IV. GUIDELINES FOR SITE DESIGN

C. LANDSCAPE ELEMENTS

C. LANDSCAPE ELEMENTS

Introduction

Landscape elements are the site amenities and furnishings that create livable exterior spaces. Landscape elements bring visual continuity to the diverse sites and projects throughout the Laboratory. Well designed landscape elements improve the image and function of the Laboratory work environment.

Landscape Elements include:

- Security features
- Signage
- Lighting
- Paving
- Site furnishings
- Planting

Principles

The principles for landscape elements are:

- Landscape elements should create an attractive, human-scale environment for visitors and staff.
- Landscape elements should be selected based on the rural or urban development character of the project site.
- Standards for landscape elements such as site furnishings, paving, lighting, plant materials and signage should be established and included in new developments.
- Landscape elements should be selected for durability, maintainability and appearance They should incorporate recycled and “green” material standards.
- Landscape design should enhance the natural landscape and promote the use of native, drought-tolerant and low-maintenance plant materials.
- Landscape plantings should encourage water harvesting and include water conserving practices and techniques.
- Landscape elements should support security needs with new innovative landscape designs and techniques.

References

Other Laboratory and industry documents to be used as references are:

SSSP
Site Safeguards and Security Plan

MUTCD
Manual of Uniform Traffic Control Devices

LEM
LANL Engineering Manual, LIR 220-03-01 (Chapter 7-Electrical, Chapter 4 Section 211-Landscaping)

IESNA
Illumination Engineering Society of North America, Lighting Handbook: Ninth Edition, 2000

NEC
National Electric Code, 1999

NMNSPA
New Mexico Night Sky Protection Act, {74-12-1 to 74-12-10 NMSA 1978}, 1999

ADA
Americans with Disabilities Act - ADA Guidelines

UFAS
Uniform Federal Accessibility Standards

Landscape Development Zones

Landscape element standards are based on being in one of two development zones: urban or rural. Each development zone is defined by its location, public visibility, and security requirements (see *Figure IV-61)*.

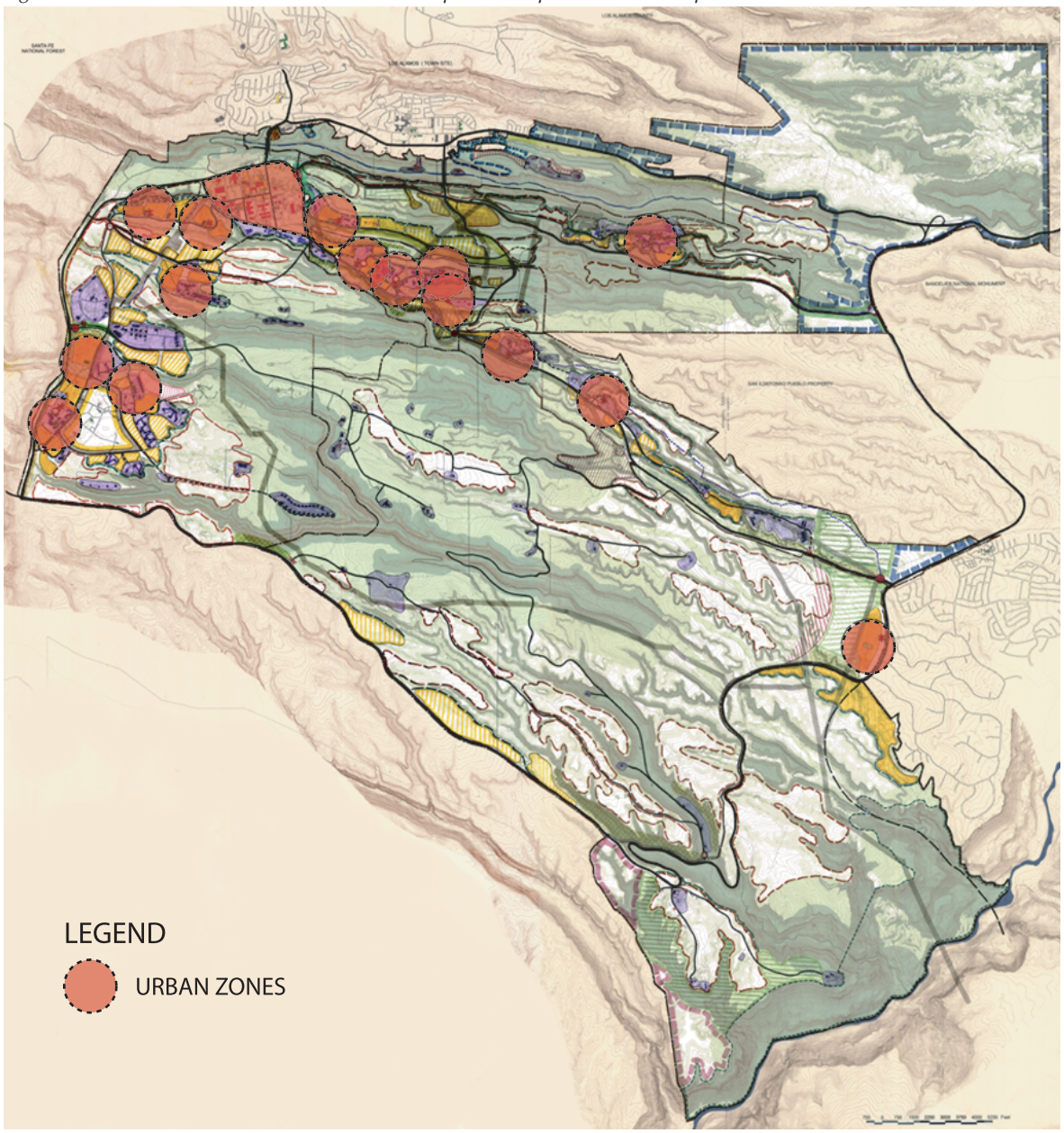
Urban Zone

Urban zones are characterized by dense concentrations of buildings, heavy traffic volumes and diversity of activities. Urban zones are noted on *Area Development Plans (ADPs)* as "centers." Examples of urban zones are TA-03, LANSCE, TA-55, and parts of TA-35.

Rural Zone

Rural zones are the remaining, less developed areas of the Laboratory. These zones are usually less populated, more isolated locations and closely surrounded by the natural environment. Examples of rural zones are TA-16 at Sigma Mesa and TA-54.

Figure IV-61: Sitewide Urban and Rural Landscape Development Zones Map



1. Security Elements

Security is an important function at the Laboratory. Properly designed security features can be effective and attractive and contribute to the visual appearance of the institution. *Images IV-12* and *IV-13* illustrate improvements possible through application of the guidelines.

The *Design Principles* encourage design opportunities for meeting security needs while improving the image of the site.

Security elements include:
- barriers
- gates
- fences
- walls
- bollards and jersey barriers
- buffer zones and landforms

a. Barriers

Barriers prevent passage or approach. They include limiting or restricting visual as well as physical access.

There are four types of barrier uses at the Laboratory:

- Limited access - Barriers that limit access to secure or classified areas or sites.
- Assets protection - Barriers that protect assets or sites from unauthorized access.
- Visual Screen - Barriers that visually screen unattractive areas from general view.
- Safety/Hazardous - Barriers that protect personnel from safety hazards.

Barriers must meet the required security level and should incorporate the design guidelines of the particular landscape development zone. See *Table IV-4* for recommended barrier materials.

Image IV-12: Before image of security fencing

Image IV-13: After security fencing upgrade concept

Guidelines

- Integrate barrier design with architectural style, colors and materials.
- Incorporate drainage and erosion control measures into the design of security fences and structures.
- Design and locate barriers for ease of maintenance.
- Barriers used to limit access and protect assets shall have a 20 ft. clear zone inside the barrier to facilitate visual supervision.
- Intrusion detection systems (IDS) should be integrated into the design of the barrier and access control systems. The selection of the particular IDS is determined by S-Division. Special design considerations for exterior IDS systems may include: topography, vegetation, wildlife, weather, soil conditions and background noise.
- Unacceptable barrier materials in any zone are:
  - wood or recycled wood
  - metal, plastic, or wooden slats woven in chain link fencing
  - plastic materials

Table IV-4: Barrier Materials

Barrier Materials								
■ preferred □ acceptable	**Limited Access**		**Asset Protection**		**Visual Screening**		**Safety Hazard**	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Gate, opaque					■	■		
Gate, visually open	■	■	■	■			■	■
Fabricated Structural Steel Fencing	■	■	■	■		■	■	■
Chain link fence, vinyl coated		■		■				■
Chain link fence, galvanized		■		■				■
Chain link fence, vinyl coated with vines					□	■		
Chain link fence, galvanized with vines						■		
Masonry wall, finish to match building	■	■	■	■	■	■	■	■
Concrete wall, finish to match building	■	■	■	■	■	■	■	■
Concrete interlocking wall units, colored	■	■	■	■			■	■
Bollard, fabricated finished steel	■	■	■	■			■	■
Bollard, pre-cast concrete	■	■	■	■			■	■
Bollard, steel pipe/filled concrete		■		■				■
Jersey Barrier, finish to match buildings	□	■		■			□	■
Jersey Barrier, standard concrete		■		■				■
Specilaized barriers (IDS)	As approved or required by S Division							

b. Gates

Gates are also barriers. Careful attention to the gate's appearance and its relationship to the surrounding buildings can result in a distinguished and attractive entrance. *Images IV-14, IV-15 and IV-16* are examples of well designed gates. Gate designs must comply with security requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Chain link gates are discouraged except where part of a chain link fence.
- Entrances and exits from secure areas and buildings shall be the minimum number required to meet operational requirements and safety concerns.
- Gates should permit visibility beyond the secure boundary.
- All gates are to be of steel manufacture.
- Gates used for visual screening such as trash and storage enclosures are to be constructed to be a minimum 33% opaque.
- Guardhouses should be designed to avoid fencing in front of or behind the guardhouse. Fencing should direct pedestrians to the guardhouse area or secured entry point.
- Gates may be designated to allow fire and emergency services access. The minimum gate width for fire and emergency access is 12 ft.

Image IV-14: Gatehouse Design Quality

Image IV-15: Pedestrian Turnstile

Image IV-16: Vehicular Gate

c. Fences

Fences, like gates, are barriers and can make a positive visual impact while meeting the security needs of a project. Fence designs must comply with requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Fence design should compliment the physical appearance of adjacent buildings and gate houses.
- The fencing layout should be planned as an integral part of the site and building plans.
- New project construction should begin with removal of existing fencing that is no longer required. Renovation of substandard obsolete fencing should be included with each construction project.
- Open fencing can provide visual screening when covered with dense vines or with tightly spaced bars or rails. Fences used for visual screening should be 33% opaque.

Image IV-17: Security Features Integrated w/ Site

Image IV-18: Raised Planter as Security Features

d. Walls

Walls can be designed to blend so well with the other site improvements that their function as security barriers is camouflaged. Walls used for security must comply with requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Wall materials appropriate for security barriers include:
  – masonry walls
  – concrete walls
  – jersey barrier walls
  – concrete interlocking unit systems
- Use wall materials that compliment the adjacent building colors and finishes.
- Walls used for visual screening should be a minimum of 6 ft. tall.
- Security walls can incorporate planters and seating in their design (*Figures IV-17 and IV-18*). The height and size of the planters and seating will depend on security requirements for the wall.
- Retaining walls are effective blast barriers as the soil retained by the wall provides additional mass.

e. Bollards and Jersey Barriers

Bollards and jersey barriers primarily restrict vehicular access (*Figures IV-62, IV-63 and IV-64*). Bollards and jersey barriers used for security must comply with requirements set by Security Division. Contact S-1 for guidance.

- Bollards should be a minimum of 30 inches tall.
- The maximum spacing for bollards is 6 ft. on center.
- Bollards should be heavy gauge structural steel or cast concrete. Wood bollards are not acceptable for any site.
- Provide removable bollards at secure locations needing emergency or service vehicle access.
- Bollards should be used in service areas, to protect transformers and other utility boxes and meters.
- Bollards and jersey barriers should be finished to enhance the site and compliment the surrounding architecture.
- Plantings integrated with bollards and jersey barriers can add additional protection and enhance the visual appearance of the barrier.

Figure IV-62: Barrier - Concrete Bollards

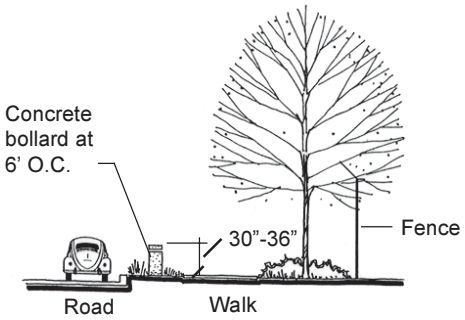


Figure IV-63: Jersey Barrier

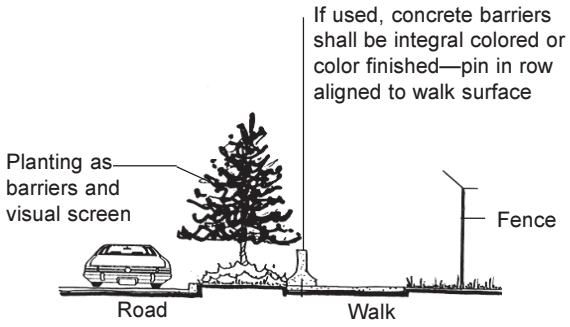


Figure IV-64: Barrier - Raised Planter

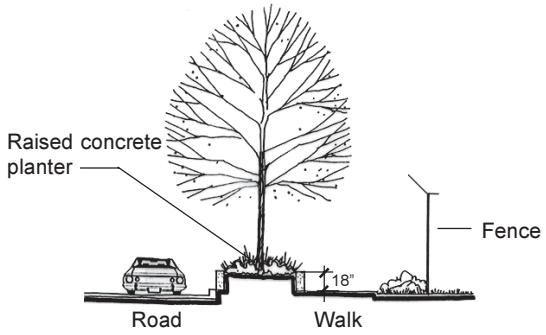


Figure IV-65: Barrier - Vertical Grade Change + Fence

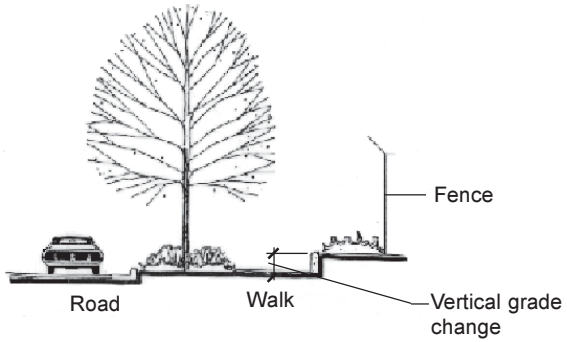


Figure IV-66: Barrier - Landscaped Berm

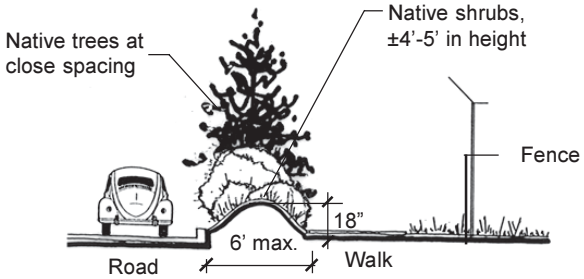
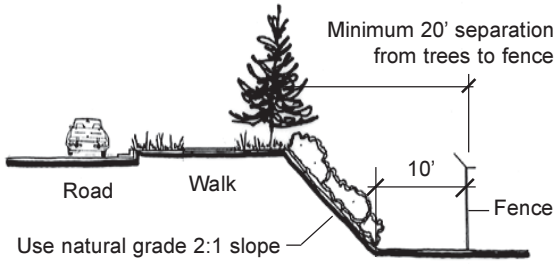


Figure IV-67: Barrier - Grade Change



f. Buffers and Landforms

Buffers and landforms use distance and natural slopes or grading to create barriers (*Figures IV-65, IV-66 and IV-67*). These barrier methods can enhance the landscape of the site while providing protection. Security buffers and landforms must comply with requirements set by Security Division. Contact S-1 for guidance.

1. Buffers

Buffer zones rely on distance to protect or screen an area. Required buffer distances are set by Security Division.

2. Landforms

Berms and swales are landforms that together with landscaping can provide asset protection, visual screening and an attractive landscape (*Figure IV-66*).

2. Signage

Signage is a communication system. It gives directions, provides information, regulates our conduct and identifies features in our environment. A signage system that communicates well improves the operations, safety and perception of the Laboratory.

Signage Categories

There are four categories of exterior signage
– identification
– directional
– regulatory
– interpretive

Principles

The underlying principles that guide signage at the Laboratory are:

- Create a unique identity by incorporating a Laboratory logo and standardized graphics into all orientation, identification, and directional signage
- Express a world-class research environment.
- Organize signage to reduce visual clutter and improve legibility.
- Promote safety and security through clear and legible information delivery.
- Replace old signs with new signs in accordance with current standards.
- Follow DOE, county, state, and Laboratory standards.

a. *Identification Signage*

There are five distinct categories of identification signs. These consist of various sizes depending on the size of the area identified.

1) Entry Identification - Laboratory

The Laboratory needs distinct entry monument identification signage at major entrances to the site. The entry monument identification signage conveys a sense of place and importance. The two entry monument identification sign types are:

- Primary entry identification (*Image IV-19*)
- Secondary entry identification *(Image IV-20*)

See *Figure IV-68* for entry monument locations.

Image IV-19: Primary Entry Signage

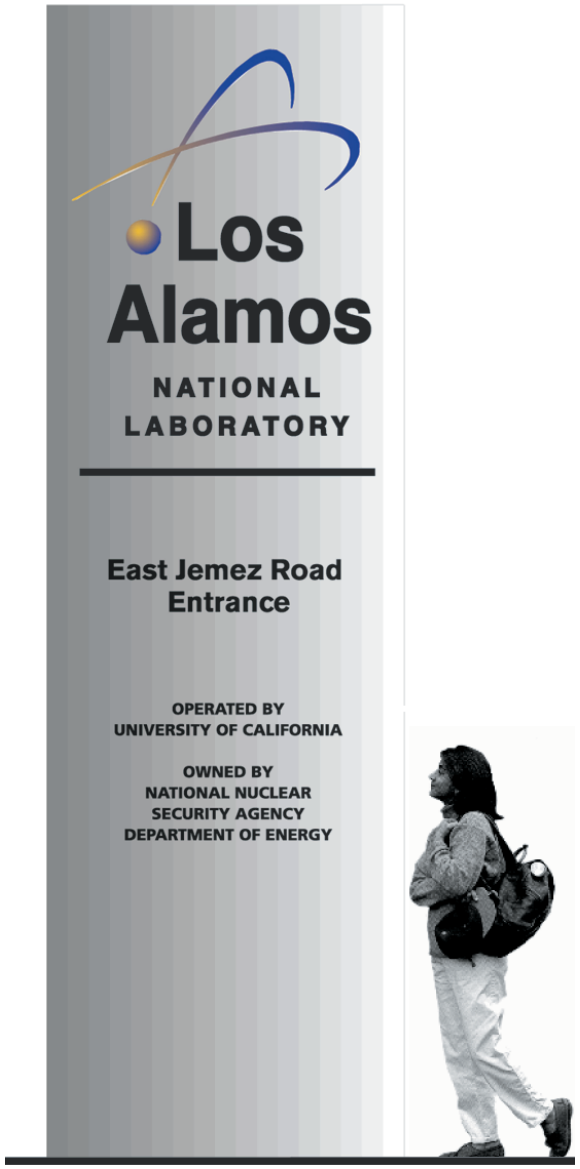


Figure IV-68: Entry Monument Locations Map

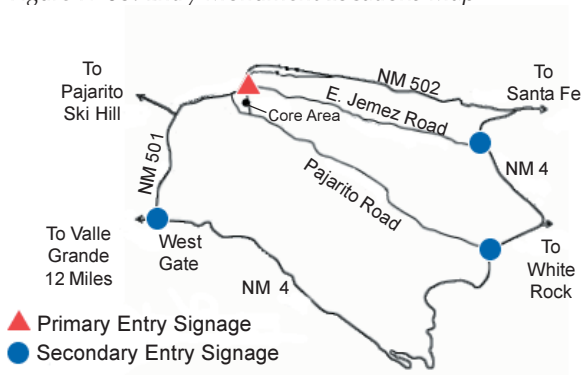
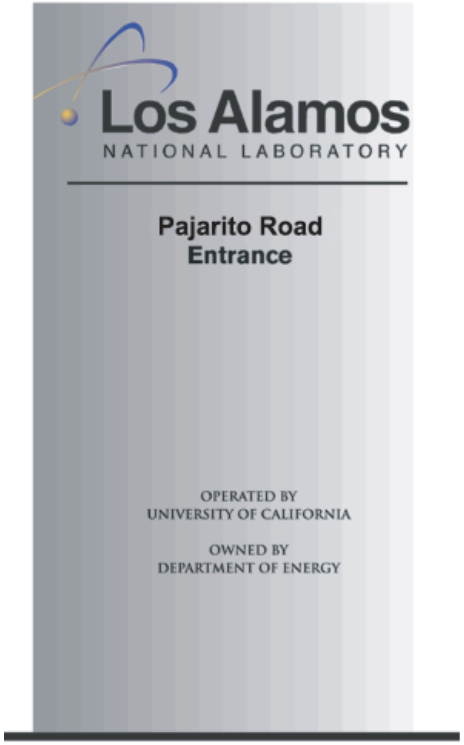


Image IV-20: Secondary Entry Signage



2) Planning Area Identification

The second signage category identifies planning areas at the Laboratory.

- Core Area
- Pajarito Corridor East
- Pajarito Corridor West
- Anchor Ranch
- LANSCE Mesa
- Omega West
- Sigma Mesa
- Dynamic Testing

Each area sign should communicate the same type and amount of information in a standard format as shown in *Image IV-21*.

3) Facility and Tech Area Identification

Identification signage for a major facility or tech area within a planning area is the next level of signage. Major facility signs are illustrated in *Image IV-24*. Tech Area signs follow the format of *Image IV-22*.

4) Building, Operation and Division Identification

Building, operation and division identification signs can be freestanding (*Image IV-25*) or building mounted (*Images IV-23 and IV-26*).

Image IV-21: Planning Area Identification (typical)

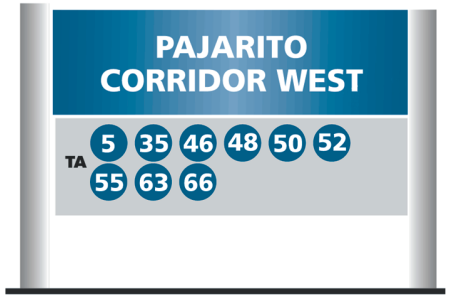


Image IV-22: Technical Area and Division Identification

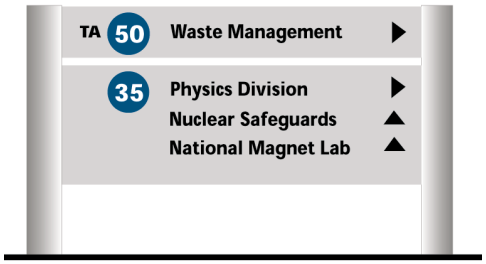


Image IV-23: Building Mounted Identification

Image IV-24: Facility Identification (typical)

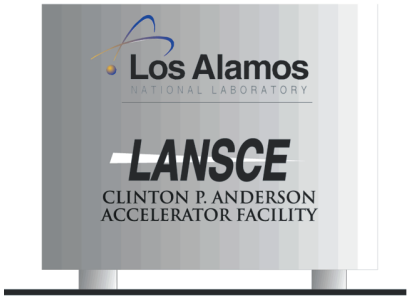


Image IV-25: Freestanding Building Identification

Image IV-26: Building MountedIdentification

b. Directional Signage

Directional signage has two categories that correspond to their use on specific roadways.

1) Major Roadway Directional

Directional signs for use on major arterials (*Image IV-27*) include directions to:

- planning areas
- tech areas

2) Interior Roadway Directional

Directional signs on interior roadways (*Image IV-28*) give directions to:

- tech areas
- divisions
- operations
- buildings

Image IV-27: Major Roadway Directional

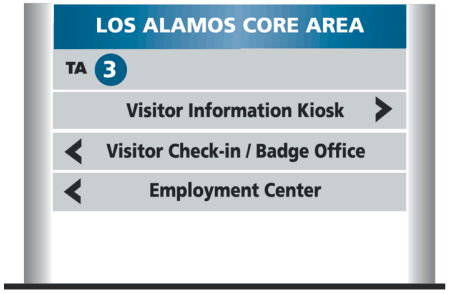
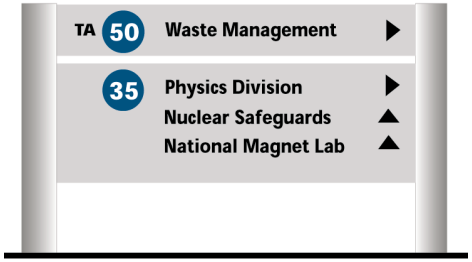


Image IV-28: Interior Roadway Directional



c. Regulatory Signage

The two categories of regulatory signs are:

1) Traffic Control

Regulatory signage (*Image IV-29*) communicating traffic control information includes:

- roadway (stop signs, speed limit postings)
- parking
- street identification

2) Safety and Security

Safety and security signage (*Image IV-30*) can be used at any of the following levels:

- site-wide
- specific areas
- building entries

Image IV-29: Traffic Control

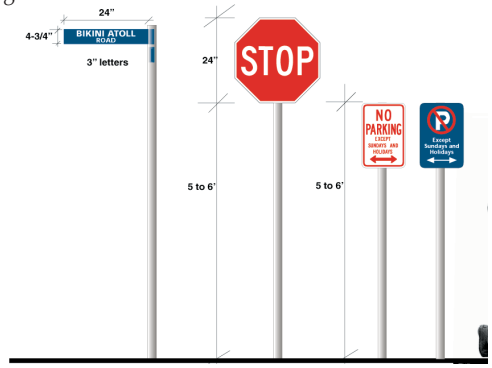
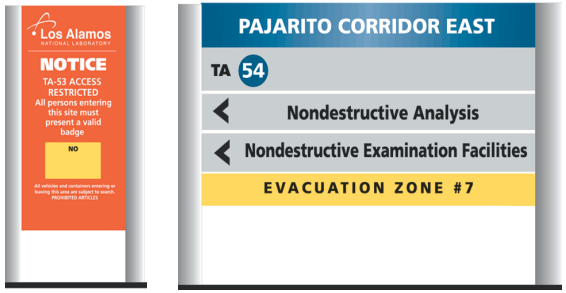


Image IV-30: Vehicular Safety and Security



d. Interpretive / Wayfinding Signage

This category of signage gives directional and interpretive information for pedestrians, visitors and public transportation patrons.

1) Pedestrian / Trail / Bicycle

Interpretive signage for pedestrians and bicyclist include:

– trail markers
– directionals

2) Visitor

Visitors signage includes:

– welcome information
– directionals (parking, destination routes)
– interpretive pull-offs (for historical or explanatory information at a site or building) (*Image IV-31*)

3) Public Transit

Interpretive signage for public transit includes:

– bus marker routes (*Image IV-32*)
– bus schedules and information

Image IV-31: Interpretive Signage

Image IV-32: Transit and Pedestrian Signage

3. Exterior Lighting

Lighting at the Laboratory provides protective lighting for securing the site. Security to operate well needs lighting standards that are consistent, reliable, and uniform.

Lighting standards for design and fixtures are needed for the following zones:

- roadways
- parking areas
- building areas
- pedestrian areas
- security areas

Principles

The following exterior lighting principles guide the location, fixture selection, and installation of lighting.

- Exterior lighting should create a hierarchy of fixtures to organize the lighting of the site.
- Exterior lighting should increase site safety and security through establishing illumination standards for different functions and areas of the Laboratory.
- Exterior lighting fixtures should reinforce a Laboratory image of "Science and Technology" *(Images IV-33* and *IV-34).*
- Exterior lighting fixtures should be selected for functional compatibility, cost-efficiency, energy efficiency, visual consistency and ease of maintenance.
- The exterior lighting system should accommodate the unique uses, functions and constraints of the Laboratory.
- The exterior lighting system should strive to reduce the negative environmental effects of outdoor lighting by incorporating light controls, monitoring operating times, minimizing light trespass and reducing light intensities where possible.

Image IV-33: Lighting - Structural (Kim Lighting)

Image IV-34: Lighting - Mitre (Architectural Area Lighting)

a. General Exterior Lighting

1) General Area Lighting

- For general illumination levels, see *Table IV-5*.
- Maintain exterior lighting standards and recommended levels set by the Laboratory Engineering Manuals *(LEM)*, IESNA Lighting Handbook, and the New Mexico Night Sky Protection Act.
- Limit light trespass to 0.5 footcandles, 10 ft. beyond the design area boundary.

2) Wall Mounted Fixtures

- Where possible use pole-mounted instead of building-mounted area lighting.
- Select wall mounted fixtures on buildings and at entrances to compliment the building architectural style and to comply with security requirements.

3) Pole Mounted Fixtures

- Use pole-mounted fixtures heights for areas as noted on *Figures IV-69 and IV-70*.
- Poles should be tapered, round aluminum with a brushed or anodized finish or tapered round galvanized steel poles. Poles should be designed to withstand extreme wind loads of 80 m.p.h. with a 1.3 gust factor.
- Do not use wood light poles.
- Structurally engineer light pole bases in parking areas and extend 30" above grade.

4) Controls

- Provide a central timer, photocell and/or motion sensor control for all exterior lighting unless specific security requirements apply.
- Provide lightning protection as required by the *LEM*.

Figure IV-69: Recommended Pole Heights

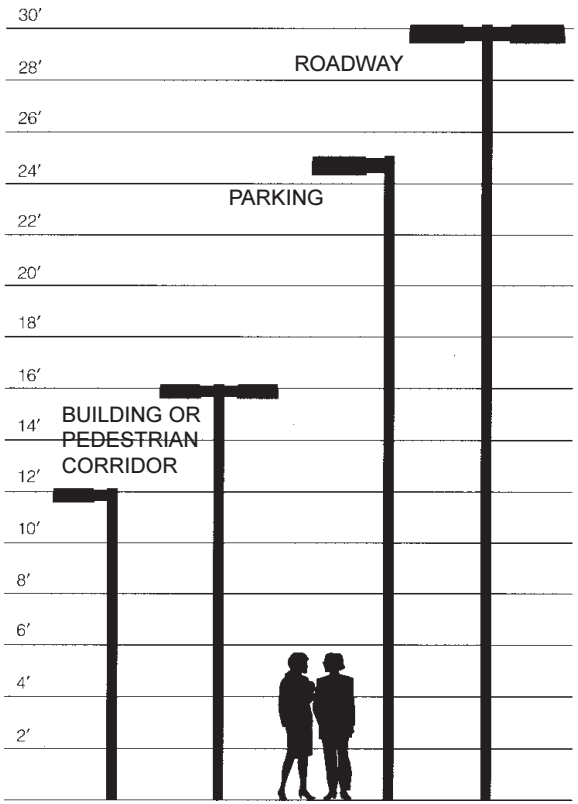
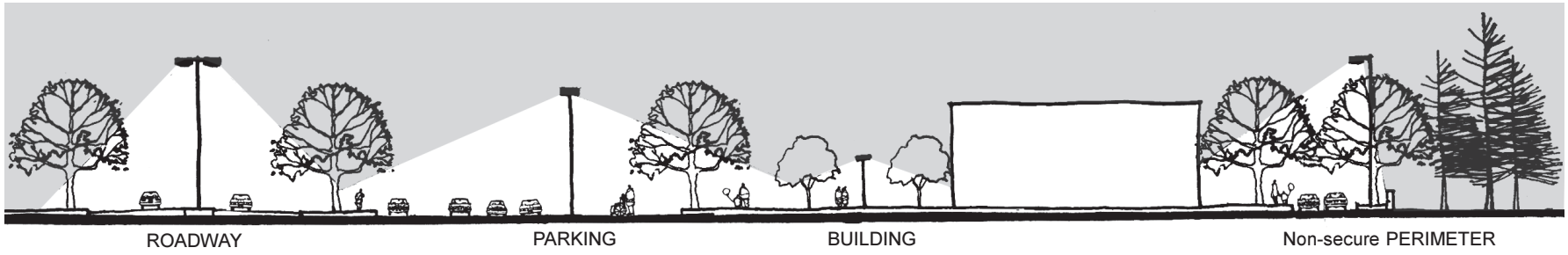


Figure IV-70: Lighting Areas



5) Luminaires

- All exterior luminaries shall be "full cutoff" type as defined in the IESNA Lighting Handbook. Only luminaires with zero candela intensity at 90 degrees above nadir and less than 100 candela at 80 degrees above nadir are considered "full cutoff."

6) Lamps

- For general site lighting, use color-corrected, high-pressure sodium lamps.
- For landscape, accent, and signage lighting use a maximum of 150 watts incandescent
- For internally illuminated signage use fluorescent lamps with low temperature ballasts and conform to Laboratory signage standards.
- The use of incandescent lamps is discouraged.

7) Placement

- Maintain a 1 ft. setback from paving for light fixtures in planting areas.
- Minimize planting near light poles for maintenance access.

b. Security Lighting

Protective illumination should be provided to permit detection and assessment of adversaries and to reveal unauthorized persons. Provide lighting as specified by DOE and S-1 requirements and as listed below:

- Protective lighting in protected areas, material access areas, and vital areas should be designed to provide 24-hour visual assessment.
- Lights should provide a minimum two (2) footcandle (fc) illumination at ground level for at least a 30 ft. diameter around protective personnel posts, and two (2) footcandle illumination for 150 ft. in all directions.
- Where protective lighting at remote locations is not feasible, patrols and fixed post locations may be equipped with night vision devices.
- Minimize glare where it impedes effective operations of protective personnel, is adjacent to highway or is objectionable to occupants of adjacent properties.
- Light sources on protected perimeters should be located so that illumination is directed outward wherever possible.
- If sodium vapor or other High Intensity Discharge (HID) lamps are used in isolation zones, then alternate lighting should be available in the event that power is lost and to cover the time before the HID lamps can be relighted (about three minutes). Both the HID lamps and the alternate lighting shall be connected to primary and standby power.

Table IV-5: Selected Required Luminance - IESNA Standards

Area	*Luminance Average (fc)*
Roadways	
Major arterial urban	0.6
Collector and transitway	0.6
Local urban	0.4
Parking Areas	0.5
Building Areas	
Entrances	5.0
Service areas	2.0
Pedestrian Areas	
Plazas	1.0
Sidewalks	
Roadside	0.2
Pedestrian Ways	0.5

4. Paving

Paving is the man-made surface upon which we walk, run, drive and bike. The stability and design of different paving surfaces determines the ease with which we can use those surfaces. Changes in material color and surface finishes can create visual interest.

Paving falls into two general classifications: hard and soft. Appropriate hard and soft paving materials for the Laboratory and their recommended uses are listed on *Table IV-6*.

Guidelines

- Design paved areas to accommodate emergency vehicle and fire department apparatus access, per NFPA 1141.
- Use specialty paving treatments to accent special areas such crosswalks, primary pedestrian corridors, plazas, courtyards, and other key pedestrian zones.
- Use paving to clearly differentiate between pedestrian and vehicular traffic.
- Match all repairs and patches to pavements, curbs and gutters to the original paving form, color, and material.
- Use asphalt or crusher fines for remote low-volume pedestrian paths.
- Where utility lines lie beneath the paving, use unit pavers such as brick or interlocking concrete pavers. They permit easy access, quick repair, and can be reused.

Table IV-6: Paving Materials

PAVING MATERIALS		FIELD PAVING		EDGING		TRAIL PAVING	
		URBAN	RURAL	URBAN	RURAL	ACCESSIBLE	NON-ACCESSIBLE
HARD PAVING							
Concrete	**Cast-in-place**	■	■	■	■		
	Stained	■	■	■	■		
	Integral Color	■	■	■	■		
	Patterned	■	■				
Brick		■	■	■			
Precast Concrete Pavers		■	■	■			
Unipavers		■	■				
Stone Pavers	**Granite**	■		■			
	Porphyry	■		■			
Asphalt						■	
SOFT PAVING							
Decomposed Granite						■	
Crushed Stone with Fines						■	
Gravel							■
Bark Mulch							■
Compacted Soil with Binder						■	

a. Hard Paving Surfaces

- Use hard paving materials that provide a firm, regular, even surface in high-traffic areas.
- Provide paving with a nonskid finish to prevent slipping; expansion joints should be narrow and filled to the surface (*Image IV-35*).
- Avoid irregular hard paving material such as cobble, bomanite, flagstone, or highly textured concrete on accessible routes.
- Avoid exposed aggregate concrete. It is unstable under freeze/thaw conditions.
- Use poured-in-place concrete for its durability, ease of installation, versatile appearance and relatively low expense.
- Use integrally colored concrete, bomanite, and stained concrete products in urban areas with heavy traffic. Select colors that are compatible with the adjacent architecture or the natural landscape.
- Limit brick or stone paving materials to accent areas, such as the entries to buildings, sitting areas and on major pedestrian corridors (*Image IV-36*).
- Use interlocking concrete pavers as accent paving in major pedestrian corridors and building entries (*Image IV-37)*. Interlocking concrete pavers are the best choice when paving over utility lines.
- Control weed growth in unit paving materials like brick or interlocking pavers by placing a geotextile weed barrier beneath the sand bedding layer.
- Asphalt is an inexpensive and flexible surface. Limit asphalt paving for walks to rural paths or trails. Install over an engineered basecourse to extend the life of asphalt surfaces and to reduce maintenance.

b. Soft Paving Surfaces

Soft paving surfaces include decomposed granite, bark, soil, crusher fines and other granular materials.

- Reserve soft paving materials for pedestrian circulation routes with low-volume uses such as trails and rural bike paths.
- Materials that cannot be firmly compacted, such as sand, gravel or bark are not recommended for running or biking surfaces. Sand, gravel and bark are not considered accessible surfaces and should be restricted to rural low volume areas.
- In urban areas, stabilize soft paving materials with an edging such as a concrete or metal edging to contain the material, minimize erosion and reduce maintenance.

Image IV-35: Textured Concrete Paving Finish Patterns

Image IV-36: Paver/Drain/Curb Example

Image IV-35: Stone Pavers Uni-decor

5. Site Furnishings

Site furnishings, used consistently, reinforce the importance of pedestrian spaces. They provide the amenities that make developed outdoor spaces usable and comfortable for people.

Site furnishings include:
- benches
- picnic tables
- trash and ash receptacles
- bicycle racks
- transit shelters

Image IV-38: Coordinated Site Elements

Guidelines

- Select furnishings made of durable, low maintenance and sustainable materials such as metal and recycled wood or plastic able to withstand extreme ultraviolet exposure .
- Coordinate site furnishings to compliment each other and the surrounding architecture (*Image IV-38*).
- Install furnishings on paved surfaces for ease of access and maintenance.
- Select site furnishing models that are handicapped accessible.
- Place site furnishings in convenient and useful locations. Densely populated areas, major plazas and pedestrian corridors should receive the highest level of treatment in terms of the number and variety of site furnishings.
- Site furnishings along pedestrian corridors and sidewalks should be out of the flow of traffic. Furnishings should be clustered to consolidate space.
- Place furnishings in locations that maintain access to buildings, fire hydrants and other safety and security elements.
- Flagpoles, fountains and public art should be used in prominent, highly visible areas.
- Locate seating areas in shaded locations when possible.

a. Benches

- Locate benches on walk edge farthest from the street in shaded locations when possible.
- Set benches at bus stops a minimum of 4 ft. from the face of the curb.
- Benches should be 6 ft. long minimum.
- Do not use wood benches.
- On walkways 6 ft. or less in width, provide an adjacent pad for bench placement.
- See *Images IV-39a and IV-39b* for the recommended benchs.

Image IV-39a: Recommended Bench-Urban Area

Image IV-39b: Recommended Bench - Rural Area

b. *Picnic Tables*

- Provide rectangular tables 6 ft. minimum.
- Use two seat tables only in areas where the demand for such tables exists.
- Provide handicapped access to at least one side of tables.
- Install tables on paved level pads with paved access to pad.
- See *Images IV-40a and IV-40b* for the recommended picnic table.

c. *Trash and Ash Receptacles*

- Provide 30-32 gal. receptacles with plastic liners.
- Locate receptacles near key activity nodes where people gather or traverse.
- Place receptacles on paved surfaces with easy access for trash collection.
- Place trash receptacles a minimum of 6 ft. from benches or seating areas.
- Secure trash receptacles to the ground.
- See *Images IV-41a* and *IV-41b* for the recommended trash receptacle.

d. *Bicycle Racks*

- Provide a minimum clearance of 15 ft. between bicycle racks and security features or buildings.
- Place racks on paved surfaces and in well-lighted areas.
- Allow a 2 ft. wide by 5 ft. long space for each bicycle rack.
- See *Image IV-42* for the recommended bicycle racks.

Image IV-40a: Recommended Picnic Bench-Urban Area

Image IV-41a: Recommended Trash Receptacle-Urban Area

Image IV-40b: Recommended Picnic Bench-Rural Area

Image IV-41b: Recommended Trash Receptacle-Rural Area

Image IV-42: Recommended Bicycle Rack

e. *Transit Shelters*

- Use the Laboratory standard design transit shelter.
- Provide modular transit shelters that can be easily adapted to several different sizes and are structured to resist local wind and snow loads.
- Specify colors that have a semi flat finish to reduce glare and are cool to the touch when in direct sunlight.
- Place shelters on paved surfaces.
- Allow a minimum clearance of 6 ft. between transit shelters and the face of the curb for pedestrian traffic.
- See *Images IV-43 and IV-44* for the recommended small and large transit shelters.

Image IV-43: Transit Shelter (small)

Image IV-44: Transit Shelter (large)

6. Planting Design

Plant materials can enhance the relation of the Laboratory to its surrounding natural environment. Plants used in the landscape of the Laboratory must be very low-maintenance, minimize irrigation water use, maximize harvested rainwater and provide an attractive setting for visitors and staff.

Plant design includes:
- xeriscape techniques
- water management zones
- environmental amelioration
- wildlife planting

Principles

The following planting design principles should be employed:

- Plant design should preserve and enhance existing natural landforms and vegetation.
- Plant design should emphasize the use of native and drought-tolerant, low-maintenance plant materials.
- Plant design solutions should minimize adverse impacts on the natural habitat.
- Plant design and maintenance should reduce fertilizer and pesticide pollution by using integrated pest management techniques, recycle green waste, and minimize runoff by using water harvesting methods.
- Plant design should include the installation of reliable, low-flow, water-efficient irrigation systems to establish plants in the initial years.
- Plant design should incorporate energy conservation and resource management concerns.

Image IV-45: Grass Mowing

Image IV-46: Native Blue Grama Grass As Lawn

Image IV-47: Coyote Willow - Native Riparian Plant

Image IV-48: Native Sheep Fescue Grass

Image IV-49: Xeric Planting

Image IV-50: Wildlife Habitat Planting

a. Xeriscape Landscape Principles

The Laboratory has a strong commitment to using xeriscape principles for landscape development to reduce the demand for irrigation water and to integrate with the natural environment of Los Alamos (*Image IV-49*). The following are the six xeriscape principles.

1) Minimize turf areas

Use native grasses (*Image IV-48*) instead of bluegrass and fescue lawns. Buffalo grass or Blue Grama Grass (*Image IV-46*) are suitable warm-season native grasses for use as lawn areas.

2) Improve the soil

Improving the soil provides the following benefits:

- Plants will grow better and use water more effectively and efficiently.
- Rainfall will more readily be absorbed by the soil, hereby reducing runoff and erosion, and acting as a supplemental water supply.

Soils can vary greatly over an installation or even on a job site. Use a soil analysis to determine the exact soil improvements needed. Although native plants in the region may not require soil improvements to thrive, the addition of organic soil allows better absorption of water and provides beneficial nutrients for plants.

3) Irrigate efficiently

Irrigating xeriscape plants slowly, deeply, and infrequently is the most desired irrigation pattern. Designing irrigation systems using drip emitters, low volume spray heads, matched precipitation heads, flow meters, controllers with rainfall sensors, and automated systems are a few of the many ways that irrigation can reduce water demand.

4) Select water-efficient plants

Cluster plants with similar water requirements to simplify irrigation system design and maintenance needs. Create watering zones (hydrozones) based on site conditions, plant material, water needs, and microclimates. The landscape design can be organized into three hydrozones, see *Figure IV-71*:

Outer Hydrozone

The outer hydrozone should be the largest planting zone. It is the natural area of the site and the edges of the developed cores. Plants chosen for this zone should be natives or very hardy plants with extremely low water requirements. Once established, these plants should require little to no irrigation and require only seasonal maintenance such as weed control and occasional pruning.

Intermediate Hydrozone

The intermediate zone is the transitional area between the inner and outer zones. Plants in this zone may require limited supplemental irrigation to augment natural precipitation. Opportunities to use runoff from paved areas or roof drains should be utilized (*Figure IV-72*). Plant densities are

reduced as compared to the inner zone. Overall maintenance and water use should be controlled and limited in this zone.

Inner Hydrozone

The inner zone should be limited to high-visibility areas in terms of appearance, image, and usage. Some rural areas of the Laboratory may not have inner hydrozone landscape areas. This zone may have a higher water use than the other hydorozones. Water-loving plants can be used in this zone if placed where irrigation or other runoff can be collected or redirected to support the plants. Long-term maintenance of this zone is critical.

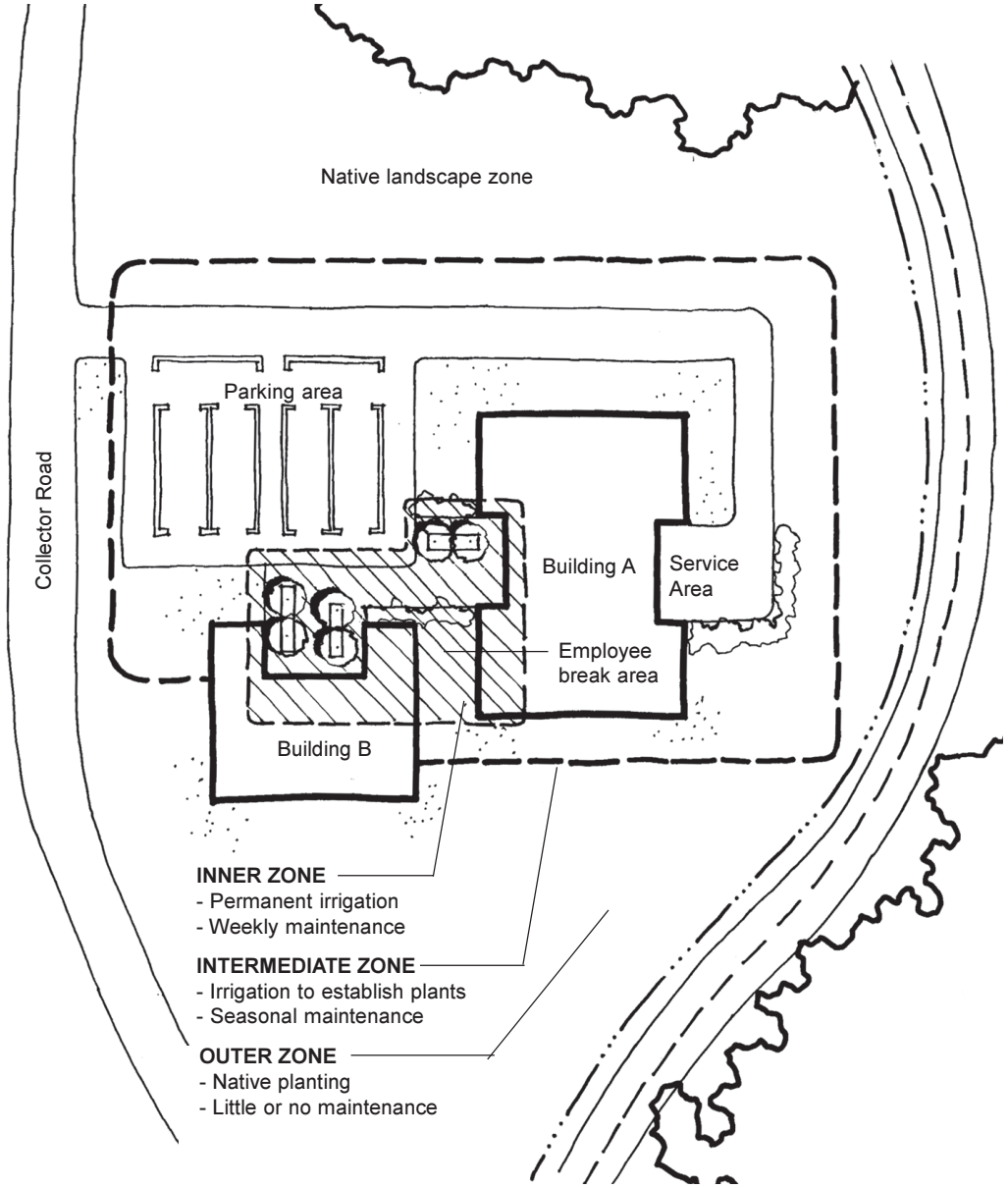
5) Use Mulches

Organic or inert mulches applied to proper depths will reduce water needs and weed growth while providing visual interest and surface erosion control. Organic mulches such as pine needles, crushed pecan shells and finely chipped bark provide the added benefit of improving the soil through slow decomposition. All non-native planting in developed areas of the Laboratory should be mulched.

6) Practice Proper Maintenance

Matching management levels to plant types creates healthier and easier to maintain landscapes. A well designed and established xeric landscape generally requires minimal maintenance and less fertilizer and insecticide. As xeric landscapes mature, they should be managed toward a less frequent but deep watering regiment.

Figure IV-71: Landscape Hydrozones



b. Water Conservation

Irrigation water is being drawn from the same finite resource that supplies the larger community; thus, the Laboratory has a strong commitment towards water conservation.

Guidelines

- Design landscape plans in conjunction with site layout and grading plans. Avoid oddly shaped or steeply graded planting areas, which are difficult to irrigate and maintain efficiently.
- Design landscaping plans in conjunction with irrigation systems to recognize differing water requirements of various plants.
- Select low to moderate water use plants for growth and survival.
- Minimize turf areas.
- Investigate water-absorbing soil additives and conduct experiments in the field to determine success and cost-effectiveness before modifying standard installation landscape construction specifications and details.
- Design irrigation systems using low-flow, low-volume automated systems wherever possible.

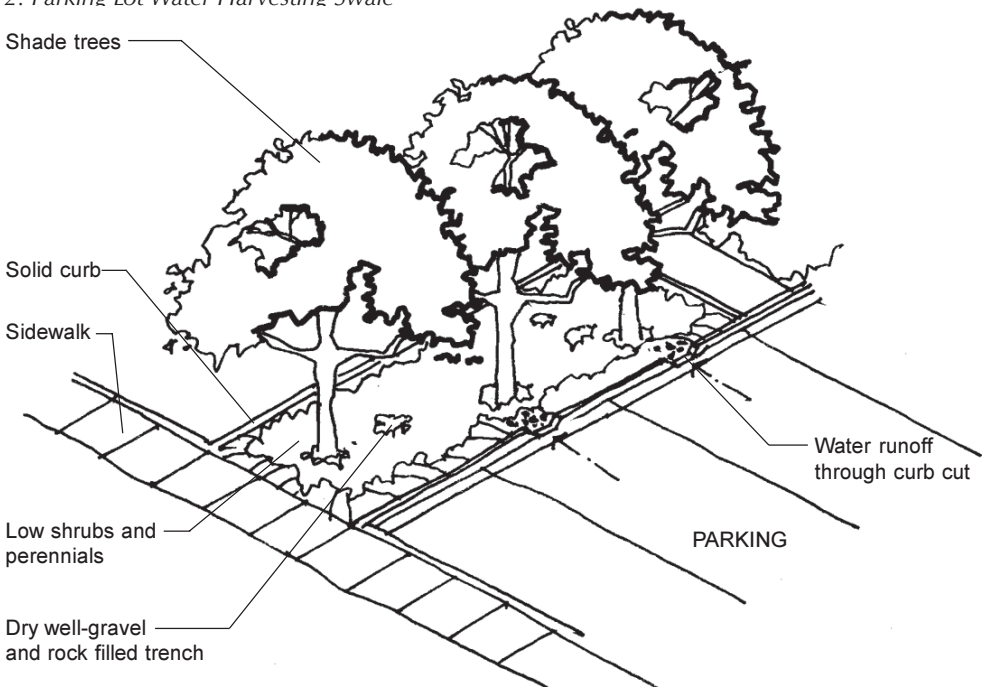
c. Rainwater Harvesting

Potable drinking water is the largest source of irrigation water used at the Laboratory. To better manage that precious resource, water harvesting of rainfall is as an alternate water source that should be utilized. Rainwater harvesting collects, concentrates, and stores natural rainfall for use by plants.

There are many ways to collect or redirect rainfall runoff from roofs, paved areas (*Figure IV-72*), or through the manipulation of the ground plane. Water harvesting methods for rainwater include

- Parallel swales (*Figure IV-73*)
- Terraced grading
- Cisterns
- Rain gardens
- Gravel grid gardens
- Hay bale swales
- Dry sumps
- French drains

Figure IV-72: Parking Lot Water Harvesting Swale



d. Functional Uses of Plants

1) Wind control

Plants can modify wind speed on the ground for distances up to thirty times their height (*Figures IV-74 and IV-75*). Dense masses of large evergreen trees planted to intercept prevailing winter and summer winds can influence the energy efficiency of facilities and increase the livability of outside spaces.

2) Temperature modification

Throughout many regions of the United States, direct radiation from the sun creates uncomfortably high temperatures during the summer season. Locating densely foliated trees and shrubs to the southwest and west of facilities can reduce heat gain. In most regions, warmth from the sun is desirable during the winter. Deciduous trees planted to the south and west of facilities will provide summer shade, while not blocking winter sun.

3) Noise abatement

Trees, shrubs, ground covers, and turf buffer noise by disguising the source of the sound and minimally reducing the sound intensity when sufficiently massed. To be truly effective in controlling noise, plants need to be used in concert with masonry walls or similar noise buffering structures.

4) Glare control

Trees, shrubs, and other vegetation can effectively reduce glare and reflection when placed between the light source and the observer.

5) Surface erosion control

Wind and water can erode valuable top soil. Plants, especially grasses, can prevent or control erosion by stabilizing the soil through their root structures. Exposed soil on cut banks and steep slopes should be immediately planted with grasses and/or native low-growing shrubs and spreading ground covers.

e. Plant Diversity

The planting philosophy of the Laboratory is to support the ecological diversity and existing natural environmental system of the site. Many species in an area automatically make that area both visually pleasing and biologically stable. In a stable community, the plant population is characterized by long-lived species and species with low reproductive powers. The diversity of successional communities enables them to survive catastrophic events such as fire. The existence of a variety of species assures greater resistance to disease and to the intrusion of alien plants. In natural areas of the Laboratory, plant selections should incorporate a variety of plants that support the natural diversity of Los Alamos flora.

Figure IV-73: Water Harvesting Parallel Swales

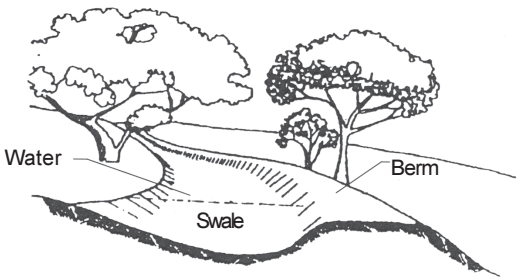


Figure IV-74: Wind Mitigation Plan

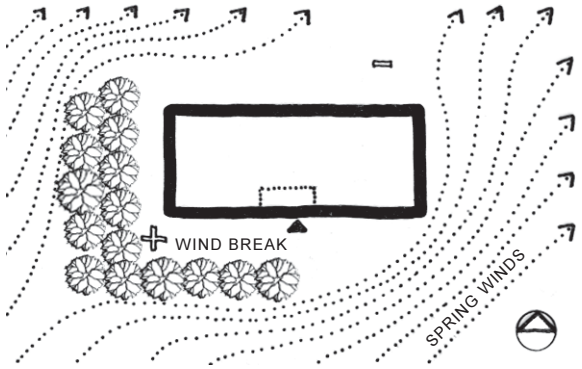
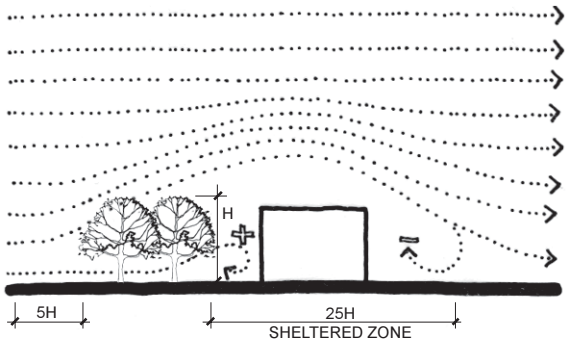


Figure IV-75: Wind Mitigation Section



g. Wildlife Food and Cover

Plants as wildlife food and cover serve an important function in the natural environment (*Image IV-50*). The Laboratory encourages planting that incorporates wildlife values.

Guidelines

- The greater number the habitat junctions the greater the species diversity. Therefore, plant two or more plant communities adjacent to each other wherever possible.
- Mix fast and slow-growing plants in groups of five or more to provide larger food supplies, be more conspicuous to wildlife and insure survival of a plant species.
- Use native plants for all restoration areas and for stabilizing drainageway slopes. Native plants are more resistant to diseases and insects and more acclimated to the site.
- Not all native plant species provide food for wildlife. Select palatable berries with an abundance of small fruits (pea size or smaller). For animals other than birds, the most attractive foods are nuts.
- Plant shrubs, vines and other vegetation important in wildlife diets along the edges of fields, lawns, roads, lakes and other openings.
- Place edge plantings at least 20 ft. across wherever possible.
- Avoid planting fruit trees such as apricots, apples, peaches, etc. in the immediate vicinity of buildings as these tend to attract bears.

1) Ground plane

- Provide a variety of ground covers by planting borders and patches of low growing native perennials, low growing shrubs, etc., to compete with invading grasses.
- Native grasslands can be locally restored by planting the proper mix of grasses either as buffer strips edging shelter belts or as large plantings. Mix tall, medium and short grass habitats to provide a more varied wildlife cover. Provide wet or dry mixtures as needed to tolerate occasional flooding or dry sites.

2) Shrubs and trees

- Mix several shrub and tree species to vary the shape and density for a greater selection of nest sites. Plant clusters of shrubs that include some thickly branching ones at least 3 1/2 ft. high.
- Select shrubs and trees that fruit at different times to provide food throughout the year.

3) Changes in slope

- Create slopes by gently sloping soil mounds with a steep rock face, or stone walls and abrupt changes in slope will be introduced to attract ground feeding birds. Natural habitats will be preserved or created: stream banks, rock outcrops and tree roots preserved to provide crevices in which birds and other small animal life can dig for insects and worms.

4) Rock or brush piles

- Provide rock or brush piles for birds and small mammals. The location of the piles is important. Locate them on the edge or within a couple hundred feet of feeding or watering areas, or along travel lanes. Place piles at intervals between water and feeding areas to create travelways and areas more habitable for wildlife.

5) Water sources

- Shallow ponds (average depth 2.3 ft.) with gently sloped sides are more widely used by waterfowl than deep ponds (average depth 6 ft. or more) with steep side slopes or lakes. Shallow ponds provide better feeding sites and cover than deep ponds, and the former more closely resemble the shallow-water marsh habitat of natural wetlands.