## A. SITING

### *Introduction*

Siting incorporates land use, circulation, infrastructure, security, safety and environmental, cultural and quality issues into a project program. The siting process must be thorough and complete as it directly affects the cost, function and aesthetics of development.

Applying the guidance in this section of the *Design Principles* will create sites that are well designed, functional and safer for visitors and Laboratory staff.

### *Principles*

Principles for the Laboratory siting process are:

- Implement the land use goals in the *Comprehensive Site Plan*, *Area Development Plans* and *Specific Area Master Plans*.
- Use a consistent and complete site analysis and siting process for all development projects.
- Efficiently use existing land and infrastructure to improve the organization and function of the Laboratory.
- Use developable areas within and adjacent to existing development to take advantage of existing infrastructure.
- Incorporate security, safety and environmental and cultural requirements at the earliest stages of project development and siting.
- Identify and use utility corridors.

### *References*

Other Laboratory and industry documents to be referenced are as follows:

**CSP 2000**
Comprehensive Site Plan 2000 and supplement CSP 2001

**ADP**
Area Development Plans

**SSSP**
Site Safeguards and Security Plan

**SS LIR**
406.00.01.0 General Security
406.00.020 Classified Security
406.00.030 Nuclear Safeguards

**DOE**
Design Basis Threat Policy Document
Publication SAND 87-1926
Publication SAND 87-1926/2 Access Delay
Technology Transfer Manual, Volumes I and II
DOE 64.30.1A
DOE M5632.1C-1

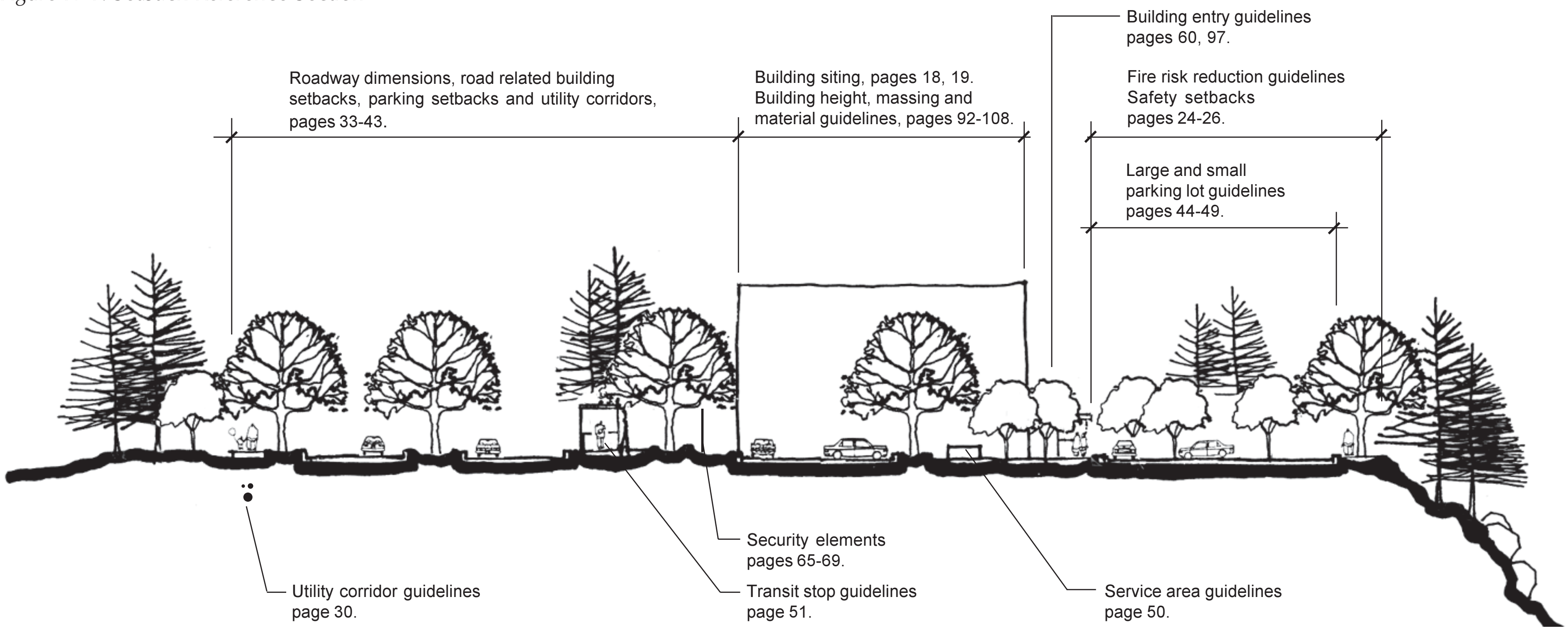
**LIR 220-01-01.4**
Construction Project Management LIR

**LIR 210-01-01.0**
Site Planning LIR

## 1. Siting Notification Process

The siting notification process applies to siting of all facilities and infrastructure within the Laboratory's boundaries. The siting notification process supports the principles of the Laboratory's *Comprehensive Site Plan* and maximizes the proper and effective use of developable land. The process is implemented by PM-1 and coordinated with all facility management units. The PM-1 staff is responsible for this process. *Figure IV-1* illustrates locations in the *Design Principles* where specific information can be found.

*Figure IV-1: Setback Reference Section*



## 2. Accountable Design

Executive Order 13123 states that:
*"The Federal Government, as the Nation's largest energy consumer, shall significantly improve its energy management in order to save taxpayer dollars and reduce emissions that contribute to air pollution and global climate change."* To meet the challenge of the Executive Order, the Laboratory must be accountable in its designs with regard to energy and resource conservation and efficiency.

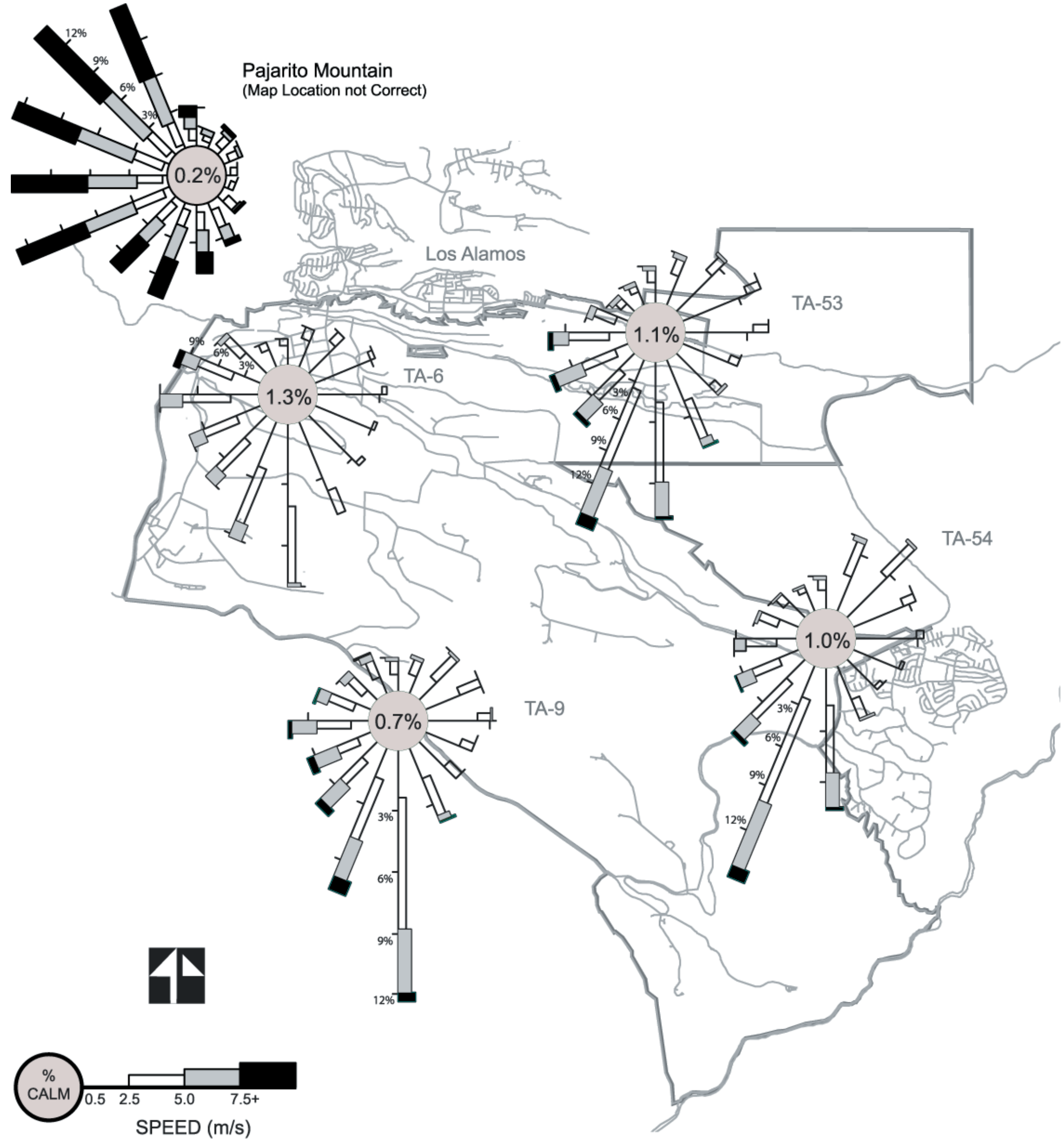
New structures and facility upgrades at the Laboratory should follow the Leadership in Energy and Environmental Design (LEED) system for environmental accountable design. Siting and constructing buildings in an environmentally sound manner improves the work environment. Using the LEED program as a standard, designers may select the environmental design or performance level that best suits their specific structures and sites.

Project managers should select standards from the following five LEED categories:

– Sustainable sites
– Water efficiency
– Energy and atmosphere
– Materials and resources
– Indoor environmental quality

All new structures, renovations, and additions should conform to the minimum LEED certification level within the rating system or a project manager selected level.

*Figure IV-2: Los Alamos Wind Conditions Summary 2000*



## 3. Building Orientation and Site Design

### a. *Building Solar Orientation*

Building siting should use solar orientation to:

- Set building orientations that increase human comfort and safety from sun, snow, rain and wind.
- Provide optimum internal building comfort and energy conservation (*Figures IV-3, IV-4 and IV-5*).

### b. *Passive Heating/Cooling*

Building designers should use solar "direct gain" analysis as an evaluation tool in order to:

- Control solar heat gain on building surfaces (*Figures IV-3, IV-4 and IV-5*).
- Control and direct sunlight for interior building daylighting as well as passive heating and cooling opportunities.

### c. *Exterior Building/Space Organization*

Other siting considerations are:

- Avoid restricting the solar access of neighboring structures in building design and orientation (*Figure IV-6*).
- Consider orienting building views to prominent vistas of the mountains and the Rio Grande Valley.
- Design outdoor spaces between buildings to take advantage of winter sun and summer shade.
- Create buffers using landforms, structures and plants to mitigate summer heat gain, glare and wind (*Figure IV-7*).

*Figure IV-3: Sun Angle Diagram 36 North Latitude*

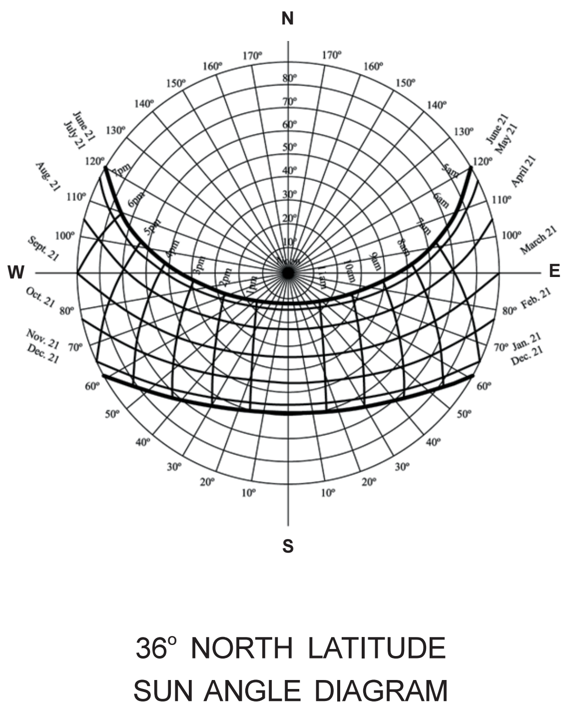



*Figure IV-4: Optimum Solar Orientation - Los Alamos*

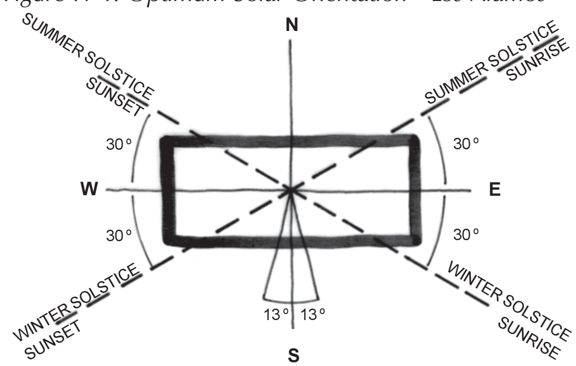



*Figure IV-5: Solar Sun Angles - Los Alamos*

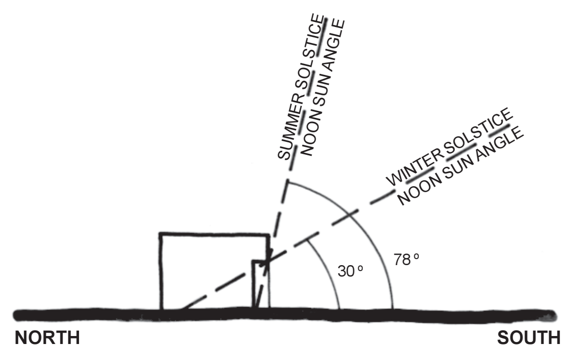
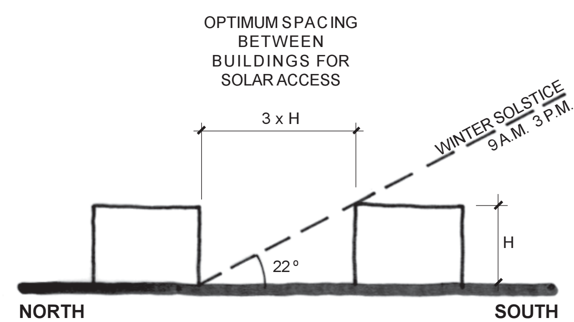



*Figure IV-6: Building Spacing for Solar Gain - Los Alamos*



## d. *Access*

Sites should be designed to:

- Provide clear routes for vehicular and pedestrian access that connect buildings to roadways, parking areas, walkways and trails.
- Separate service and maintenance access from primary pedestrian routes and areas.
- Meet the guidelines for accessibility established in the Americans with Disabilities Act (ADA) and Uniform Federal Accessibility Standards (UFAS).

## e. *Site Grading*

Sites should be graded to:

- Balance their cut and fill to within 10% unless there are extenuating circumstances related to the site or building use.
- Provide positive drainage away from structures.
- Maintain on-site road grades that do not exceed 8%.
- Limit retaining walls to a maximum height of 6 feet (*Figure IV-8*).
- Retain 100-year storm runoff on-site where practical.

Buildings on sloped sites should:

- Berm into the slopes where practical to reduce the buildings visual impact.
- Step the building's massing to follow the site's slope.

Site grading should avoid:

- Fill slopes of greater than 3:1.
- Cut slopes of greater than 2:1.
- Continuous fill or cut slopes of longer than 20 feet.
- Abrupt grading changes at the bottom or top of slope (*Figure IV-9*).

*Figure IV-7: Methods To Reduce Summer Solar Gain*

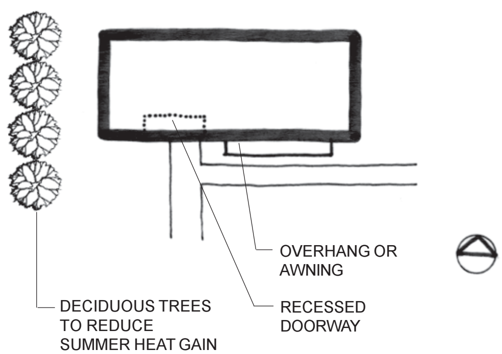



*Figure IV-8: Slope Grades And Retaining Walls*

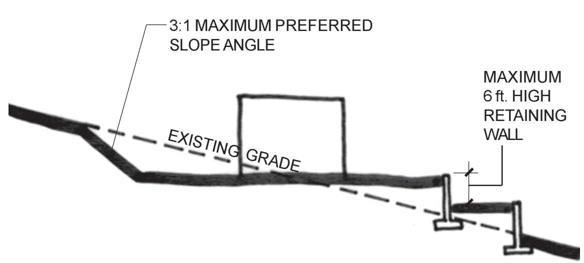
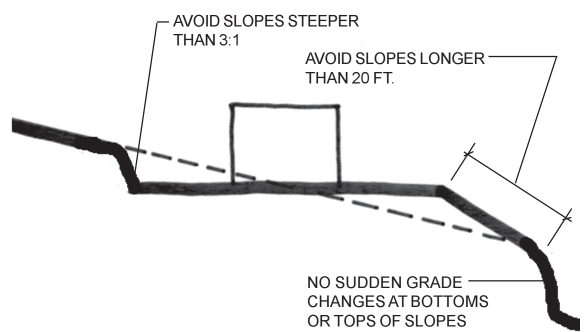



*Figure IV-9: Grading Problems*



## 4. Site Development Program Checklist

A Site Development Program checklist should be created and included in the initial programming of every project. The checklist should coordinate the project's site development program with the overall planning guidance in the *Comprehensive Site Plan (CSP)*, the relevant *Area Development Plan (ADP)*, the related *Specific Area Master Plans* and the guidance in the *Design Principles*.

The checklist should include all siting issues regardless of the project's scale. A sample checklist is presented to the right.

**SAMPLE**
***SITE DEVELOPMENT***
***PROGRAM CHECKLIST***

***Land Use***

- Long-range land use goals ☐
- Physical constraints ☐
- Operational constraints ☐
- Developable sites ☐

***Security/Safety Requirements***

- Security requirements ☐
- Safety requirements ☐

***Environmental/Cultural Requirements***

- Environmental/cultural requirements ☐
- Drainage and terrain management ☐

***Utilities Infrastructure Requirements***

- Utility corridor alignments ☐
- Utility sources ☐

***Circulation Requirements***

- Road system ☐
- Parking system ☐
- Pedestrian system ☐
- Bicycle system ☐
- Transit system ☐

***Landscape Elements Requirements***

- Security/safety elements ☐
- Signage elements ☐
- Exterior lighting elements ☐
- Paving elements ☐
- Site furnishings ☐
- Planting / water harvesting ☐

## 5. Site Analysis

Site analysis is the first step in development planning. The analysis evaluates a proposed project in context with the physical and operational constraints of a site. A thorough site analysis identifies development potentials, restrictions and the supporting institutional investments that may be needed to meet a project's schedule and budget.

The site analysis can be depicted on a summary map or series of maps that present all development issues affecting the planning and construction of a project (*Figure IV-10*). The map should incorporate existing conditions data and long-range site development and infrastructure goals from the *CSP*, *ADP's* and *Specific Area Master Plans*. Include the following information in the analysis:

– topography / slope
– soil types
– vegetative cover
– geologic and seismic data
– adjacent land uses
– buildings and structures
– utility easements or corridors
– utility lines and sizes
– road system
– parking network
– pedestrian network
– bicycle network
– transit network
– security improvements
– safety improvements and buffers

*Figure IV-10: Sample Site Analysis for TA-66*

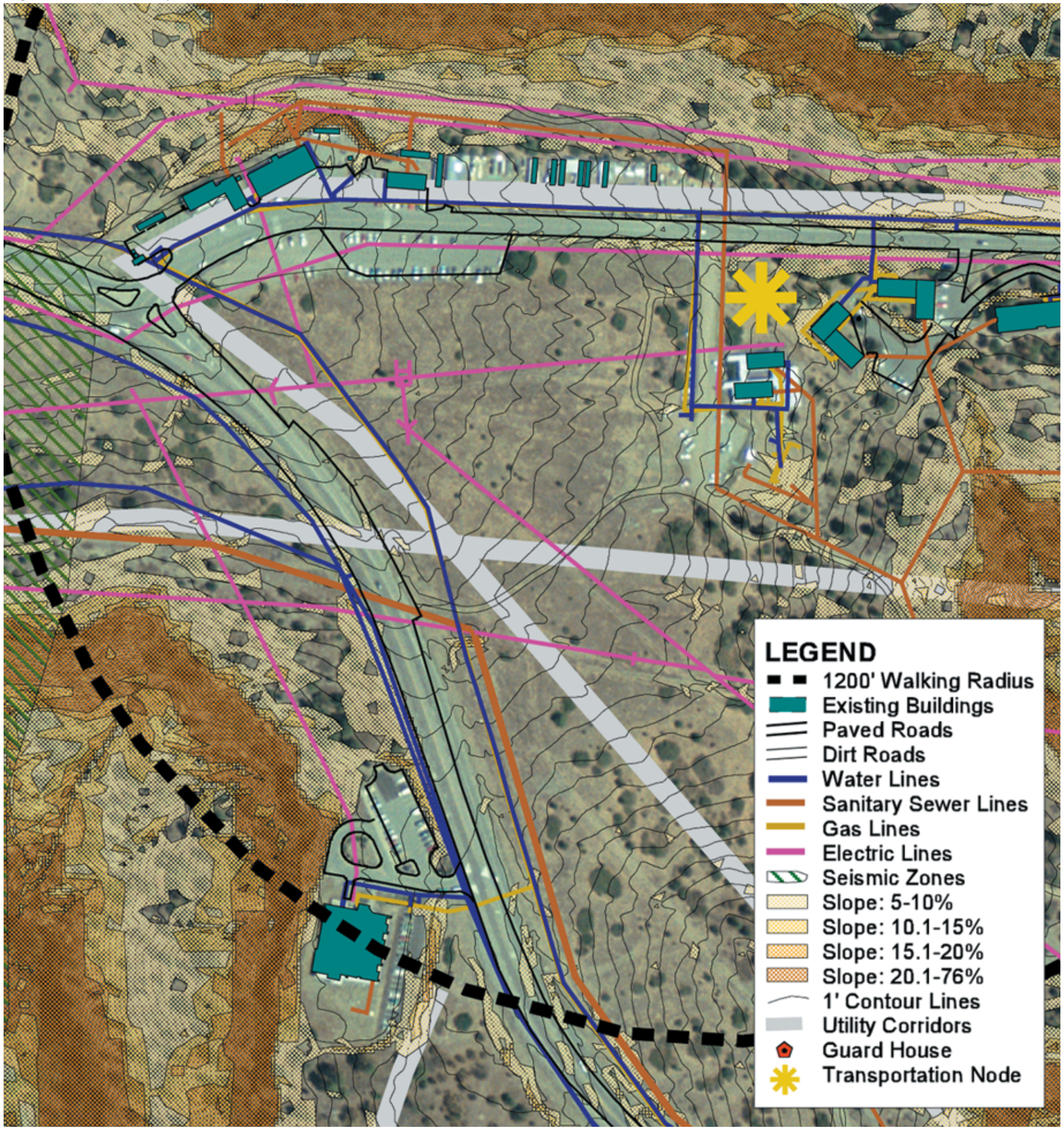
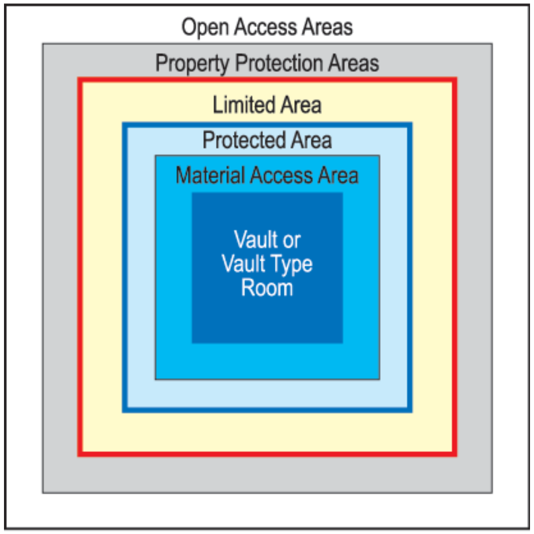
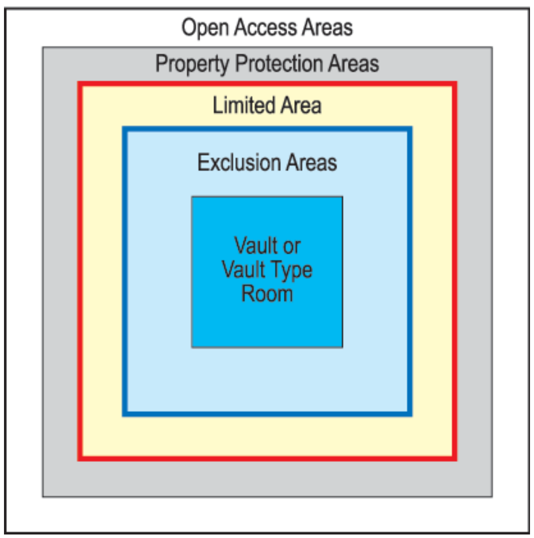


*Figure IV-11: Site Security Concept*

NUCLEAR MATERIAL PROTECTION




CLASSIFIED MATTER PROTECTION




## 6. Security Site Development Issues

Security considerations are critical when siting new facilities or redeveloping existing sites.

Site development goals related to security are:

- Provide site improvements that are appropriate to the security needs of the project area and the health and safety of employees, the public and the environment.
- Provide security improvements that are aesthetically integrated into overall site development.
- Promote personnel security by providing well lighted, "defensible-space" site and building designs.
- Incorporate effective and efficient protection measures into the design programs for new development.

Specific security requirements are defined for every project. This section identifies general security factors that affect site design.

### a. *Integrated Safeguards and Security Management (ISSM)*

The Laboratory's Integrated Safeguards and Security Management (ISSM) emphasizes a Laboratory-wide security culture and enhanced security performance, and establishes a unified management model for achieving cost-effective operations. The goal of ISSM is to achieve excellent safety, health and environmental performance and to meet business imperatives without violating safeguards and security requirements. The *Design Principles* support the goals of ISSM.

### b. *Security Principles*

The Laboratory's security principles are:

- Consolidate secure and hazardous functions and interests.
- Minimize public proximity to secure interests and safety areas.
- Limit public access to secure interests and safety areas.
- Enhance awareness of physical security and safeguard threats through education of all Laboratory personnel.

### c. *Security Siting Impacts*

High levels of security have greater impacts on site planning. Security requirements affecting the site design can include:

– specific location within a planning area
– size of development site
– buffers and setbacks from structures, parking and circulation routes
– physical relationship of structures and facilities on site
– circulation for pedestrians, vehicles and emergency services
– perimeter fencing and access controls
– utility corridor location and protection
– redundancy of utility distribution and source
– design of buildings and structures
– security interest housed or contained in a facility
– terrain management and landscaping
– exterior lighting requirements
– exterior signage

## d. Site Security Concept Description

Physical security is based on a "protection in-depth/graded protection" concept. This concept physically places the most important data, material, or persons in a highly controlled center surrounded by areas of decreasing levels of security. *Figure IV-11* illustrates the concept for both nuclear materials and classified matter.

## e. Security Designations / Locations

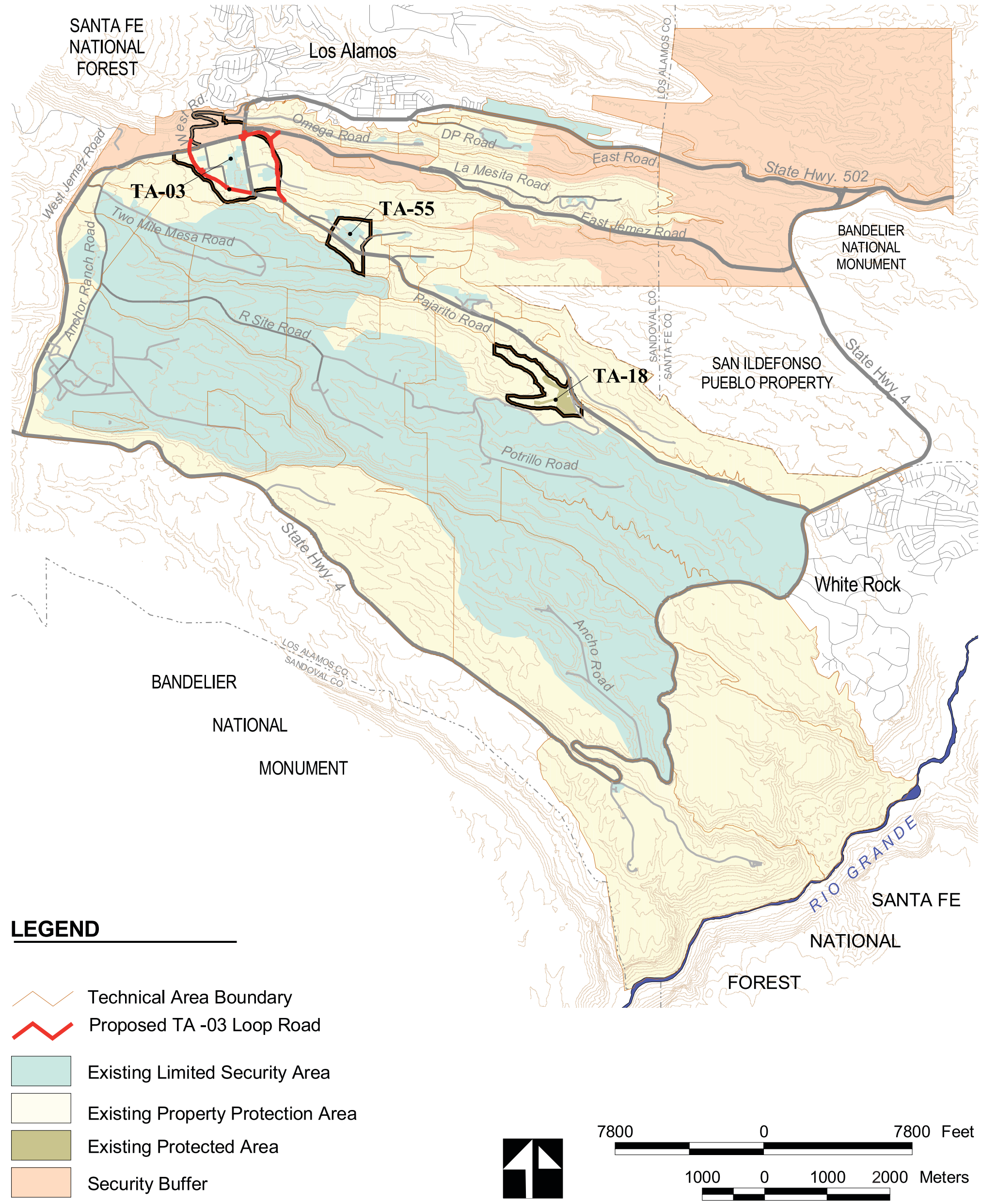
The level of security required for any project must be in compliance with the Safeguards and Security Division Security Plan. Overall site-wide security locations are shown on the Laboratory Security Plan *(Figure IV-12).*

## f. Security Elements Siting Approval

Siting of control gates, fences and other physical barriers must be approved by the Security Strategic Planning Team of S-1. Siting factors include:

- topography
- erosion and drainage
- disturbance to site by construction
- existing site functions
- maintenance requirements
- visual impact

*Figure IV-12: Site-wide Security Map*



## 7. Safety Site Development Issues

Recent fires at the Laboratory have emphasized the need for proper land use and site design to reduce risks from natural and man-made safety threats.

### a. *Fire Management Zones*

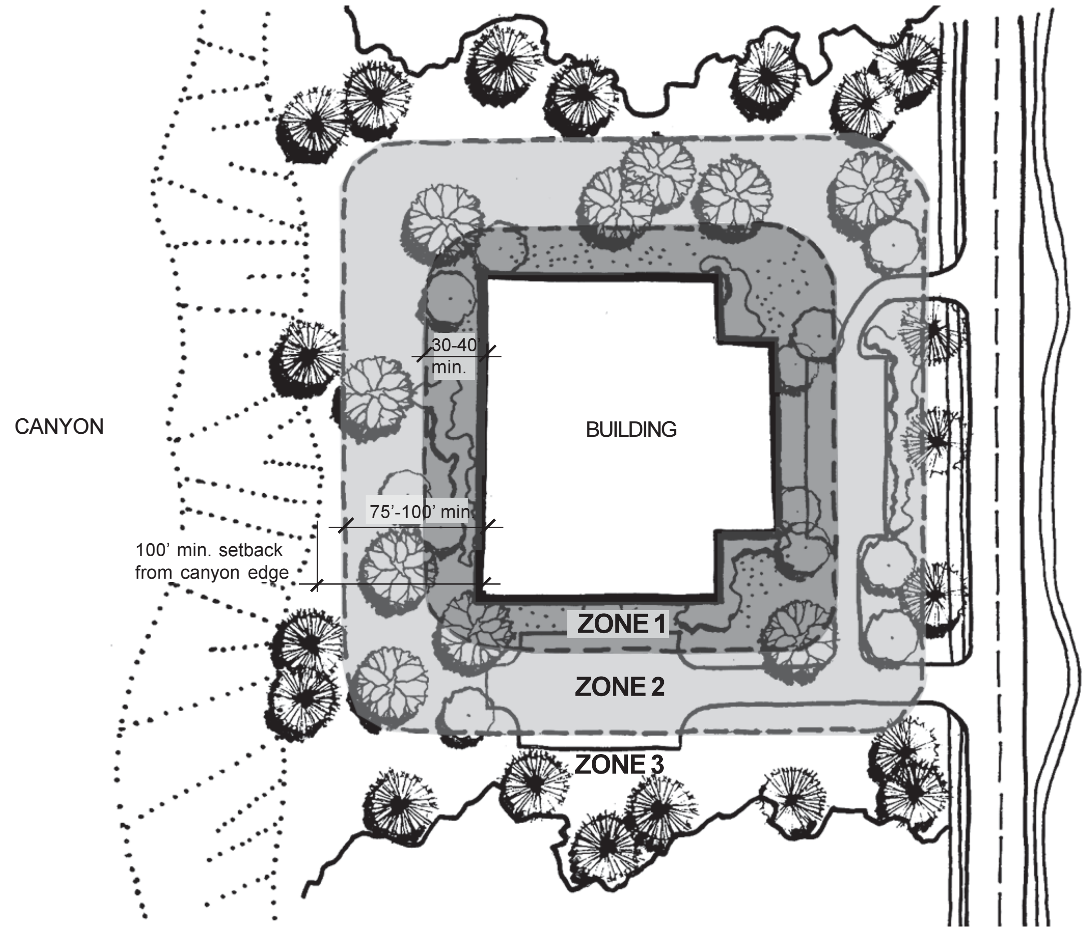
Three fire management zones should be maintained around buildings in roughly concentric areas to reduce fire risks (*Figure IV-13)*.

**Zone 1** is the main defensible space area. It is the area requiring maximum development modification and management. Its size depends on the structure size and the slope of the ground. Steeper slopes require larger defensible zones.

**Zone 2** is a transition zone between Zones 1 and 3. Management of this area is less intense than Zone 1 and focuses on reducing fuels and undergrowth beneath trees. The distance measurements for Zone 2 are similar to Zone 1, but combined they should extend at least 75-100 ft. from the structure.

**Zone 3** is an area of traditional forest management activities. The area extends from the outer edge of Zone 2 to the property boundaries. No specific size of zone is required.

*Figure IV-13: Fire Setback Guidelines Sketch*



### b. General Fire Risk Reduction Guidelines

- Set back all new structures 100 ft. from canyon edges to create a fire safety break (*Figures IV-13, IV-14, and IV-15*).
- Secure and hazardous facilities should have fire-retardant ground surfaces that extend 50 ft. from exterior walls of structures.
- Provide emergency and fire fighting access and improvements as required by the Laboratory.
- Provide space around buildings three stories and taller to position aerial fire apparatus (ladder, bucket, water tower, etc.). The space should be on at least one side and preferably two sides of each building. The space should be parallel to walls with windows.
- Separate fire lanes/roads and buildings with a distance of 10 ft. minimum and 50 ft. maximum.

*Figure IV-14: Fire Setback Guidelines Sketch / Development on Mesas*

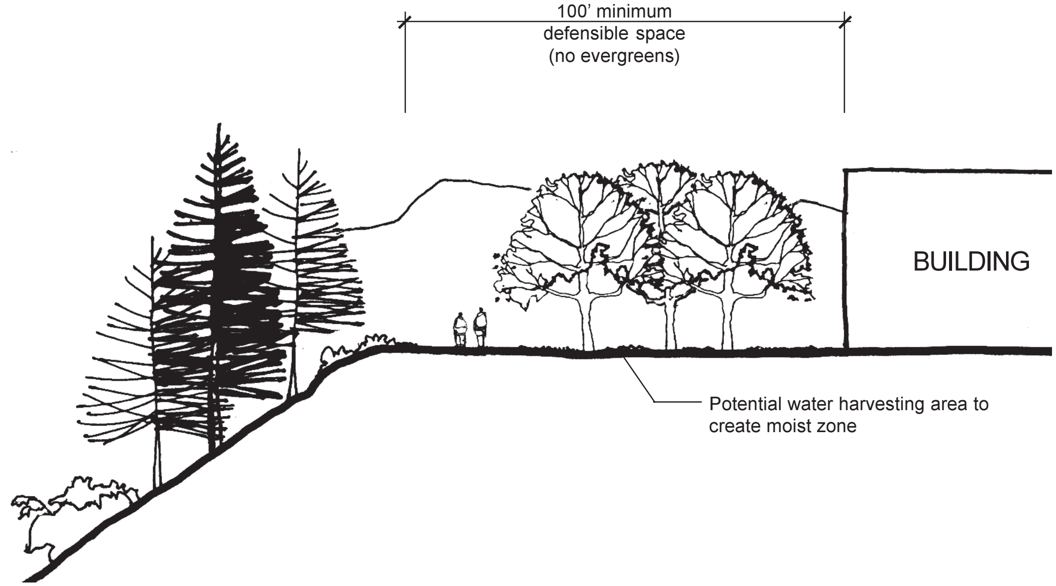
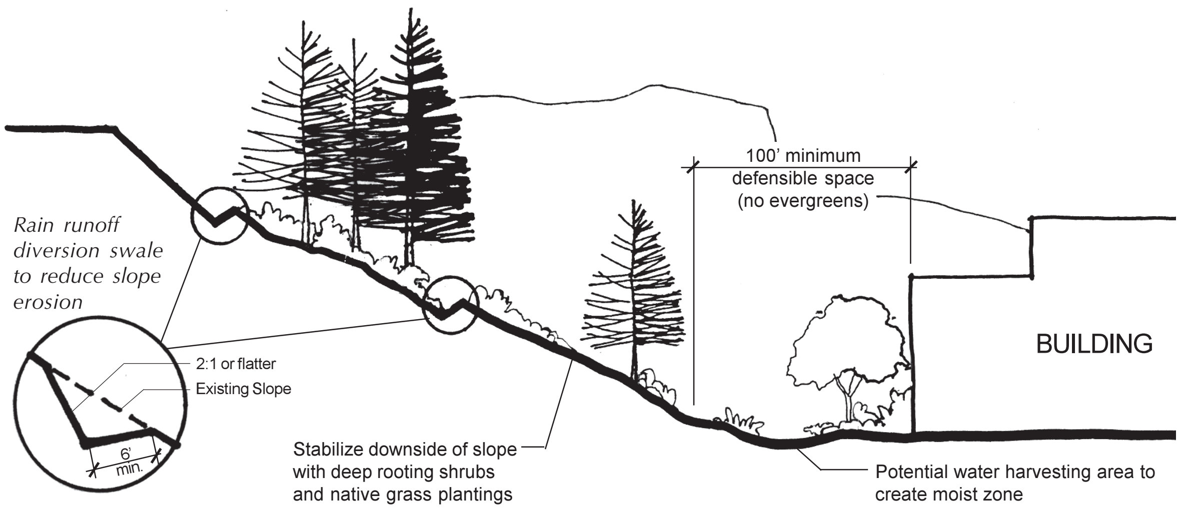



*Figure IV-15: Fire Setback Guidelines Sketch / Development in Canyons*



### c. *Landscape Fire Risk Reduction Guidelines*

Planting near structures should be selected based on fire-wise practices and consistent with the native environment.

- Install and maintain landscape improvements to allow passage around structures by the largest fire apparatus used by the Laboratory.
- Shrubs: Use low-growing shrubs to reduce the fire spreading potential. Specify non-resinous varieties when close to structures.
- Deciduous Trees: Use deciduous and ornamental trees in areas immediately adjacent to and between structures. Place native Aspen and Narrowleaf Cottonwood where sufficient soil moisture for healthy growth can be maintained.
- Evergreen Trees: Plant evergreen trees at a safe distance from structures. Prevent tree crowns from touching one another or buildings. Maintain a 5 to 10 ft. clearance between tree crowns at their mature spread.
- Prune trees to a bottom canopy height of about 8 ft. within Zone 1, gradually decreasing to a pruned bottom canopy of 5 ft. at the transition from Zone 2 to Zone 3.
- Beyond 75 ft. from structures, plant shade-tolerant native grasses under the forest trees to reduce ground fire potential.
- Setbacks and considerations for landscape development around structures on mesas and at the bottom of canyons or hillsides are illustrated in *Figures IV-14 and IV-15.*

### d. *Flood Reduction*

Identify areas subject to flooding and develop mitigation measures to reduce or eliminate flood potential. Typical flood mitigation measures include:

- Removal and prevention of development in 100-year flood zones.
- Set back construction from edges of flood zones at least 25 ft.
- Construct flood diversion structures and improvements with new development.

### e. *Safety Hazard Zones*

Safety hazard zones are restricted areas around materials or activities that either need protection or that need to be protected from access/exposure by the public and non authorized Laboratory staff. The zones can be applied to hazards from natural causes (wildfires) as well as man-made causes (toxic sites resulting from current or former Laboratory activities).

Safety hazard zones are usually physical spaces separating the particular hazard to be avoided or item(s) to be protected. Techniques used to establish the zone can range from restrictions on development such as building setbacks from canyon edges to avoid wildfire encroachment or fences or walls to restrict access.

## 8. Environmental/Cultural Resource Site Development Issues

As steward of 43 square miles, the Laboratory is committed to protecting the natural environment and mitigating development impacts on the natural and cultural resources of the site.

Environmental and cultural resource issues that affect site development are:

– threatened and endangered species habitat protection
– wetlands and riparian protection
– cultural resources protection and preservation
– water quality protection
– erosion control
– terrain management

### a. *Threatened and Endangered Species Habitat Protection Issues*

If a threatened and endangered species habitat (*Image IV-1*) is identified on a site proposed for development, the Environmental, Safety and Health (ESH) division will develop project specific mitigation, protection and/or management plans to be incorporated into the project program.

When designing and constructing new roads, identify the need for wildlife underpasses to minimize accidents between wildlife and vehicles. Consult with the Laboratory's ESH division on the type of underpass and placement.

### b. *Wetlands and Riparian Protection Issues*

If wetlands or riparian areas are identified on a site proposed for development, ESH will develop specific mitigation, protection and/or management plans to be incorporated into the project program.

### c. *Cultural Resources Protection and Preservation Issues*

If cultural resources (*Image IV-2*) are identified on a site proposed for development, ESH will develop specific mitigation, protection and/or management plans to be incorporated into the project program.

### d. *Water Quality Protection Issues*

Water quality protection deals with both maintaining and improving the quality of water in the natural environment and as a source for potable water.

Specific water quality requirements will be developed for projects by ESH. General guidance to protect water quality include:

- Identify water pollution sources from development and operation of the site. Common site development sources of water pollution are:
  - runoff from parking lots and roads
  - concentrated rainwater runoff
  - pesticide, herbicide and fertilizer use
  - road and walkways de-icing activities
  - construction debris and materials
- Create prevention, mitigation and/or management plans for each water pollution source.
- Use best management practices to address water quality problems. A partial list of method for addressing water quality problems are:
  - constructed wetlands
  - water quality ponds and channels
  - erosion control measures (see pg. 24)
  - terrain management measures (see pg. 24)

*Image IV-1: Endangered Species - Spotted Owl*

*Image IV-2: Cultural Resources - Omega Bridge*

### e. *Erosion Control Issues*

Advanced planning plays a significant role in effective erosion control. Erosion includes both water and wind erosion. General erosion control measures include:

- Develop an erosion control plan for all new development sites.
- Determine suitable locations for development and construction activities to avoid erosion.
- Identify erosion impacts caused by proposed actions on the erosion control plans. The erosion control plan may reveal potential impacts to adjacent sites and surrounding areas that affect the watershed areas beyond the installation boundaries. Wider impacts from erosion can be avoided, controlled, or mitigated.
- When erosion control vegetation is needed near high use, visually prominent areas, use ornamental plants able to withstand abuse from vehicles and pedestrians rather than native grasses and easily damaged vegetation.
- Incorporate some of the following strategies into the design of site improvements:
  1) Avoid increasing runoff.
  2) Slow runoff to allow percolation.
  3) Control the effects of water on steep slopes.
  4) Control drainage adjacent to buildings and structures.
  5) Design drainage channels to reduce and control runoff.
- Coordinate erosion control improvements with hydrologic and drainage requirements identified in the LEM.
- Identify soils that are highly susceptible to erosion in advance of any proposed actions.
- Identify best management practices and alternative methods for erosion control in each plan. A partial list of methods to consider are:
  1) *Surface controls*
     check dams (*Image IV-3*)
     straw bale barriers (*Figure IV-16*)
     riprap
     revegetation
     vegetative bioengineering (Figure *IV-17*)
     sediment fences and materials
     soil cement or stabilizers
     sediment ponds
     parallel grade swales (*Figure IV-73*)
  2) *Subsurface controls*
     mat and grid systems
     underground drainage systems.

### f. *Terrain Management Issues*

Terrain management involves the prevention of soil and earth movement and loss from development activities. Management methods include retaining walls, terraced grading, cut and fill slope maximums. Erosion control measures are often used for terrain management.

*Figure IV-16: Erosion Control - Straw Bale Barrier*

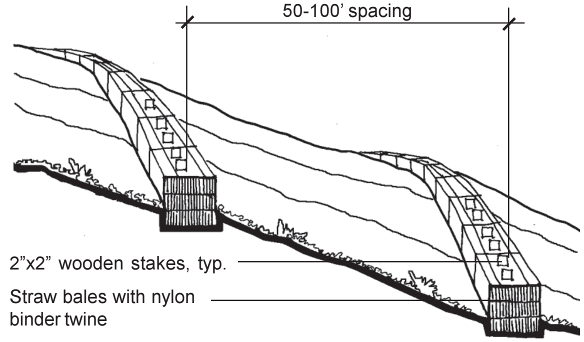



*Figure IV-17: Erosion Control - Bank Stabilization*

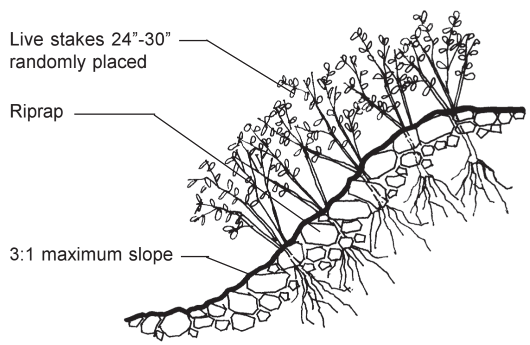
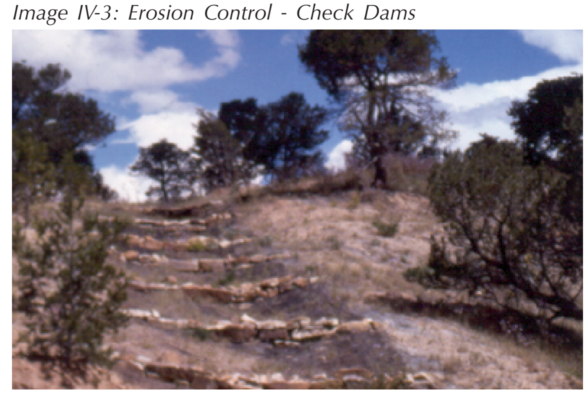



*Image IV-3: Erosion Control - Check Dams*



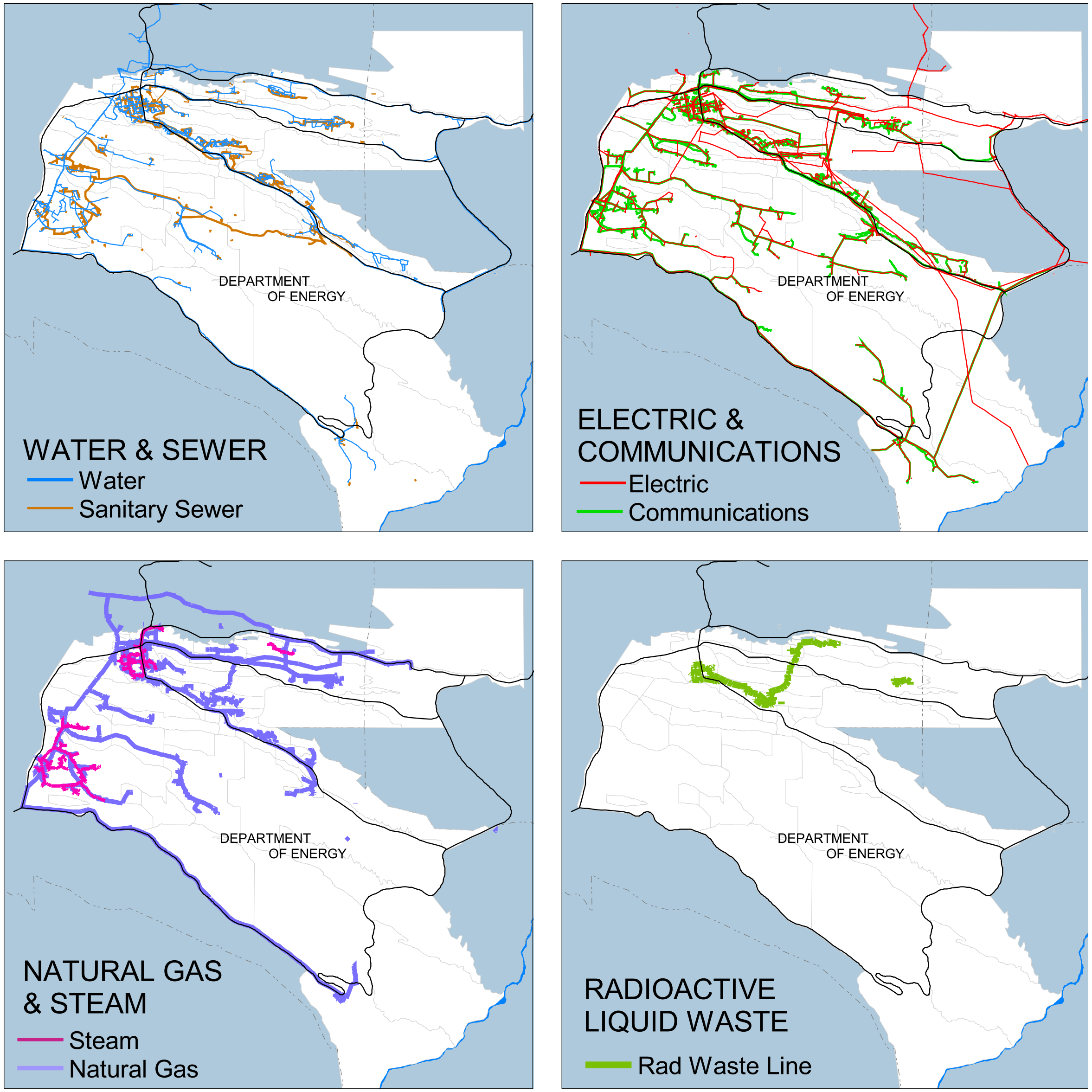
## 9. Utilities And Utility Corridors

Utilities supply critical services such as water, power, natural gas, steam, sewage treatment, telephone and communications services, and stormwater runoff. Their development impacts all sites. With proper coordination and placement, utilities improvements can be visually compatible and contribute to an attractive Laboratory environment.

### *Guidelines*

- Use utilities corridors identified in the *CSP, ADPs* and *Specific Area Master Plans*. *Figure IV-18* shows site-wide corridors.
- Develop a long-range program to place selected above ground utilities underground. Priorities can be based on the benefits to be realized such as operational cost savings, safety, security and visual improvements. Placing utilities underground is a safeguard during potential fire events.
- Place utilities underground on new projects.
- Integrate utility development with the planning of future structures, roads and pedestrian walkways.
- Develop an organized system of utility locations for each project that anticipates and allows access for maintenance, periodic repair/upgrading, or replacement.
- When utilities are located above ground, reduce their visual impact by using non-reflective materials and screening with planting, walls or fencing.
- Locate above ground structures away from public view when possible.

*Figure IV-18: Site Wide Utility Corridor Map*



- Place fire hydrants in clearly visible locations and maintain access to hydrants.
- Closely coordinate the placement of utilities within the streetscape to avoid conflicts. Plant materials, paving, site furnishings, signs and light fixtures should not complicate access for utility maintenance.
- Conceptual locations of utilities as related to roads and pedestrian corridors are illustrated in *Figures IV-19, IV-20 and IV-21*.

*Figure IV-19: Urban Arterial - Utility Corridor Section*

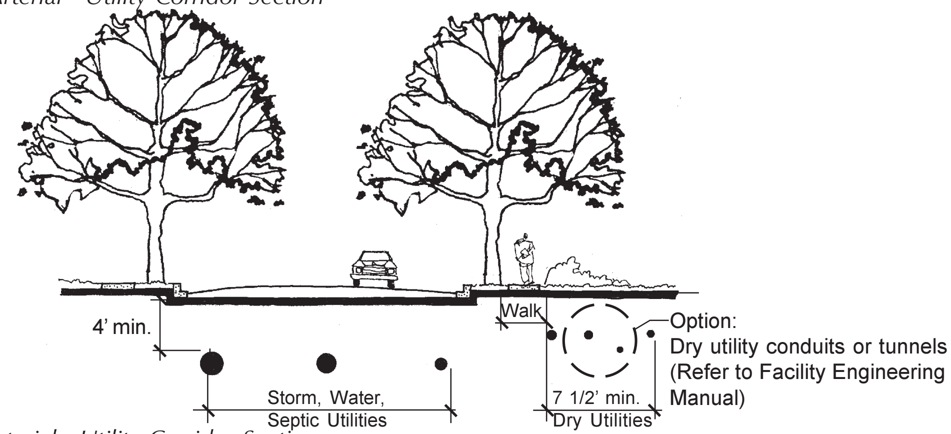



*Figure IV-20: Rural Arterial - Utility Corridor Section*

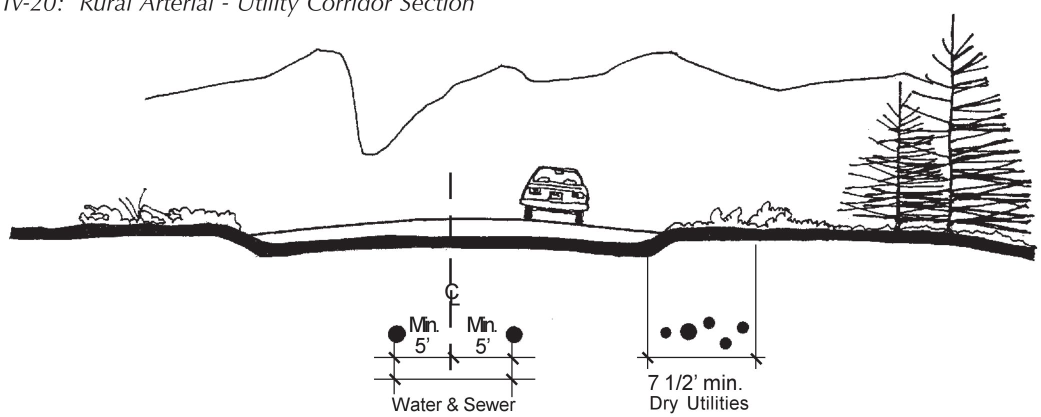



*Figure IV-21: Major Pedestrian Corridor - Utility Corridor Section*