mechanical Utilities, Phase II—Sewer Monitoring, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1994.

ENVIRONMENT AND LANDSCAPE STUDIES

1–2 GeV Synchrotron Radiation Source at Lawrence Berkeley Laboratory, Environmental Assessment, prepared by Lawrence Berkeley Laboratory Plant Engineering Department, assisted by Ira Fink and Associates, Inc., August 1989.

Area Planning Study Report: Life Sciences Research Area, prepared by Eldon Beck Associates, September 1992.

Buildings 62/72 Site Utilization Study, prepared for Lawrence Berkeley Laboratory by MBT Associates, November 1979.

Building 90 Area Study, prepared by Eldon Beck Associates, August 1991.

The Changing Visual Needs of a National Laboratory, prepared by Design Systems Group, October 1993.

Construction of Replacement Hazardous Waste Handling Facility at LBL, Environmental Assessment, April 1992.

Environmental Monitoring and Remediation Facilities, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, January 1989.

FSEIR, September 1992.

Landscape/Fire Management Plan: Initial Measures, prepared by Eldon Beck Associates, February 1992.

Landscape Master Plan, Phase I Report, LBL, prepared by Eldon Beck and Associates, May 1990.

Landscape Master Plan, Phase 2: Sitewide, prepared by Eldon Beck and Associates, October 1992.

Mitigation Monitoring Plan for the Proposed Renewal of the Contract between DOE and Regents for Operation and Management of LBL, assisted by Ira Fink and Associates, Inc., September 1993.

Omnibus Environmental Assessment, Volume I, Lawrence Berkeley Laboratory, 1976.

Operation Plan for Hazardous Waste Handling Facility, Lawrence Berkeley Laboratory, March 1991.

Parking Study: Building 50E and F Expansion, prepared by Eldon Beck Associates, September 1992.

Slope and Seismic Stabilization Above Bevatron & Mechanical Shops, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, January 1989.

Storm Drainage Study, Strawberry Creek Watershed at University of California, Lawrence Berkeley Laboratory, G.T. Kuntz, Consulting Engineer, prepared for the Lawrence Berkeley Laboratory Plant Engineering Department, February 1980.

Supplemental Environmental Impact Report for the Proposed Renewal of the Contract Between DOE and the Regents of UC for Operation and Management of LBL, Draft, prepared by Ira Fink and Associates, Inc., April 1992.

HEALTH AND SAFETY STUDIES

Annual Environmental Monitoring Report of the Lawrence Berkeley Laboratory, 1986, prepared by the Engineering Division for the U.S. Department of Energy, April 1987.

Environmental Health and Safety Project, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1992.

Fire and Safety Systems Upgrade, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1991.

Hazardous Materials Safeguards, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1991.

Health and Safety Manual, PUB-3000, Lawrence Berkeley Laboratory, prepared for the U.S. Department of Energy by Lawrence Berkeley Laboratory, July 1986.

Medical Services Building Asbestos Abatement and Rehabilitation, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1993.

Self-Assessment Manual, PUB-3105, August 1992.

ENERGY CONSERVATION AND UTILITIES STUDIES

East Canyon Electrical Safety Project, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1990.

East Site Substation and Feeders, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, March 1988.

Electrical Systems Rehabilitation, Phase IV — Blackberry Switching Station Replacement, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, February 1992.

In-House Energy Management Annual Report, Lawrence Berkeley Laboratory, January 1993.

Mechanical Equipment Replacement, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1993.

Original Labsite Substation, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, January 1989.

Rehabilitate Utilities in the Original Laboratory Site, Conceptual Design Report, Lawrence Berkeley Laboratory, various consultants, 1983.

Sanitary Sewer Restoration, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1993.

Ten-Year In-House Energy Management Plan, FY 1985 to FY 2000, Lawrence Berkeley Laboratory, May, 1992.

Upgrade of Site Mechanical Utilities, Phase II, Conceptual Design Report, Lawrence Berkeley Laboratory, February 1991.

PARKING AND TRAFFIC STUDIES

Lawrence Berkeley Laboratory, 1986 Staff and Guest Housing and Transportation Survey, 3 volumes, conducted for Lawrence Berkeley Laboratory by Ira Fink and Associates, Inc., Cross-Tabulations, July 1986 and September 1986.

Roadway Safety and Stabilization, Phase I, Conceptual Design Report, Lawrence Berkeley Laboratory Plant Engineering Department, February 1993.

GENERAL PLANNING DOCUMENTS

Chemical and Materials Sciences Laboratory, Building 62, Conceptual Design Report, Lawrence Berkeley Laboratory, March 1979.

Fire Management Plan for the UC Hill Area, prepared for the University of California, Berkeley, Environmental Health and Safety, by Wildland Resource Management, Consultants, December 1986.

FY 1993 Site Development Plan, Lawrence Berkeley Laboratory, April 1993.

LBL Facilities Decommissioning Plan, FY 1992–1997, September 1991.

LBL Facilities Renewal Plan, FY 1988–2002, Lawrence Berkeley Laboratory, September 1986.

LBL Institutional Plan, FY 1994–1999, October 1993.

LBL Site Planning Review, January 1992.

LBL Space and Personnel Database, 1991.

Life Cycle Asset Management Partnering Agreement Between Lawrence Berkeley National Laboratory and the Oakland Operations Office, November 1996.

Long Range Development Plan, Radiation Laboratory, University of California, November 1957.

Long Range Development Plan, University of California, Berkeley, prepared by the Office of Architects and Engineers under the auspices of the Campus Planning Committee, June 1962.

Long Range Plan, Radiation Laboratory, Berkeley Hill Area, University of California, October 1953.

Long Range Site Development Plan, Lawrence Berkeley Laboratory, April 1984.

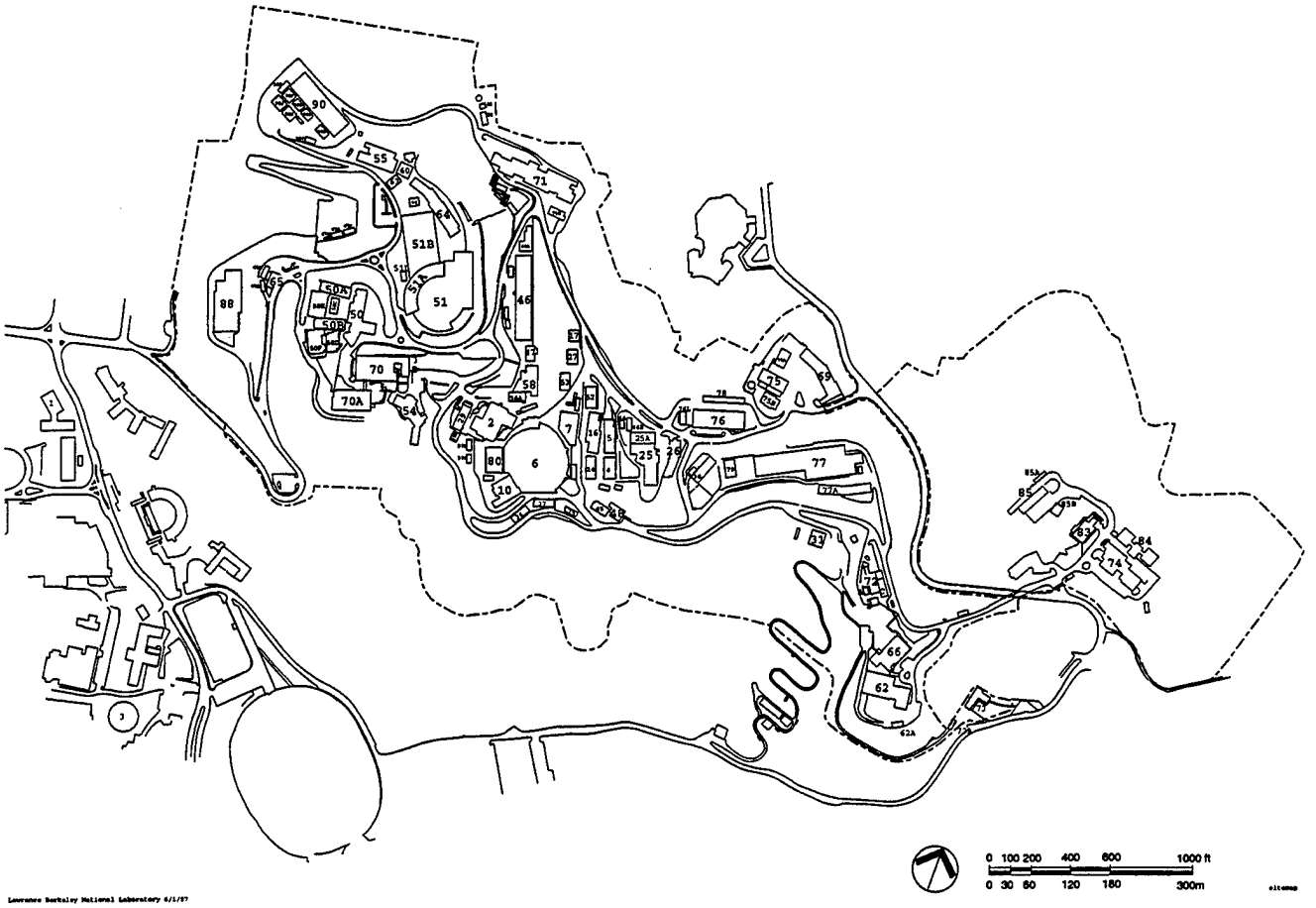
Space Needs Assessment Plan, October 1996.

Strategic Facilities Initiative Report, Marginal Facilities Plan, FY 1989–1994, March 1989.

Supplement to the April 1984 Site Development Plan, Lawrence Berkeley Laboratory, December 1987.

University of California, Berkeley, Hill Area Dewatering and Stabilization Studies, conducted by Converse Consultants, May 1984.

APPENDIX B. BERKELEY LAB MAP WITH BUILDING NUMBERS



Berkeley Lab map with building numbers.

Berkeley Lab Off-Site Building Numbers

Building Number	Building Name/Description	Building Number	Building Name/Description
Local Off-Site Leased Buildings			
903	Receiving/Warehouse — 2700 Seventh St., Berkeley	905	Hesse Hall
934	DYMO Bldg: Printing Plant, Cell & Molecular Biology	921	Stanley Hall
	— 91 Bolivar Dr., Berkeley	927	Koshland Hall
936	CFO and OSRA — 2070 Allston Way, Berkeley	953	McCone Hall
938	Promenade: Information Systems and Services & Human Resources — 1936 University Ave., Berkeley	983	Wurster Hall
		990	Evans Hall
		995	Barker Hall
Campus Buildings Assigned Berkeley Lab Numbers			
001	Donner Laboratory		
003	Melvin Calvin Laboratory		
003A	Trailer (on roof of 3)		
003B	Modular Bldg. (on roof of 3)		
008	Hearst Mining		
011	Hildebrand Hall		
018	Gilman Hall		
019	LeConte Hall		
019A	Birge Hall		
020A	LSB Addition		
021	Giauque Hall		
022	Latimer Hall		
024	Etcheverry		
038	Lewis Hall		
039	Cory Hall		
301	Hilgard		
850	Tan Hall		

APPENDIX C
1997 BERKELEY LAB BUILDING AND REHABILITATION STATUS

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
HILL-SITE BUILDINGS						
Area 1 - Blackberry Research Area						
013A	ENV MON (B88W)	7	76	0	2	-
013B	ENV MON (B90W)	7	76	0	2	-
013E	SWR MON (B88S)	6	68	0	2	-
013G	WSTE MON (B70W)	13	140	0	2	-
033B	BB CNYON GATEHSE	9	94	4	1	1
050	AFR, PHY, AUDITORIUM, LIBRARY, COPY CTR	4,411	47,479	119	2	54
050A	DIRECTORATE, PHYSICS, NUCLEAR SCIENCE	6,200	66,741	196	2	35
050B	PHYSICS, COMPUTING SCIENCES	5,898	63,483	215	2	30
050C	COMPUTING SCIENCES, NERSC	257	2,766	21	1	17
050D	COMPUTING SCIENCES	461	4,959	19	1	18
050E	PHYSICS, NS DIVN OFFICE, ICS	1,011	10,878	62	1	13
050F	ICS, TEID	783	8,429	27	1	12
051	BEVATRON, EHS, HR, ES	8,173	87,979	55	2	47
051A	BEVATRON	2,313	24,894	0	2	39
051B	EXTERNAL PARTICLE BEAM HALL	4,105	44,182	0	2	35
051F	NS	139	1,495	0	3	18
051G	NS	134	1,440	0	3	18
051L	COMPUTER TRAINING CENTER	80	863	0	3	12
051N	ES	60	645	4	2	9
051Q	ES	258	2,780	0	3	-
054	CAFETERIA	1,420	15,281	3	2	47
054A	WELLS FARGO ATM	18	195	0	1	15
055	LS	1,768	19,027	54	2	46
055A	LS	143	1,535	1	2	12
055B	EMG GEN	19	209	0	1	10
055C	LS	48	520	0	3	19
056	BIOMED ISOTOPE FAC	166	1,782	0	1	21
060	HIBAY LAB	316	3,400	0	2	18
063	EE	251	2,702	0	3	20
064	LS/B-FACTORY	2,256	24,281	34	2	46
064B	OFFICE	45	480	0	3	20
065	VISITOR CTR	318	3,426	13	2	45
065A	OFFICE	135	1,454	6	3	13
065B	OFFICE	95	1,020	7	3	14
067B	EE: MOBL WNDW THERML TEST FAC SUPPT	115	1,237	3	3	19

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
067C	EE: INDOOR ENVIRONMENT LABORATORY	115	1,237	0	3	19
067D	MOBILE INFILTRATN TST UNIT (MITU)	12	130	0	3	-
067E	EE FIELD LAB	28	296	0	3	25
070	NS, EE LAB	5,807	62,507	123	2	42
070A	NS, LS, CS, ES, ENG LAB	6,303	67,848	127	2	36
070B	UTIL STOR TERMINAL HUT	35	382	0	2	18
070E	STOR	40	432	0	2	-
070G	LIQUID NITROGEN STORAGE	16	173	0	2	10
088	88 CYCLOTRON	4,921	52,970	140	2	37
088B	CMPRSSR SHLTR & STOR	50	534	0	2	-
088C	FLAMBL GAS/LIQD STOR	7	80	0	2	-
088D	EMG GEN	25	265	0	1	18
090	DOE EE EHS, ES, COPY CTR	8,301	89,357	390	2	37
090B	FACILITIES	134	1,440	8	3	20
090C	FACILITIES	110	1,185	3	3	20
090E	FACILITIES	17	188	0	3	20
090F	FACILITIES	228	2,459	10	3	18
090G	FACILITIES	172	1,846	9	3	19
090H	FACILITIES	172	1,849	8	3	20
090J	FACILITIES	264	2,846	16	3	19
090K	FACILITIES	264	2,844	12	3	19
090P	ES	198	2,129	13	3	18
090Q	RESTROOMS	39	425	0	3	19
090R	UTIL BLDG	15	160	0	3	18
	Area 1 - Total	**68,709**	**739,598**	**1,702**		
Area 2 - Central Research Area						
002	ADVANCED MATERIALS LABORATORY	7,976	85,856	153	1	9
002A	HAZARDOUS MATERIALS STORAGE	17	182	0	1	4
004	ALS SUPPORT FACILITY	946	10,178	23	2	53
004A	SFTY EQPMT STOR	12	133	0	3	23
005	AFR	668	7,192	14	2	47
005A	MECH STOR	15	160	0	3	-
005B	ELEC STOR	15	160	0	3	-
006	ADVANCED LIGHT SOURCE	10,827	116,546	87	1	6
007	ALS SUPPORT	1,991	21,433	20	3	54
007A	RADIO SHOP	12	128	0	3	23
007C	OFFICE	45	480	2	3	20
010	ALS SUPPORT FACILITY	1,409	15,172	22	2	53
010A	UTIL STORAGE	22	242	0	3	-
013C	ENV MON (STRWB CNY REC SOUTH)	7	76	0	2	-
013D	ENV MON (B71N)	7	76	0	2	-
013F	SWR MON (HAAS CLUBHS NE)	3	36	0	2	32
013H	RADN MON (B45SW)	8	90	0	2	-
014	ES LAB	390	4,200	17	2	53

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
016	AFR LAB	1,094	11,771	3	2	54
016A	UTIL STORAGE	32	339	0	2	37
017	EHS	192	2,065	3	3	48
017A	TELEPHONE STOR	16	174	0	-	-
025	ENG SHOP	1,900	20,450	21	3	50
025A	ENG SHOP	681	7,335	14	2	34
025B	WASTE TREATMT	24	258	0	2	-
026	HLTH SVCS, EH&S	981	10,563	22	2	33
027	ALS SUPPORT FACILITY	305	3,288	1	3	49
029	ENG, LS	982	10,567	22	3	50
029A	ENG	163	1,751	9	3	19
029B	ENG	134	1,439	7	3	19
029C	EE	134	1,440	9	3	19
029D	RST RM TRLR	26	276	0	3	19
034	ALS CHILLER	480	5,163	0	-	5
037	UTIL SVC	542	5,833	0	1	10
040	ENG ELECTRONICS LAB	88	952	0	3	50
041	ENG COMMUNINCATIONS LAB	92	995	5	3	49
043	COMPRESSOR	95	1,020	0	1	9
044	IND AIR POLLUTN STDIES	74	800	0	3	41
044A	FACILITIES	45	480	0	3	18
044B	EE	134	1,439	8	3	18
045	FIRE APPARATUS	310	3,342	0	1	27
045A	SMK HOUSE	12	128	0	1	-
046	AFR, EE, ENG, PRINTING PLT, PHOTO LAB	5,629	60,595	131	2	48
046A	ENG DIVISION OFFICE	516	5,550	28	2	20
046B	ENG	115	1,238	5	3	18
046C	AFR	96	1,028	2	3	20
046D	AFR	72	775	2	3	13
047	AFR	580	6,242	22	2	40
048	FIRE STATION, EMG COMMAND CTR	436	4,695	21	1	16
048A	FIRE STA STOR	30	320	0	2	19
052	CABLE WINDING FACILITY	597	6,425	0	2	54
052A	UTIL STORAGE	48	516	0	2	36
052B	ALS SUPPORT	109	1,174	10	3	18
053	E&E	644	6,935	8	2	48
053A	GARDNRS STOR	18	192	0	2	32
053B	AFR	43	464	1	3	25
058	HEAVY ION FUSION	959	10,321	10	2	47
058A	ACCEL R&D ADDN	1,175	12,653	0	2	28
071	ION BEAM TECH, CTR BEAM PHY, EHS/CS/NS	5,281	56,841	44	2	41
071A	ION BM TECH, LOW BETA LAB	383	4,127	0	2	34
071B	CTR BEAM PHYS	656	7,062	11	2	19
071C	OFFICE, B-FACTORY	47	511	3	3	29
071D	OFFICE, B-FACTORY	48	520	3	3	27

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
071E	STORAGE	48	513	0	3	24
071F	OFFICE, B-FACTORY	48	516	1	3	23
071G	OFFICE	48	517	1	3	23
071H	OFFICE, B-FACTORY	132	1,424	5	3	23
071J	OFFICE, B-FACTORY	120	1,288	6	3	19
071K	AFR/CS/B-FACTORY	44	474	3	3	23
071P	B-FACTORY	48	512	3	3	16
071Q	RESTROOM TRAILER	0	0	0	2	1
080	ALS SUPPORT FACILITY	2,778	29,908	57	2	43
080A	ALS SUPPORT FACILITY	89	960	2	1	20
081	LIQD GAS STORAGE	105	1,129	1	1	29
082	LOWER PUMP HOUSE	50	537	0	2	16
	Area 2 - Total	**53,898**	**580,170**	**842**		
Area 3 - Grizzly Operations Support Area						
031	CHICKCRK MAINT, ES	560	6,033	12	2	11
031A	ES	58	624	1	3	-
033C	GRZZL PK GATEHSE	7	80	0	3	32
036	GRIZZLY SUBSTAION	84	901	0	1	8
042	SALVAGE	118	1,268	0	3	55
042A	EMG GEN HOUSE	13	144	0	3	-
061	STDBY PROPN PLT	30	323	0	2	28
068	UPP PUMP HOUSE	46	500	0	2	18
069	ARCHIVES, PROCUREMENT & SHIPPING	1,649	17,752	51	2	30
075	NTLF, RADIOISO SVCS	794	8,545	19	2	36
075A	EH&S	372	4,000	0	2	10
075B	EH&S	435	4,681	26	3	18
075C	EH&S	42	450	0	3	-
075D	WSTE STOR	96	1,035	0	2	-
075E	OFFICE, EH&S	38	410	5	3	-
075F	LAB PACK SEG & SEP	19	207	0	2	-
075G	BASES STORAGE	7	75	0	2	-
075H	FLAMMABLE LIQUIDS	2	21	0	2	-
075J	HAZ WSTE CMPACTN	39	424	0	2	-
075K	ACIDS STORAGE	7	75	0	2	-
075L	POISONS STORAGE	7	75	0	2	-
075O	HAZ WSTE STOR	15	157	0	2	-
075P	HAZ WSTE STOR	15	157	0	2	-
076	FACILITIES SHOPS	2,922	31,450	149	2	33
076A	PAINT STOR	15	160	0	3	-
076D	ELECL	15	160	0	3	-
076H	EMG UTIL STOR	15	160	0	2	-
076J	CUSTOD STOR	15	160	0	3	-
076K	FACILITIES	33	357	0	3	-
076L	FACILITIES	134	1,439	7	3	20
077	ENG SHOPS	6,389	68,768	66	2	34

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
077A	ULTRA HIGH VACUUM FACILITY	1,009	10,862	6	1	9
077C	WELDG STOR	2	23	0	2	-
077D	DRUM LIQD STOR	10	108	0	2	-
077H	AUXILRY PLATG SHOP	54	576	0	2	14
078	CRAFT STORES	501	5,392	5	2	31
079	METAL STORES	414	4,453	1	2	32
	Area 3- Total	**15,979**	**172,005**	**348**	**2**	
Area 4 - Strawberry Research Area						
033A	STRAWB CNYN GATEHSE	5	52	0	3	32
062	MS, CS LAB	5,168	55,626	66	2	32
062A	EE, MS	116	1,248	2	3	19
062B	UTIL STOR	16	169	0	1	-
066	SURFACE SCI CATALYSIS, CTR FOR ADV MTRL	4,099	44,123	83	1	10
072	NAT'L CENTER FOR ELECTRON MICROSCOPY	567	6,105	15	2	36
072A	HIGH VOLTAGE ELECTRON MICROSCOPE	235	2,532	0	2	17
072B	ATOMIC RESOLUTION MICROSCOPE	410	4,413	0	2	13
072C	ARM SUPPORT LAB	496	5,335	2	1	13
073	ATM AEROSOL RSCH	393	4,228	3	2	36
073A	UTIL STOR	37	403	0	2	36
074	LS LABS	4,221	45,430	150	2	35
074C	EMG GEN	17	180	0	2	-
074D	STORAGE	18	190	0	2	-
083	LS LAB	650	6,995	28	2	18
083A	LS OFFICE TRAILER	50	538	0	3	32
085	HAZARDOUS WASTE HANDLING FACILITY	1,433	15,420	13	1	1
085B	OFFICE TRAILER	335	3,603	15	1	1
	Area 4 - Total	**18,264**	**196,590**	**377**		
	Hill-Site Grand Total	**156,850**	**1,688,363**	**3,269**		
Area 5 - Campus Research Area (UCB Campus Buildings w/ assigned Berkeley Lab Numbers)						
001	DONNER LAB	4,526	48,722	158	-	56
003	MELVIN CALVIN LAB	1,898	20,426	70	-	34
003A	MCL ROOF TRLR	70	756	0	-	12
003B	MCL ROOF MODULAR	49	532	0	-	-
008	HEARST MINING	997	10,730	5	-	90
011	HILDEBRAND	1,750	18,837	11	-	31
018	GILMAN	1,043	11,226	25	-	80
019	LE CONTE	507	5,455	6	-	73
019A	BIRGE	1,425	15,336	30	-	33
020A	LSB ADDN	33	358	2	-	-
021	GIAUQUE	883	9,500	1	-	43

Building Number	Building Name Description	Area gsm	Area gsf	Employees	Condition Assessment	Age
022	LATIMER	1,493	16,073	29	-	34
024	ETCHEVERRY	192	2,072	2	-	33
038	LEWIS	482	5,183	9	-	49
039	CORY	1,247	13,428	0	-	47
301	HILGARD	88	948	2	-	-
850	TAN HALL	543	5,847	5	-	1
905	HESSE	16	176	0	-	73
921	STANLEY	28	304	1	-	45
927	KOSHLAND HALL	30	327	0	-	-
953	MCCONE HALL	23	248	2	-	-
983	WURSTER	301	3,239	0	-	-
990	EVANS	113	1,218	6	-	26
995	BARKER	256	2,757	2	-	33
	Area 5 - Total	**17,995**	**193,698**	**366**		
Local Off-Site Leased Buildings						
903	WAREHOUSE, RECEIVING	11,381	122,504	4	-	-
934	DYMO: LS LAB	2,854	30,720	44	-	28
936	HINKS: CFO	1,610	17,334	76	-	-
938	PROMENADE: HR, ISS, CSEE	1,941	20,898	131	-	-
	Local Off-Site Leased Total	**17,786**	**191,456**	**255**		
Summary						
	Hill Site Total	156,850	1,688,363	3,269		
	UCB Campus Total	17,995	193,698	366		
	Local Off-Site Leased	17,786	191,456	255		
	Grand Total	**192,631**	**2,073,517**	**3,890**		

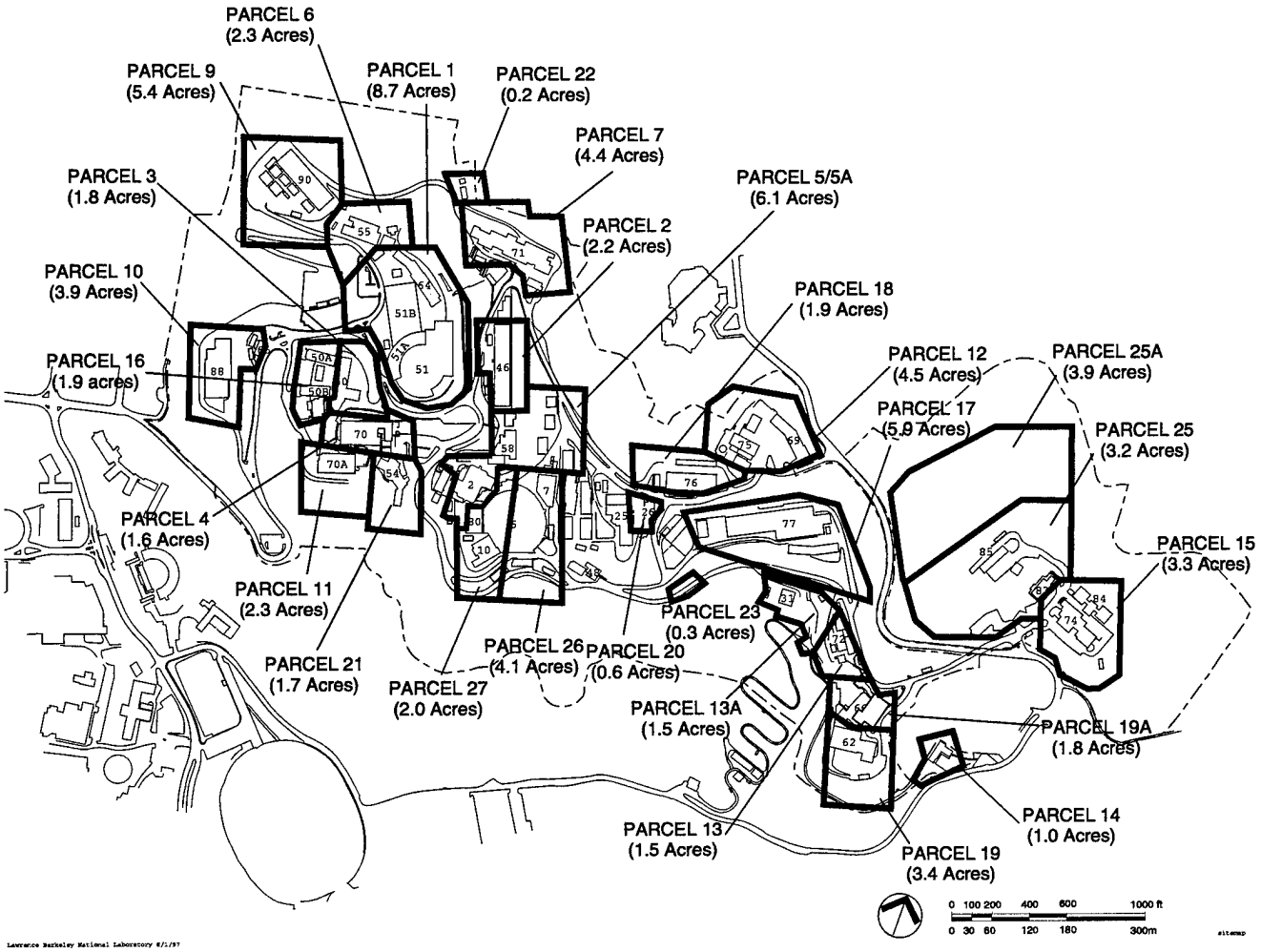
Condition Assessment

Status 1 - Adequate. Structure, systems, and components are adequate for current use. Building structure, safety, and utilities are adequate in capacities, technological quality, and reliability to support functions required by occupants and processes.

Status 2 - Functional, Can Be Economically Upgraded. Structure, systems, and components are functional for current use but are approaching technological obsolescence.Can be economically upgraded.

Status 3 - Substandard, Cannot Be Economically Upgraded. Structure, systems, and components have been used beyond their normal life span and cannot be economically upgraded.

APPENDIX D. BERKELEY LAB LAND LEASES



Land leases.

Parcel Number	Area (Acre)	Effective Date	Expiration Date
1	8.7	1949	1999
2	2.2	1948	1998
3	1.8	1948	1998
4	1.6	1953	2003
5	4.3	1950	2000
5A	1.8	1986	2036
6	2.3	1951	2001
7	4.4	1955	2005
9	5.4	1959	2009
10	3.9	1959	2009
11	2.3	1959	2009
12	4.5	1959	2009
13	1.5	1960	2010
13A	1.5	1985	2000
14	1.0	1960	2010
15	3.3	1961	2011
16	1.9	1960	2010
17	5.9	1962	2012
18	1.9	1962	2012
19	3.4	1962	2012
19A	1.8	1985	2035
20	0.6	1963	2013
21	1.7	1965	2015
22	0.2	1967	2017
23	0.3	1969	2019
25	3.2	1978	2028
25A	3.9	1991	2041
26	4.1	1988	2037
27	2.0	1988	2037
998 (Occupancy Agreement)	1.5	1948	–
999 (Contractor Controlled)	117.1		
Total Acres	**200.0**		

APPENDIX E. ACRONYMS AND OTHER INITIALISMS

ABAG	Association of Bay Area Governments
AC	Alameda County
AECR	Advanced Electron Cyclotron Resonance
AGMEF	Ana G. Méndez Educational Foundation
ALS	Advanced Light Source
AML	Advanced Materials Laboratory
BARRNet	Bay Area Regional Research Network (Consortium)
BART	Bay Area Rapid Transit system
BES	Basic Energy Sciences
BPA	Bonneville Power Administration
Cal-EPA	California Environmental Protection Agency
CAM	Center for Advanced Materials
CAMP	Capital Asset Management Process
CCF	Central Computing Facility
CDF	Collider Detector at Fermilab
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERN	European Council for Nuclear Research (Geneva)
CFP	Comprehensive Facilities Plan
CIEE	California Institute for Energy Efficiency
CRE	Conservation and Renewable Energy
CRT	cathode ray tube
DECnet	Digital Equipment Corporation's networking system
DFSC	Defense Fuel Supply Center
DOD	Department of Defense

DOE	U.S. Department of Energy
DOE/OAK	DOE Operations Office at Oakland
EBMUD	East Bay Municipal Utilities District
ECR	electron cyclotron resonance
EH&S	Environment, Health and Safety Division
EM	Environmental Management
EMCS	energy monitoring and control system
ERVN	Energy Resources Videoconferencing Network
ERWM	Environmental Restoration and Waste Management
ES&H	Environment, Safety and Health (DOE)
ESnet	Energy sciences network (computer support for DOE energy research)
FNAL	Fermilab National Accelerator Laboratory
FTE	full-time equivalent position
FTS	Federal Telecommunications System
GPE	General Purpose Equipment
GPP	General Plant Projects
gsf	gross square feet
gsm	gross square meters
HILAC	Heavy Ion Linear Accelerator
HVAC	heating, ventilating, and air conditioning
ICS	Integrated Communications System
IHEM	In-House Energy Management
JSU	Jackson State University
LBNL	Lawrence Berkeley National Laboratory
LBLnet	Laboratory-wide computer network
LCAM	Life Cycle Asset Management
LCP	Life Cycle Plan

LLNL	Lawrence Livermore National Laboratory
LRDP	Long Range Development Plan
m^2	square meters
m^3	cubic meters
MEL-FS	Multiprogram Energy Laboratory Facilities Support
MFE	Magnetic Fusion Energy
MFTF	Mirror Fusion Test Facility (Livermore)
Mgsf	millions of gross square feet
MILnet	Military (DOD-sponsored) computer network
Mnsf	millions of net square feet
NCEM	National Center for Electron Microscopy
NEPA	National Environmental Protection Act
NIH	National Institutes of Health
NMFECC	National Magnetic Fusion Energy Computer Center
NMR	nuclear magnetic resonance
OECD	Organization for Economic Cooperation and Development (Europe)
OER	Office of Energy Research
OHER	Office of Health and Environmental Research (DOE)
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSP	Operational Safety Procedure
PEP	Positron Electron Project
PET	positron emission tomography
PG&E	Pacific Gas & Electric Company
PNL	Pacific Northwest Laboratories
RFS	Richmond Field Station (UC)
RHIC	Relativistic Heavy Ion Collider

RPM	Risk Priority Matrix
SDP	Long Range Site Development Plan
SEIR	Supplemental Environmental Impact Report
SFI	Strategic Facilities Initiative
SLAC	Stanford Linear Accelerator Center
SLC	Stanford Linear Collider
SSC	Superconducting Super Collider
SSCL	Surface Science and Catalysis Laboratory
TEC	total estimated cost
TFTR	Tokamak Fusion Test Reactor (Princeton)
TPC	Time Projection Chamber
TSI	Technical Site Information
UC	University of California
UCB	University of California, Berkeley
VHF	very high frequency
WAPA	Western Area Power Administration
WFO	Work for Others
WW II	World War II

INDEX

SYMBOLS

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