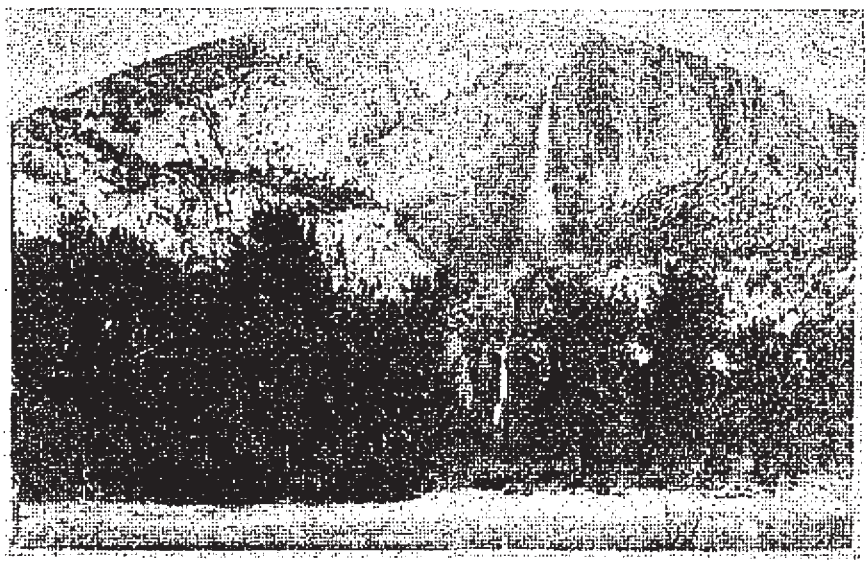
D-986

Comprehensive Landscape and Revegetation Plan

Reconstruct Yosemite Lodge Project
Yosemite National Park, CA



prepared for:

The Denver Service Center of the
National Park Service
Denver, CO

and

Office of Flood Recovery
Yosemite National Park
Yosemite, CA

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These construction documents do not represent any final decision concerning redevelopment of the Yosemite Lodge. The final decision shall be made in the Record of Decision for the Yosemite Valley Plan / Supplemental Environmental Impact Statement.

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INTRODUCTION

On January 1-3, 1997, Yosemite National Park experienced an extreme flood event as the result of a warm heavy rainfall on an extremely heavy early winter snowpack. The flood, which is currently estimated as a 100-year event, was the largest event recorded in the 80-year period of stream gauge records on the Merced River in Yosemite Valley. The flooding of the Merced River severely damaged much of the Park's infrastructure and facilities located in the floodplain of Yosemite Valley.

Among the damaged facilities, the Yosemite Lodge suffered extensive damage to about 50% of the guest lodging units and to 100% of the permanent concessioner employee housing at the Lodge area. In accordance with the 1992 *Concession Services Plan* it became necessary to replace and relocate these facilities to provide guest services to visitors and housing for concessioner employees.

The reconstruction of the Yosemite Lodge will involve the replacement of critical facilities and the removal of unnecessary structures from the floodplain. New development associated with the replacement of lodging and housing units will focus upon locating those facilities in previously disturbed, more resilient, and less environmentally damaging locations within the greater Lodge site. These actions are in accordance with and implement the policies of the 1980 *General Management Plan.*

The purpose of this document is to present a Landscape and Revegetation Plan for the Yosemite Lodge Reconstruction project. The Plan will present the design concepts and overall approach to revegetation activities associated with the removal, relocation, and replacement of Lodge facilities. The Plan will also document the process and methodology for project implementation in the form of a work plan. The work plan will present specifications for the collection and propagation of native plants, interim and final seeding, planting of containerized and specimen plants, and landscape maintenance during the establishment period.

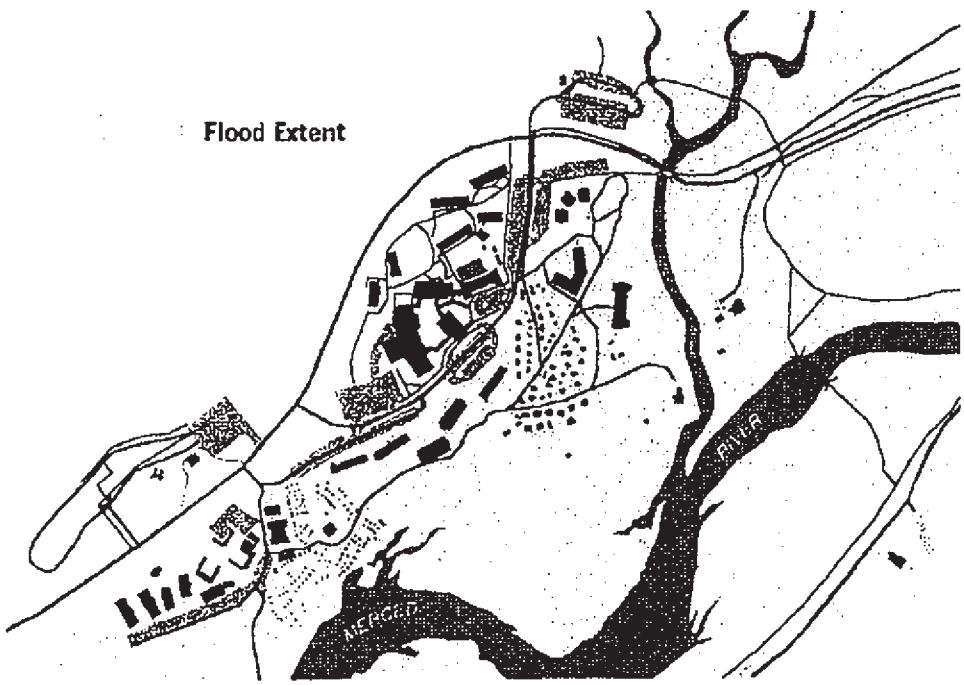


Figure 1. *Project Location. Yosemite Lodge Area and Extent of January '97 Flood.*

Concept and Approach

The natural setting of Yosemite Valley is characterized by outstanding and unique geological features which create a physical setting unlike that found anywhere else in the world. The broad glacial-carved Valley, in combination with the Merced River and its associated floodplain, has given rise to a complex of oak woodland, floodplain meadow, and mixed-conifer woodland communities unique along the western slope of the Sierra Nevada. It is this exceptional assemblage of natural communities which forms the context within which the newly reconstructed Yosemite Lodge will reside. Following reconstruction, an important experience of guests and visitors to the Lodge will be to become aware of and to understand this sublime setting. The visitor will experience a facility in harmony with its environs because the diversity of the natural surroundings will be an integral feature incorporated throughout the development. Visitors will use the Lodge facilities as a staging ground from which to explore the variety of experiences the Park has to offer.

The overall concept guiding revegetation planning and design at the Yosemite Lodge is the establishment of a landscape that is consistent with the natural surroundings and which fosters a sense of place unique to the Yosemite Valley. Revegetation activities will seek to model the historic structure and occurrence of native vegetative communities within Yosemite Valley and specifically, the immediate Lodge environment. The character of vegetation in the Valley is influenced by a range of local environmental factors including rockfall from the surrounding cliffs, seasonal flooding of the Merced River, and the historic occurrence of periodic wildfires. These factors, and others, have historically determined the formation and presence of native vegetative communities in the current location of the Yosemite Lodge. Those communities include: Canyon Live Oak scrub, adapted to recurring rockfall events, poor and rocky soils, and extended periods of drought; Riparian and Floodplain forests and meadows, adapted to periodic flooding, deposition, and seasonally available moisture; and the stately Black Oak woodlands and open Ponderosa Pine forests adapted to dry summer conditions and the periodic occurrence of wildfire.

These existing and historic vegetative communities will be re-established and enhanced within the Lodge development area using an applied ecological approach to revegetation. Specifically, revegetation and landscaping at the Lodge will be informed by the science of ecological restoration which seeks to emulate natural vegetational succession, native community structure, and species composition. The diversity of the physical setting at the Lodge has historically determined the diversity of the vegetative communities found there. Revegetation activities will use this historic distribution as a model to guide the replanting of community-based assemblages of native plant species in their ecologically appropriate locations. Native plants to be used in the revegetation effort will be propagated from locally-collected seed and cuttings. This approach will ensure that selected plants will be adapted to local environmental conditions and that the genetic integrity of the local flora is preserved. The result of this ecological approach to revegetation will be the establishment of self-sustaining, native communities characteristic of those found in the surrounding natural areas of Yosemite Valley.

Project Setting

Three broad physiographic zones have been identified within the Lodge project area and its immediate surroundings. These zones are defined by the physical setting of the Lodge environs (landforms, existing and historic plant communities, drainages and floodplain, and developed areas) and serve to inform the overall revegetation approach. The physiographic zones as defined by the project design team include: Talus Slope; Developed (Transition); and Meadow/ Riparian. Given the revegetation approach of using natural communities as a model, landscape development will focus on re-establishing the native vegetation within each zone that would be expected to inhabit those areas under natural conditions. The National Park Service has conducted various vegetation surveys of the area, identifying the existing vegetation in Yosemite Valley (Acree, 1994), the existing vegetation within the Lodge development area (Cunningham-Summerfield, 1998, and Bitterroot Restoration, 1998), and the probable historic vegetation which occurred on the current Lodge development site circa 1866-1890's (Cunningham-Summerfield, 1998). These surveys will guide the overall revegetation prescriptions and species selection within each physiographic zone.

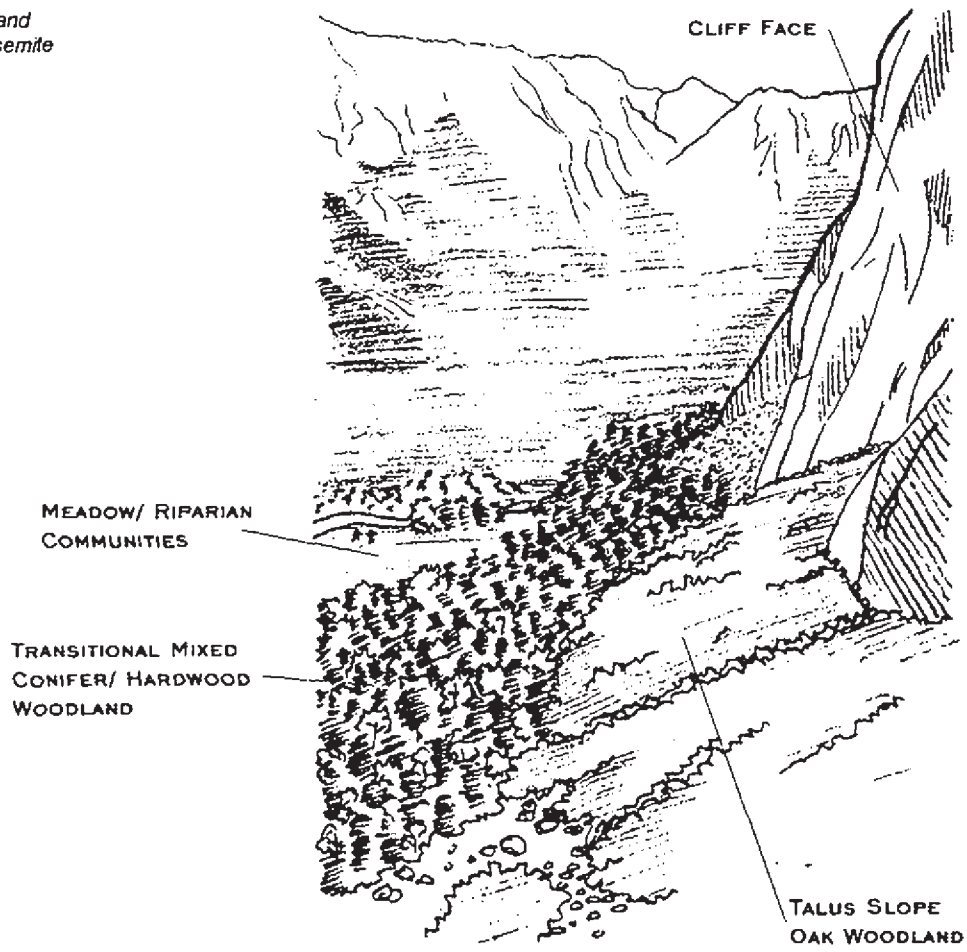


Figure 2. *Physical and Natural Setting. Yosemite Valley.*

Figure 3. *Talus Slope Zone.*

Talus Slope Zone

Setting. This zone encompasses the northern portions of the Lodge development and is characterized by moderately sloping topography strewn with stones and boulders and dissected by occasional small drainages. This landform occurs at the base of the cliffs and is composed of colluvial and alluvial rocky soils deposited during seasonal runoff and rockfall events. The soils tend to be low in organic matter and highly permeable. Seasonal rainfall and runoff tends to occur in brief, periodic episodes, filling the drainages rapidly before percolating deep into the substrate. The water table in this area is estimated to be greater than 5 feet below the soil surface, but the soil is moist during winter and spring from seasonal storms and runoff from surrounding escarpments. The upper part of the soil is dry during the summer and fall.

Vegetation. Due to the coarse texture and high permeability of the soils, vegetation within this zone must be adapted to summer drought conditions, or be able to utilize brief and infrequent summer precipitation. Vegetation must also be adapted to the occasional deposition of rockfall from the cliffs above. The ability of the various plant communities to colonize newly deposited soils is evident by their distribution within the area.

Plant communities currently found in the Talus Slope Zone within the Lodge development and its surroundings (as per Acree, 1994) include:

Canyon Live Oak Forest- Dense "tree-like" multi-trunked live oak forest with boulder, sand, or gravel outcroppings. Greater than 80% closed canopy. 15% rocky understory coverage. Herbaceous understory in open pockets.

Open Ponderosa Pine/ California Black Oak Woodland- Mixed woodland dominated by Ponderosa Pine, California Black Oak, and Incense Cedar with 10 to 60% overstory coverage. 50 to 75% annual herbaceous cover. 80 to 90% duff coverage.

Ponderosa Pine Forest- Similar to Open Ponderosa Pine/ California Black Oak Forest but denser with 75 to 100% overstory coverage. Mixed woodland dominated by Ponderosa Pine, California Black Oak, and Incense Cedar. Herbaceous annual understory covers from 25 to 45% with a 90% duff coverage.

Potential Natural Communities. Plant communities thought to have historically existed within the Talus Zone areas of the Lodge development and its surroundings (as per Cunningham-Summerfield, 1998) include:

Decomposed Granite Barrens With Ponderosa Pine and Canyon Live Oak.

Mostly Bare, Ponderosa Pine With California Black Oak and Canyon Live Oak.

Developed (Transition) Zone

Setting. This zone lies in the intermediate areas between the Talus Slope and the Meadow/ Riparian zones. The site is characterized by gently sloping topography composed of relatively stable sandy loam soils deposited from the more active talus fans above. Flooding within the zone is a rare occurrence and tends to be restricted to high intensity winter storms or snow melt. Infiltrating water from precipitation and floods percolates rapidly into the coarse, sandy substrates. The water table in this area is estimated to be greater than 5 feet below the soil surface, but the soil is moist during winter and spring from seasonal storms and runoff from surrounding escarpments. The upper part of the soil is dry during the summer and fall.

The presence of the Lodge development and associated structures within this zone greatly influences the natural setting through alterations in the natural hydrology, soil structure and compaction, and introduced vegetation. Although many of these factors are unavoidable given the presence of development, reconstruction activities will focus upon reconciling those conflicts between the developed areas and the functioning of natural systems.

Vegetation. Soil water retained for plant growth is moderate in this zone. Vegetation must be adapted to summer drought conditions or be able to utilize moisture contained in the lower depths of the soil. Historically, the structure of plant communities in these areas was also influenced by the periodic occurrence of wildfire. The resulting appearance of forest communities in these areas tended toward an open, park-like woodland, dominated by large, stately trees and a relatively continuous herbaceous cover. Isolated groves of denser forest occurred sporadically throughout. Revegetation efforts will focus on re-establishing similar forest types given the absence of recurring wildfire. Over time, it is likely that the open, park-like structure will need to be maintained to a limited extent by vegetation management and mechanical means such as clearing and thinning.

Figure 4. *Developed (Transition) Zone.*

Plant communities currently found in the Developed (Transition) Zone (as per Acree, 1994) include:

Developed Open Area- Sparse Vegetation- Human developed area with sparse vegetation. Existing vegetation often irrigated and landscaped. Less than 20% vegetation.

Developed California Black Oak Woodland- Overstory similar to California Black Oak Woodland with watered lawns, pavement, and buildings comprising a majority of the understory. Greater than 75% overstory cover.

Bare- None or sparse vegetation. Greater than 75% bare soil in winter. 25-50% herbaceous cover during the growing season. Less than 25% duff coverage. Less than 10% tree coverage. Differs from Developed Open Area- Sparse Vegetation by lack of buildings or roads.

Ponderosa Pine Forest- Similar to Open Ponderosa Pine/ California Black Oak Forest but denser with 75 to 100% overstory coverage. Mixed woodland dominated by Ponderosa Pine, California Black Oak, and Incense Cedar. Herbaceous annual understory covers from 25 to 45% with a 90% duff coverage.

Potential Natural Communities. Plant communities thought to have historically existed within the Developed (Transition) Zone and its surroundings (as per Cunningham-Summerfield, 1998) include:

Mostly Bare, Ponderosa Pine With California Black Oak and Canyon Live Oak.

Short Grass Meadow

Open Ponderosa Pine With California Black Oak

Meadow With Ponderosa Pine and California Black Oak

Meadow/ Riparian Zone

Setting. This zone is located on the terrace immediately adjacent to the active floodplain of the Merced River. The landform is characterized by relatively flat topography consisting of sandy loam soils similar to those found within the Developed (Transition) Zone. The southernmost edge of the zone is defined by steep banks where the terrace drops abruptly along the edge of the active floodplain. Flooding is a very rare occurrence and is primarily associated with extreme flood events and inundation from the adjacent Merced River. Infiltrating water from precipitation and floods percolates rapidly into the coarse, sandy substrates. Due to the proximity of the terrace to the active floodplain, the water table in this area may occasionally be less than 5 feet below the soil surface. The soil is moist during winter and spring from seasonal storms. Runoff from surrounding escarpments and talus fans may occasionally fill the small drainages which dissect the area, but most runoff will have percolated deep into the substrate before reaching the lower reaches of this zone. The upper part of the soil is dry during the summer and fall.

Figure 5. *Meadow/ Riparian Zone.*

Potential Natural Communities. Soil water retained for plant growth is moderate in this zone. Shrubs, grasses, and forbs must be adapted to summer drought conditions or be able to utilize brief and infrequent summer precipitation. Trees and larger shrubs must be able to take advantage of the moisture contained in the lower depths of the soil. The widespread presence of annosus fungi (*Heterobasidion annosum*), or "root rot", within this zone has, in recent history, caused significant mortality of conifers in the area. The spread of this fungus is attributable to many factors, among them the encroachment of dense conifer stands given the absence of recurring wildfire. In order to check the spread of these fungal populations, and to return the area to a more natural and desirable condition, vegetation management will focus on the re-establishment of hardwood forests within these areas. Hardwood stands are relatively unaffected by the disease and represent the historic landscape character of this site prior to the suppression of naturally occurring wildfire in Yosemite Valley.

Plant communities currently found in the Meadow/ Riparian Zone (as per Acree, 1994) include:

California Black Oak Woodland With Encroaching Conifers- Mature California Black Oak with immature mixed conifers. The diameter of the majority of the oaks is larger than the diameter of the majority of the conifers. Conifers average 15 inches or less in diameter and occur in a ratio of 5 to 15 conifers to one oak. 55 to 85% overstory coverage. Duff coverage is approximately 80% and herbaceous coverage is 20 to 70%.

Developed Open Area- Sparse Vegetation- Human developed area with sparse vegetation. Existing vegetation often irrigated and landscaped. Less than 20% vegetation.

Developed California Black Oak Woodland- Overstory similar to California Black Oak Woodland with watered lawns, pavement, and buildings comprising a majority of the understory. Greater than 75% overstory cover.

Ponderosa Pine Forest- Similar to Open Ponderosa Pine/ California Black Oak Forest but denser with 75 to 100% overstory coverage. Mixed woodland dominated by Ponderosa Pine, California Black Oak, and Incense Cedar. Herbaceous annual understory covers from 25 to 45% with a 90% duff coverage.

Riparian/ Conifer Corridor- Riverbank strip with broadleaved trees, conifers, shrubs, and herbs. 25-75% herbaceous coverage. This is possibly a successional phase occuring in oxbows and cutoff channels. Understory coverage varies according to slope, substrate, river velocity, season, and width of river.

Impacted Mixed Riparian/ Conifer Corridor Forest- Similar to Mixed Riparian/ Conifer Corridor Forest with denuded soil and trampled herbaceous understory. Lack of young trees and shrub layer.

Plant communities thought to have historically existed within the Meadow/ Riparian Zone and its surroundings (as per Cunningham-Summerfield, 1998) include:

Short Grass Meadow

Open Ponderosa Pine With California Black Oak

Meadow With Ponderosa Pine and California Black Oak

Open Ponderosa Pine With California Black Oak and Bracken Fern

Revegetation Treatments

Classification System and Process

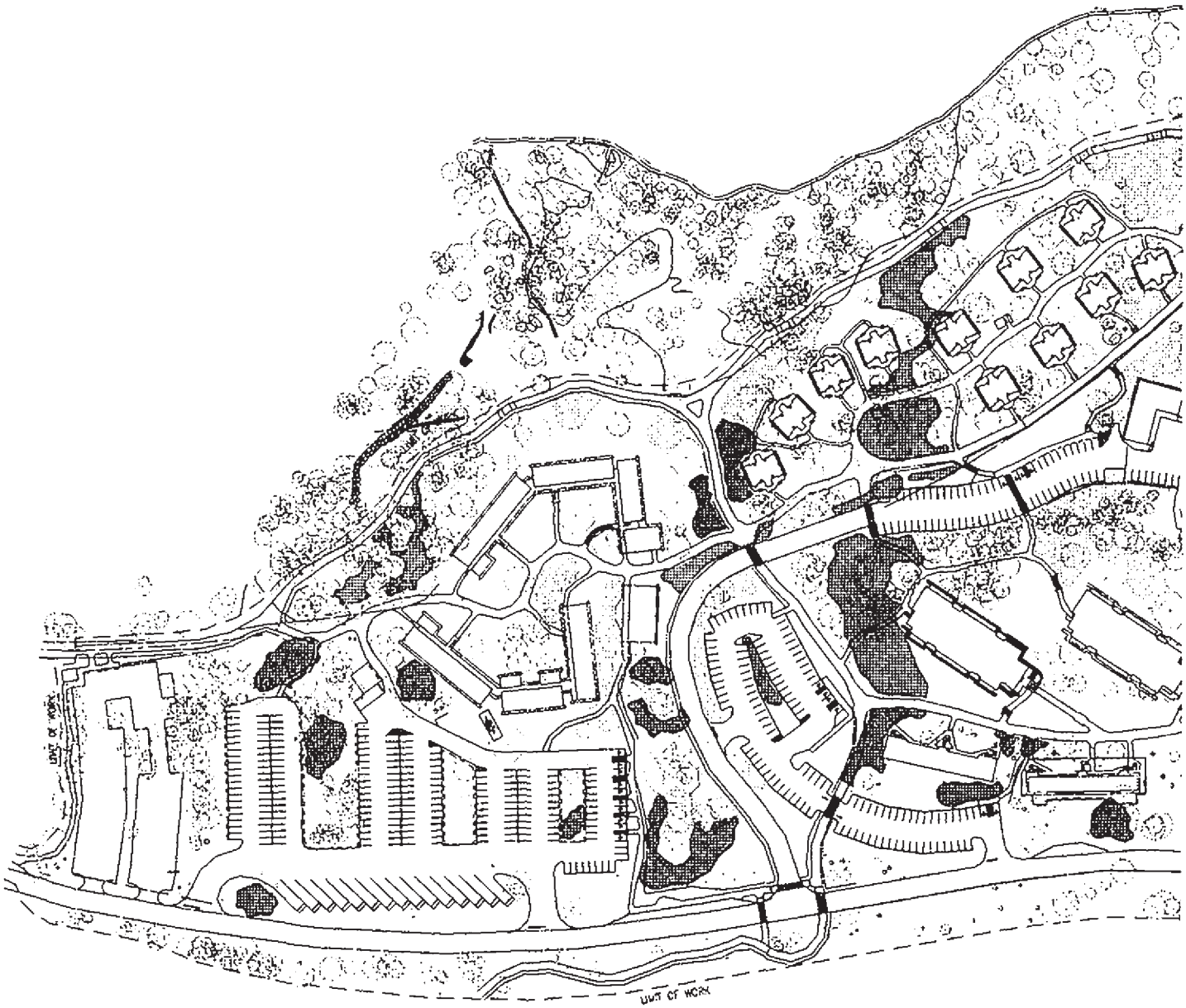
The existing Lodge facilities and the greater project site are described in terms of three broad physiographic zones (see previous section entitled "Project Setting"). These three zones roughly correspond to existing landforms, vegetative communities, and the existing Lodge development. The zone concept was formulated to enable the process of describing existing vegetation on site and to develop and evaluate the proposed revegetation treatments for specific areas of the new development. The classification of the three zones includes: **Zone 1: Talus Slope; Zone 2: Developed (Transition);** and **Zone 3: Meadow/Riparian.**

Revegetation prescriptions and species selection for each zone were developed according to a three-tiered system which considers **Tree Canopy, Shrub Understory,** and **Herbaceous Cover** as separate layers. The Tree Canopy (T) layer is assumed to include species which grow higher than 15' and form an overstory canopy. The Shrub Understory (S) layer includes species which attain heights between 3' and 15', including those species appropriate for screening purposes. The Herbaceous Cover (H) layer includes grass, forb, and sub-shrub species which typically form the ground plane from 3' and lower.

Existing native vegetation within each zone served to guide the selection of species appropriate for revegetation in corresponding treatment areas. Rather than forming distinct delineations from one zone to the next, the majority of existing native plant species occur on a gradient across the three zones. Some species occur with equal frequency in each zone across the entire site. Most species, while demonstrating a preference for a given zone, are also found to a lesser degree in other zones. Very few native species occur in only one zone. This gradient of occurrence was emulated in determining the species composition for each zone and corresponding treatment areas.

Observations were made across the site and in adjacent native plant communities to gain an understanding of the specific habitats and plant communities which would serve as models during revegetation activities. Attention was paid to the associations formed by groups of species and their preferred growing conditions. From these observations, a series of plant assemblages were developed that emulate the community structure of the surrounding native vegetation. These plant assemblages, planted in similar settings and environmental conditions, form the basis for determining revegetation treatments by specific area across the project site.

Given the developed nature of the Developed (Transition) Zone, planting within formally landscaped areas may include native species found in adjacent natural communities which are valued for their aesthetic and functional qualities. The selection of native species for these formal landscaped areas will take into consideration the appropriate placement and use of these materials and their compatibility with the model natural communities proposed for the zone.



Zone 1: Talus Slope Tree Canopy/ Forest Cover Types (T1) - 2.91 acres total

The tree canopy in this area will consist of an open California Black Oak/ Ponderosa Pine Woodland, with Canyon Live Oak and Bay Laurel inhabiting drainages, existing understory, and the northernmost fringes (talus areas) of the zone.

T1A- Ponderosa Pine/ Calif. Black Oak/ Canyon Live Oak – 2.53 acres
T1B- Canyon Live Oak – .18 acres
T1C- Calif. Bay Laurel/ Ponderosa Pine/ Canyon Live Oak – .2 acres

Zone 2: Developed (Transition) Tree Canopy/ Forest Cover Types (T2) - 1.57 acres total

The tree canopy in this area will consist of an open California Black Oak/ Ponderosa Pine Woodland, with isolated, denser groves of Pacific Dogwood and Bay Laurel scattered throughout.

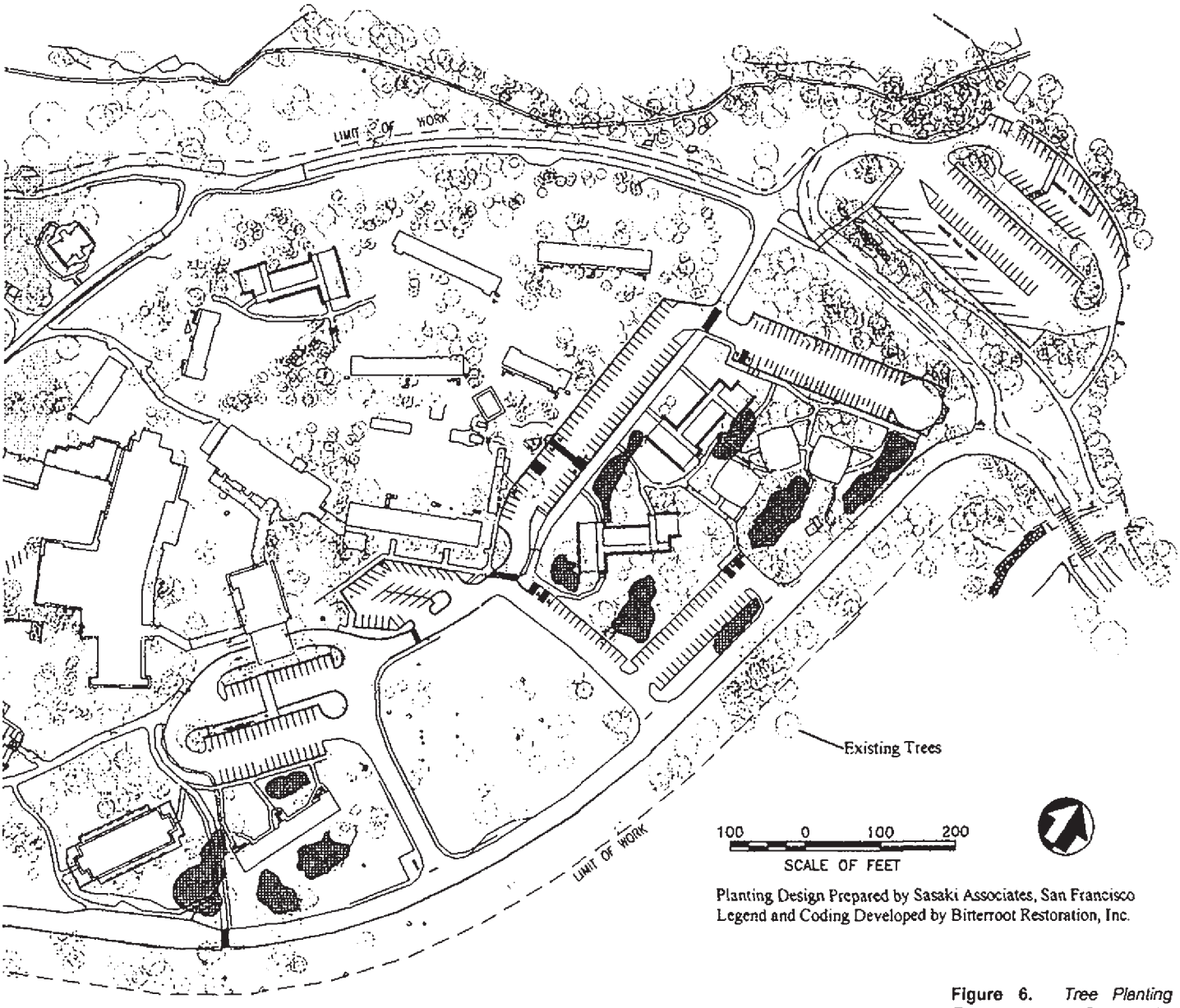


Figure 6. *Tree Planting Zones and Community Designations*

- T2A- Calif. Black Oak – .51 acres
- T2B- Calif. Black Oak/ Pacific Dogwood – .24 acres
- T2C- Calif. Black Oak/ Ponderosa Pine/ Canyon Live Oak – .82 acres

Zone 3: Meadow/ Riparian Tree Canopy/ Forest Cover Types (T3) - 1.2 acres total

The tree canopy in this area will consist of an open California Black Oak Woodland interspersed with stands of other hardwoods such as Big Leaf Maple, Pacific Dogwood, and Bay Laurel.

- T3A- Big Leaf Maple/ Pacific Dogwood – .68 acres
- T3B- Calif. Black Oak/ Big Leaf Maple – .52 acres

Zone 1: Talus Slope Tree Canopy/ Forest Cover Types (T1)

T1A- Ponderosa Pine/ Calif. Black Oak/ Canyon Live Oak
planted at 15' spacing, or 193 trees/ acre

This cover type is primarily an upland coniferous forest with an oak component. Canopy cover varies widely in density, while the understory remains primarily dry. Canyon Live Oak is most often found as seedlings or young plants in the understory.

Calif. Black Oak	30%
Canyon Live Oak	10%
Ponderosa Pine	60%

T1B- Canyon Live Oak
planted at 15' spacing, or 193 trees/ acre

Canyon Live Oak is an appropriate species to plant in existing dense understory areas. Scattered individuals will also do well in open areas, usually around a "nurse log" or other vegetation.

Canyon Live Oak	100%

T1C- Calif. Bay Laurel/ Ponderosa Pine/ Canyon Live Oak-
planted at 15' spacing, or 193 trees/ acre

This cover type represents an upland coniferous forest with a dense mid- to understory. Bay Laurel is an evergreen tree often characterized by a spreading canopy which extends down to the ground plane. This cover type is appropriate for use as dense, forested screening.

Calif. Bay Laurel	50%
Canyon Live Oak	20%
Ponderosa Pine	30%

Zone 2: Developed (Transition) Tree Canopy/ Forest Cover Types (T2)

T2A- Calif. Black Oak
planted at 10' spacing, or 435 plants/acre

Black Oak forests are one of the defining characteristic features of Yosemite Valley. Black Oak is usually found as a component of other forest types throughout California. Yosemite Valley is unique in that Black Oak forms extensive, monotypic stands. Black Oak stands are usually open or sparse beneath, having a simple, low-statured understory.

Calif. Black Oak	100%

T2B- Calif. Black Oak/ Pacific Dogwood
planted at 10' spacing, or 435 plants/acre

This cover type is a transitional community similar to that found in intermediate areas between coniferous upland forests and riparian forest stands in Yosemite Valley. It is a deciduous canopy which can become quite dense and shady given the proportion of Dogwood and especially Bay Laurel. Due to its shade tolerant qualities, Bay Laurel has the ability to provide visual screening as the canopy often extends down to the ground plane.

Calif. Bay Laurel	20%
Calif. Black Oak	50%
Pacific Dogwood	30%

T2C- Calif. Black Oak/ Ponderosa Pine/ Canyon Live Oak
planted at 10' spacing, or 435 plants/acre

This cover type is similar to T1A- Ponderosa Pine/ Calif. Black Oak/ Canyon Live Oak Cover Type described above, but is more transitional in nature. This transition is illustrated by a greater Black Oak component as the community moves out of the upland areas and closer to the lower meadows.

Calif. Black Oak	60%
Canyon Live Oak	10%
Ponderosa Pine	30%

Zone 3: Meadow/ Riparian Tree Canopy/ Forest Cover Types (T3)

T3A- Big Leaf Maple/ Pacific Dogwood
planted at 10' spacing, or 435 plants/acre

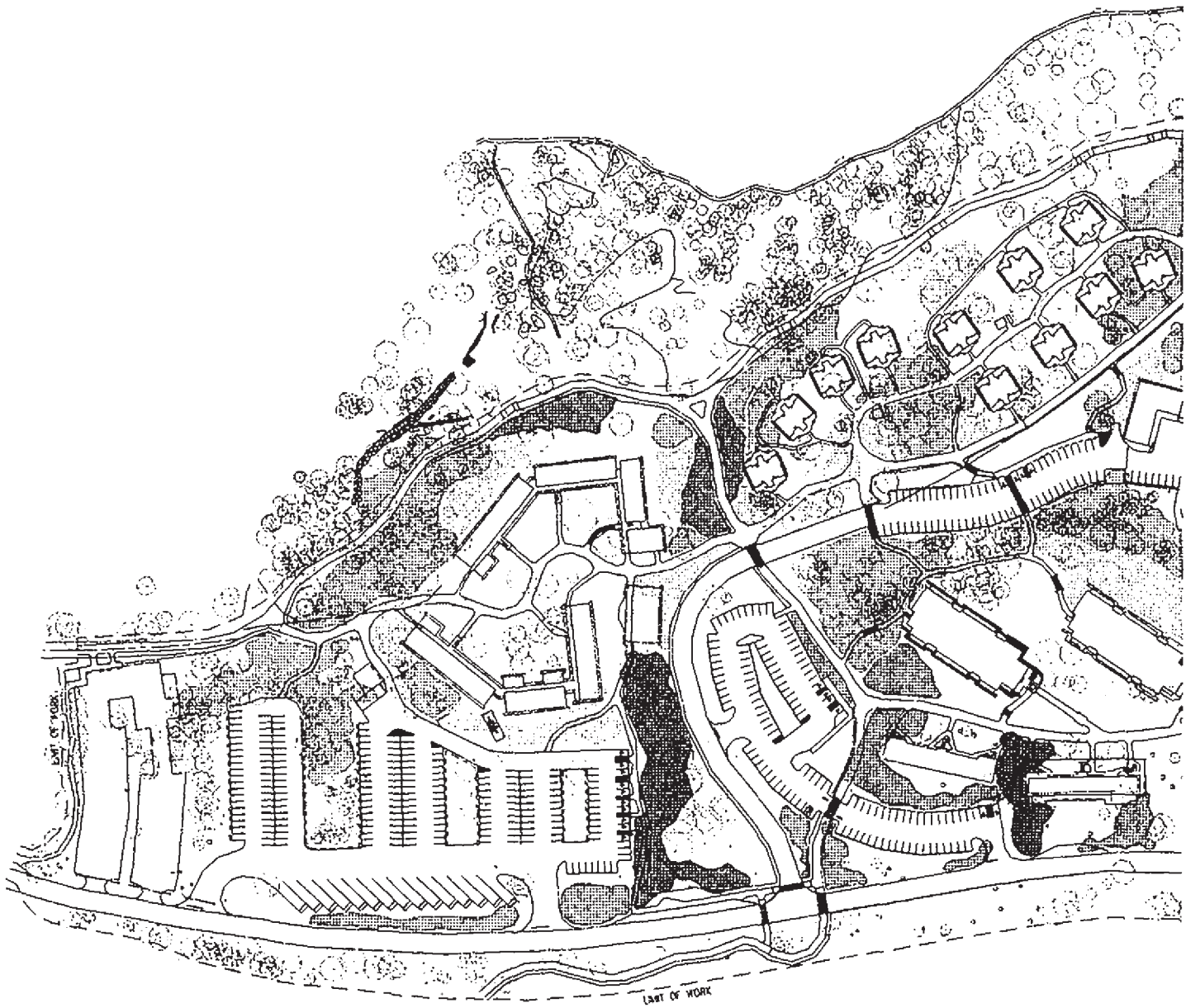
This cover type is characterized by a dense, closed canopy. Understory plants tend to be dense and multi-storied, with slightly greater available soil moisture. Bay Laurel is an evergreen tree often characterized by a spreading canopy which extends down to the ground plane. This cover type is appropriate for use as dense, forested screening.

Big Leaf Maple	40%
Calif. Bay Laurel	20%
Pacific Dogwood	40%

T3B- Calif. Black Oak/ Big Leaf Maple
planted at 10' spacing, or 435 plants/acre

This cover type represents the transitional areas of meadow/ riparian forests where the canopy and understory tends to be sparser, more open, and perhaps drier.

Big Leaf Maple	40%
Calif. Black Oak	60%



Zone 1: Talus Slope Shrub Understory/ Cover Types (S1) - 6.5 acres total

S1A- Low Massing, open areas – .95 acres
S1B- Medium Massing, open areas – 1.49 acres
S1C- Medium Massing, understory – 3.68 acres
S1E- Screening Plantings – .38 acres

Zone 2: Developed (Transition) Shrub Understory/ Cover Types (S2)

S2A- Oak Understory
S2B- Screening Plantings

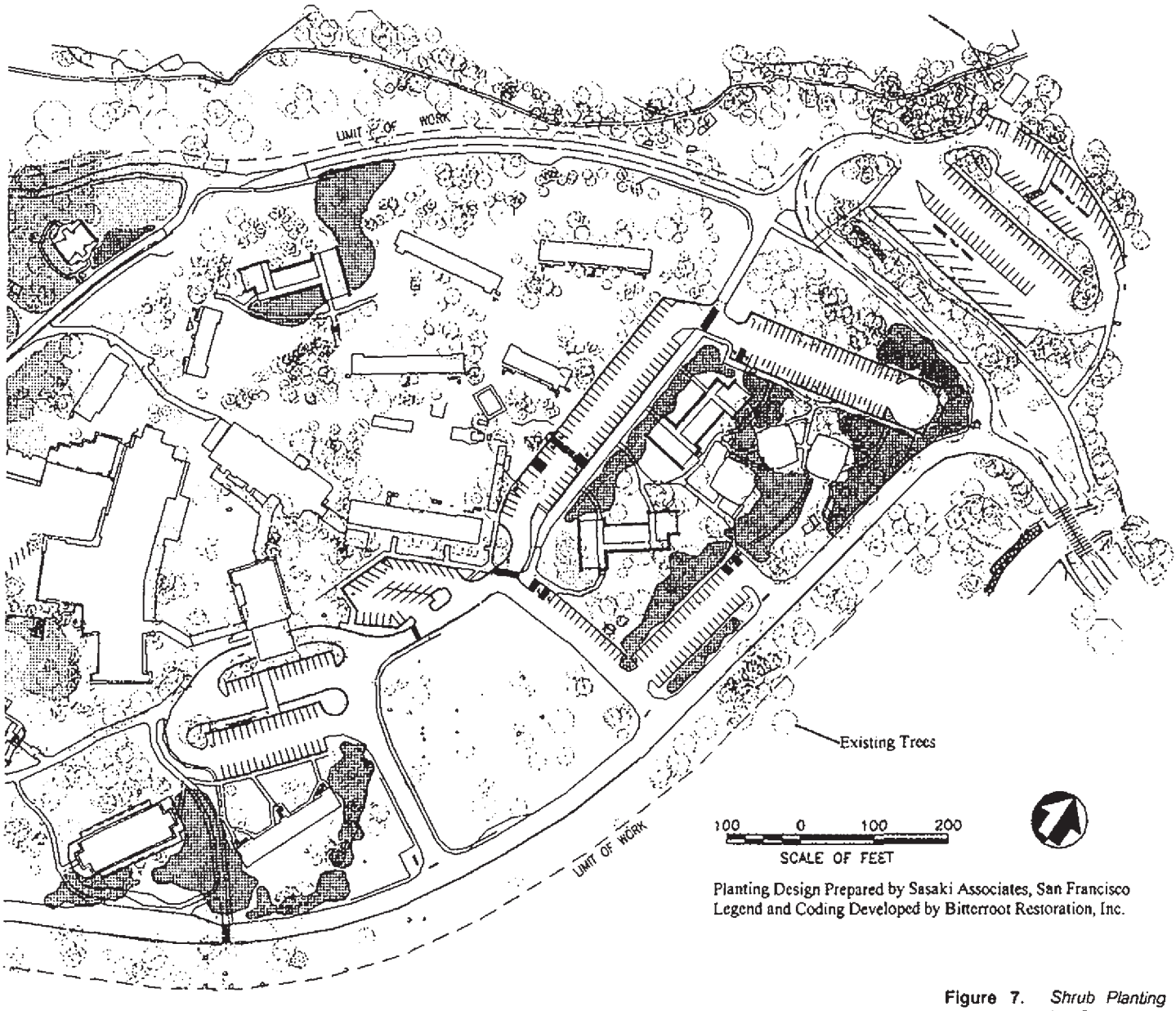


Figure 7. *Shrub Planting Zones and Community Designations*

Zone 3: Meadow/ Riparian Shrub Understory/ Cover Types (S3) - 2.3 acres total

- S3A- Low Massing, dry, open areas – .36 acres
- S3B- Low Massing, moist, open to shady areas – .8 acres
- S3C- Medium Massing/ Screening, dry, open areas – .98 acres
- S3D- Medium Massing/ Screening, moist, open to shady areas – .16 acres

Zone 1: Talus Slope Shrub Understory/ Cover Types (S1)

These plantings include those native shrub species typically found in the understory of the previously described Talus Slope forest types. Species selection focuses on those plants known to inhabit open, sunny, and seasonally droughty areas of the Valley.

S1A- Low Massing, open areas
planted at 5' spacing, or 1,742 plants/acre

Bush Beardtongue	30%
California Brickellbush	30%
Sierra Gooseberry	15%
Yerba Santa	25%

S1B- Medium Massing, open areas
planted at 8' spacing, or 680 plants/acre

Blue Elderberry	30%
Deer Brush	35%
Whiteleaf Manzanita	35%

S1C- Medium Massing, understory
planted at 5' spacing, or 1,742 plants/acre

Blackcap Raspberry	35%
Mtn. Pink Currant	30%
Sierra Gooseberry	35%

S1E- Screening Plantings
planted at 5' spacing, or 1,742 plants/acre

Blue Elderberry	65%
Deer Brush	35%

Zone 2: Developed (Transition) Shrub Understory/ Cover Types (S2)

These plantings primarily include those native species typically found in the understory of the previously described Developed (Transition) forest types. Developed areas are enhanced by the addition of native shrub species found in adjacent natural communities and other areas of the Valley. Species selection in less formal, more natural areas of the Zone includes those native species known to inhabit open, sunny, and seasonally droughty areas of the Valley or within denser forest stands as they may occur. Species selection for more formal, intensively landscaped areas focuses on those native species valued for their exceptional aesthetic or functional qualities.

S2A- Oak Understory
planted at 4' spacing, or 2,722 plants/acre

Deergrass	40%
Western Azalea	60%

S2B- Screening Plantings
planted at 4' spacing, or 2,722 plants/acre

American Dogwood	25%
Western Chokecherry	25%
Mockorange	25%
Spicebush	25%

Zone 3: Meadow/ Riparian Shrub Understory/ Cover Types (S3)

These plantings will primarily include those native species typically found in the understory of the above-mentioned Meadow/ Riparian forest types. Species selection will focus on those plants known to inhabit open meadows and floodplain margin areas of the Valley, as well as species associated with the understory of riparian forest types.

S3A- low massing, dry, open areas
planted at 6' spacing, or 1,210 plants/acre

Bush Beardtongue	25%
California Brickellbush	25%
Deergrass	30%
Sierra Gooseberry	20%

S3B- low massing, moist, open to shady areas
planted at 6' spacing, or 1,210 plants/acre

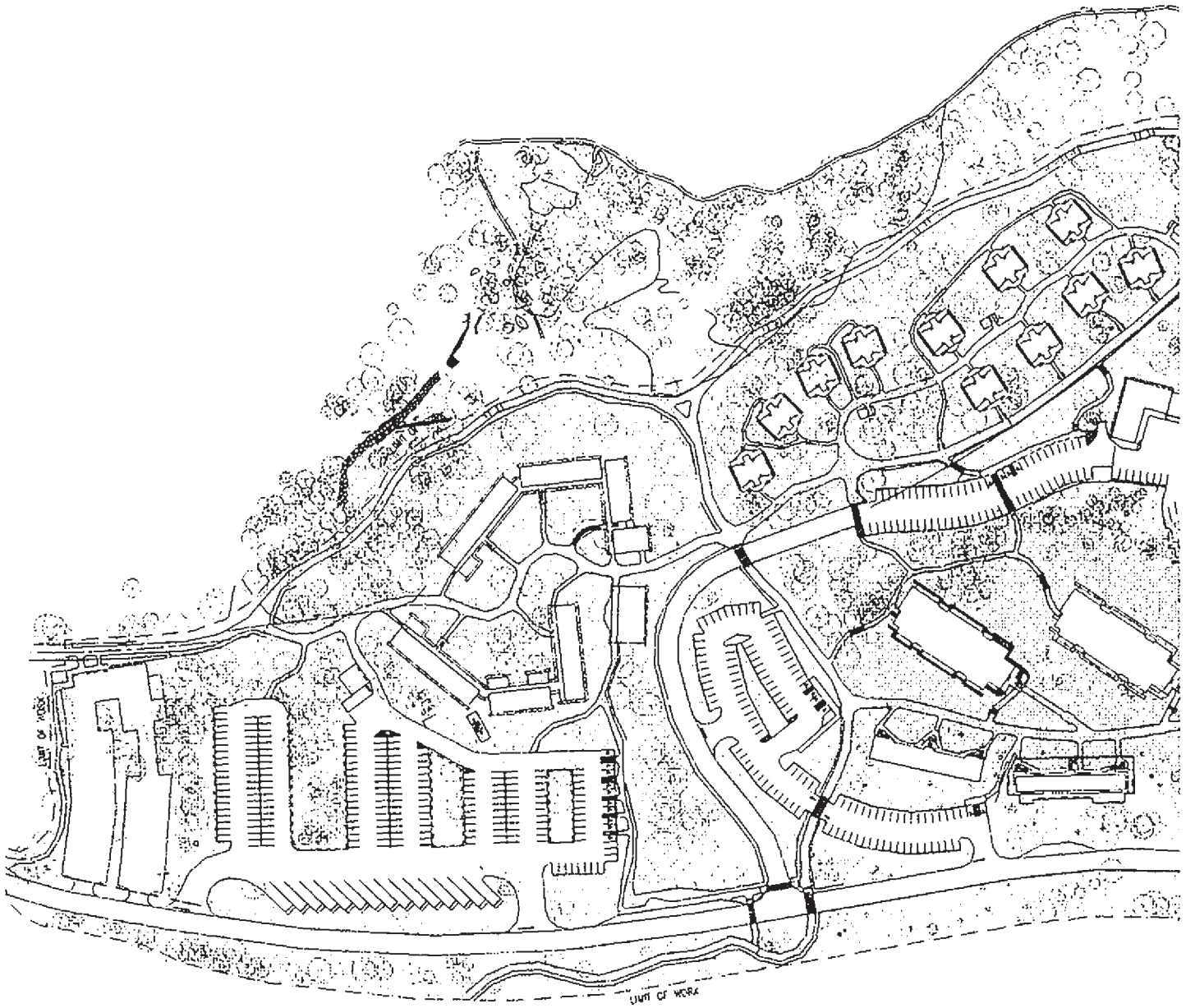
Mtn. Pink Currant	30%
Wood's Rose	30%
Western Azalea	40%

S3C- medium massing/ screening, dry, open
planted at 6' spacing, or 1,210 plants/acre

Blue Elderberry	30%
Western Chokecherry	35%
Deer Brush	35%

S3D- medium massing/screening, moist, open to shady
planted at 6' spacing, or 1,210 plants/acre

American Dogwood	50%
Western Chokecherry	50%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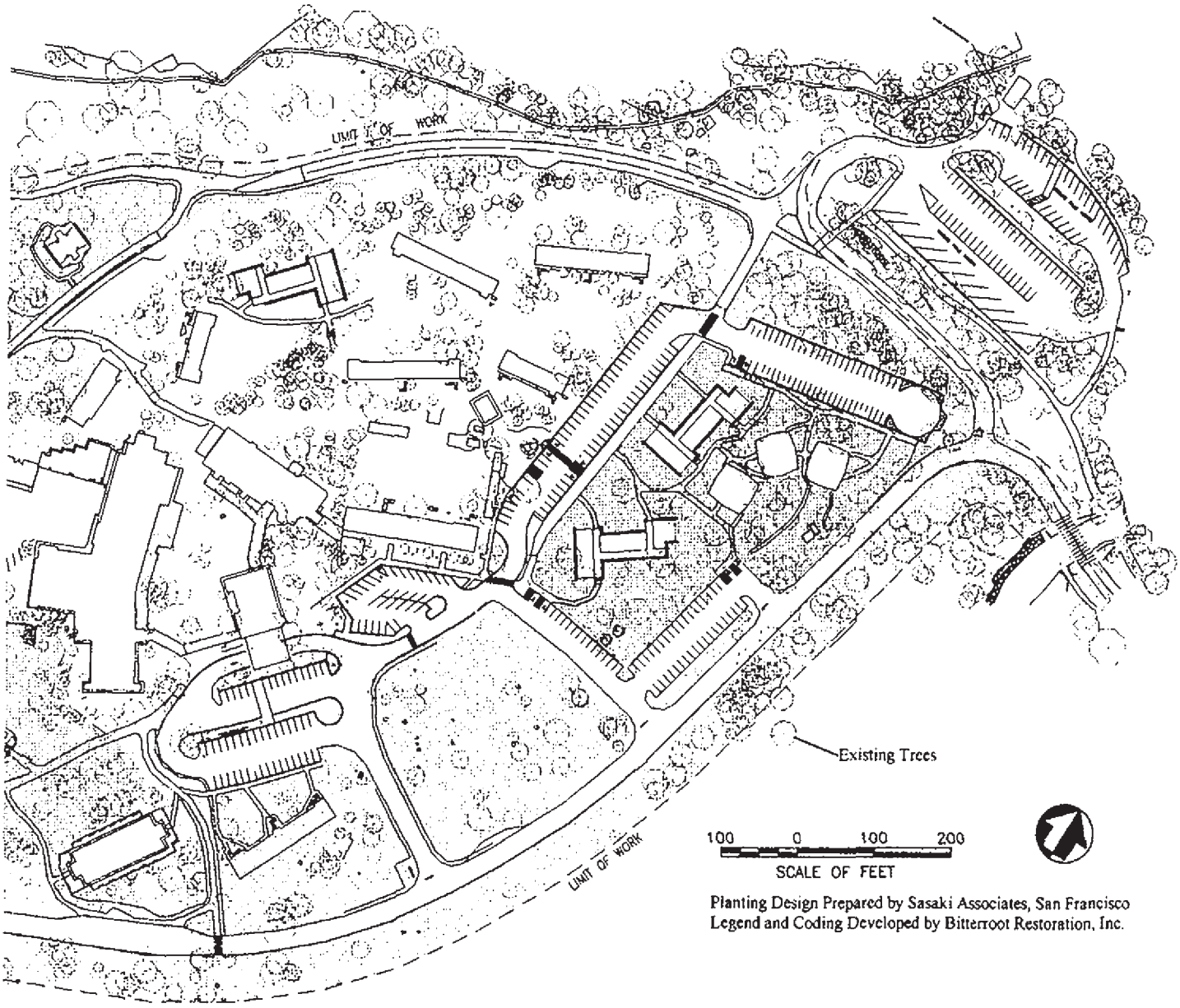


Figure 8. *Herbaceous Seeding Areas and Seed Mix Designations*

Zone 1: Talus Slope Herbaceous Cover (H) - 28.33 acres total (all zones)

H- Standard Herbaceous Mix- applied to all areas of bare ground or disturbed soils within project boundaries

Zone 2: Developed (Transition) Herbaceous Cover (H+) - 4.61 acres

H+- Enhanced Herbaceous Mix- applied in addition to the Standard Mix in areas where added diversity and enhanced aesthetics are desired

Zone 3: Meadow/ Riparian Herbaceous Cover (H)

H- Standard Herbaceous Mix- applied to all areas of bare ground or disturbed soils within project boundaries

Zone 1: Talus Slope Herbaceous Cover (H)

Herbaceous cover within the Talus Slope plant communities is typically sparse and patchy. Coverage will likely consist of scattered bunch grasses and sparse forbs, with more continuous grass and forb coverage in shady or sheltered areas. Revegetation of the herbaceous cover will be accomplished by broadcasting a seed mix of grass and forb species native to the Yosemite Valley.

H seed mix- seeded at a target rate of 60-80 PLS/ sq. ft.

Blue Wildrye	75%
California Brome	20%
Lupine	2.5%
Buck Lotus	2.5%

Zone 2: Developed (Transition) Herbaceous Cover (H+)

Herbaceous cover within the Developed (Transition) Zone will consist of the standard Herbaceous Cover Seed Mix (H) supplemented and enhanced by the addition of various native grass, wildflower and forb species. The intention of this Enhanced Herbaceous Cover (H+) treatment will be to add diversity and interest to strategic locations within the development. The herbaceous cover in these areas will represent the diverse character of the meadow communities found throughout the Valley. Revegetation of this herbaceous cover will be accomplished by broadcasting the standard "H" seed mix, with a follow-up application of the "H+" mix in discreet locations to enhance aesthetics.

H+ seed mix- seeded at a target rate of 60-80 PLS/ sq. ft.

Grasses
Harford Melic
Needle Grass

Wildflowers and Forbs
Bigelow's Sneezeweed
Cow Parsnip
Dragon Sagewort
Meadow Goldenrod
Rydberg's Penstemon
Showy Milkweed
Tincture Plant
Yarrow

Zone 3: Meadow/ Riparian Herbaceous Cover (H)

Given the open meadow-like structure of the floodplain and riparian forest types within this zone, the herbaceous cover will be a significant feature of the landscape in these areas. Dense stands of grasses and forbs will be punctuated by isolated stands of low-growing shrubs on the meadow margins. Revegetation of the herbaceous cover will be accomplished by broadcasting a seed mix of grass and forb species native to the Yosemite Valley. The following mix is the standard herbaceous mix which will be applied to all areas throughout the project site which have been disturbed as a result of construction activities.

H seed mix- seeded at a target rate of 60-80 PLS/ sq. ft.

Blue Wildrye	75%
California Brome	20%
Lupine	2.5%
Buck Lotus	2.5%

Planting Design

The intention of the site planting design is to provide a framework which identifies the variety of environmental settings existing on site and which facilitates the establishment of self-sustaining native plant communities in those settings. In most cases, revegetation prescriptions respond to existing stands of vegetation or groves of mature trees on site. Thus, the revegetation approach in less formal, more "naturalistic" areas seeks to mimic and blend with extant native vegetation types found on site.

In contrast, within developed and more formally landscaped areas, the form and growth habits of native species were closely identified with functionality in the landscape. Specifically, areas where dense screening, enhanced aesthetics, or open views were desired were matched to the appropriate native species for that function and location.

The precise placement and arrangement of individual plant materials is not included in the planting design for this project. An attempt to do so would be inappropriate for a revegetation approach in which a naturalistic array of plants in their native settings is desired. The placement of plants will occur in the field just prior to planting, allowing for the opportunity for the vegetation to more intimately respond to actual site conditions such as subtlety of grade, sun/shade, and relation to built features.

Planting Process

Revegetation of the project site and newly constructed facilities will be implemented in a phased manner and will involve the utilization of various methods during each phase. A detailed description of individual techniques is provided in the "Revegetation Methods" section. The sequencing of planting activities begins with an initial application of native grass and forb seed immediately following completion of sitework. Seed and organic fertilizers will be applied to all bare ground and soils disturbed by demolition and construction activities. Seeded cover will be expected to establish over the subsequent seasons until the next appropriate planting season. Final revegetation will occur during the next fall season which follows the completion of all construction and sitework.

Final revegetation of the project site will begin with the placement of specimen trees in those areas designated for forest canopy establishment. Individual placement will respond to many factors including existing stands of trees, function in the landscape, or aesthetics. All trees will be planted utilizing an equipment-mounted auger, staked, and in certain locations, caged.

The planting of all large-container shrubs will follow, utilizing the same mechanical methods. Large shrubs will be placed surrounding newly planted stands of trees in naturalistic arrangements, densely planted in areas where instant screening is desired, or grouped in open areas. In areas subject to heavy foot-traffic or animal browsing, shrub plantings will be caged or protected with low fences.

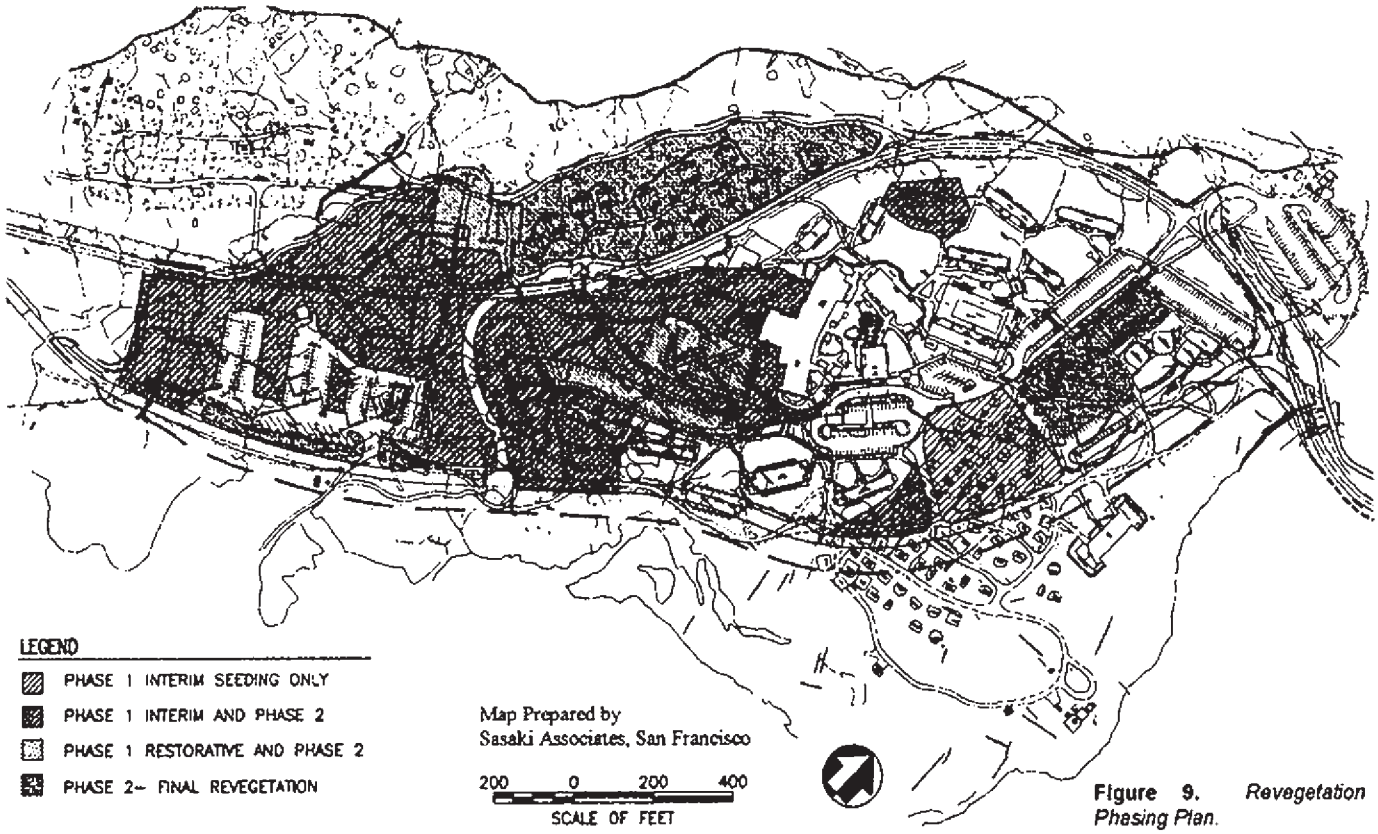


Figure 9. *Revegetation Phasing Plan.*

Specimen trees and large shrubs will not be planted beneath the canopies of existing trees. The process of augering planting holes can be harmful to the roots of mature trees. In addition, plantings in contact with existing tree roots are susceptible to transmitting pathogens such as "root rot" diseases. Planting of understory areas will be limited to hand-planted seedlings. Seedlings may be planted beneath the "dripline" of existing trees while maintaining a fair distance from the trunk or exposed roots. Hand planting will allow plants to be placed where the seedling is not in contact with existing roots and can be planted vertically at the proper depth. Seedlings will be planted within and around groups of newly planted trees and shrubs. Planted seedlings will complement larger individual plants by providing increased density and a diversity of sizes within a stand of vegetation.

The final planting step involves the application of seed in certain designated areas. This final seeding will consist of a collection of native wildflower, forb, and grass seed intended to add diversity and interest to key areas. Plantings and newly seeded areas will be irrigated and maintained for one year following final revegetation. At that time, maintenance watering will be drastically reduced and gradually eliminated. This reduction in maintenance will be possible and even desirable in areas in which the native vegetation has become established and is capable of sustaining itself.

Layers and Planting Designations

The drawings which follow present the development of planting designations for three representative areas across the project site. Each of these three "scenarios" illustrates the designation scheme and typical planting approach in a series of two drawings. The first drawing shows the planting designations as they relate to a representative area of the project. The second drawing shows how those designations may translate into the particular species and planting groupings.

For each scenario, the first drawing presents the planting designations in terms of layers which correspond to the tree canopy, shrub layer, or herbaceous cover to be planted (see "Revegetation Treatments" section). These layers can be visualized in a "top-down" fashion, in which the topmost layer presented is the existing tree canopy boundary, showing the relation of existing trees to structures and built features. The next layer designated is the proposed tree layer, which is shown to surround and build upon existing stands of trees. The proposed tree layer is not shown extending underneath the canopy of existing trees as new trees will not be planted in these locations. Next, the shrub layer is delineated by boundaries which show planting areas extending beneath the canopies of existing trees and overlapping with areas to be planted with new trees. Finally, the herbaceous layer is assumed to include all seedable areas within the project boundaries including those designated for tree and shrub planting.

Species Composition and Planting Layout

The second drawing included in each scenario shows how the various layers and planting designations may be represented in a final planting layout. Each cover type designation has been identified as to the assemblage of native species that type represents (see "Revegetation Treatments" section). These assemblages will include naturalistic groupings of individual species placed according to their environmental preferences, function in the landscape, and aesthetics. Although cover type designations consist of distinct groupings of individual species, each assigned to specific zones within the project site, these distinctions should be unapparent after final planting. Rather, the transitions between environmental settings and plant communities will be subtle and naturalistic, if not imperceptible.

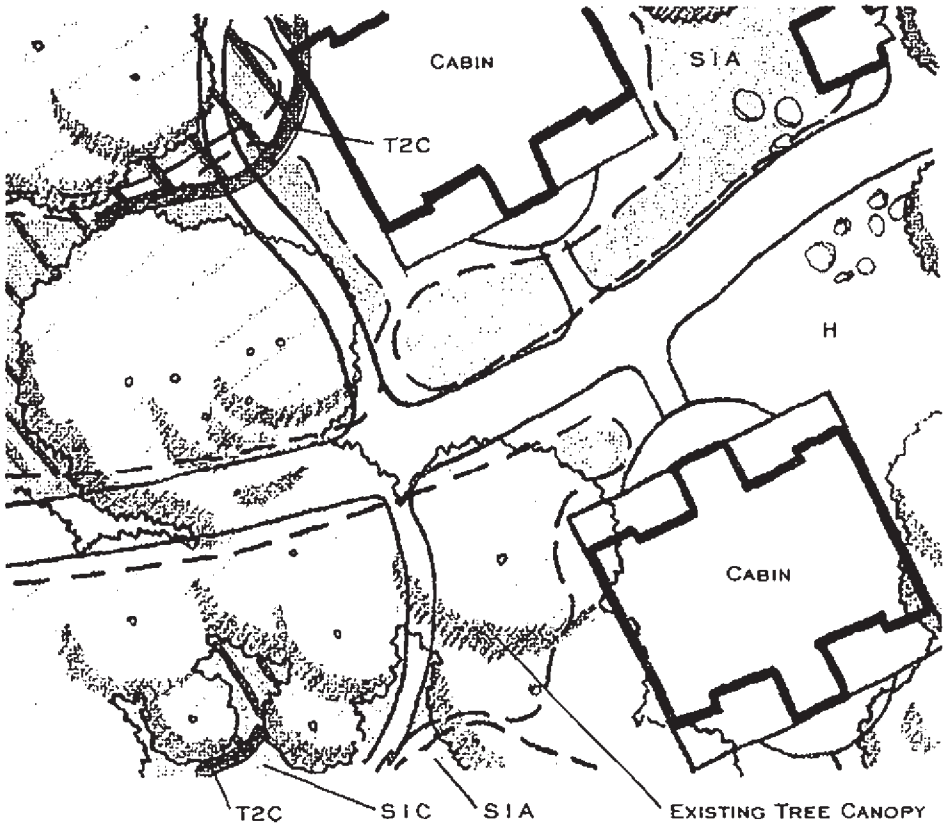


Figure 10. *Talus Slope Zone Planting Designations.*

Zone 1: Talus Slope Zone Typical Planting Scenario

Layers and Planting Designations

Tree Layer- Zone 2 Forest Cover Types

T2C- Calif. Black Oak/ Ponderosa Pine/ Canyon Live Oak

Shrub Layer- Zone 1 Shrub Understory Cover Types

S1A- Low Massing, open areas
S1C- Medium Massing, understory

Herbaceous Layer- Zone 1 Herbaceous Cover

H- Standard Herbaceous Mix

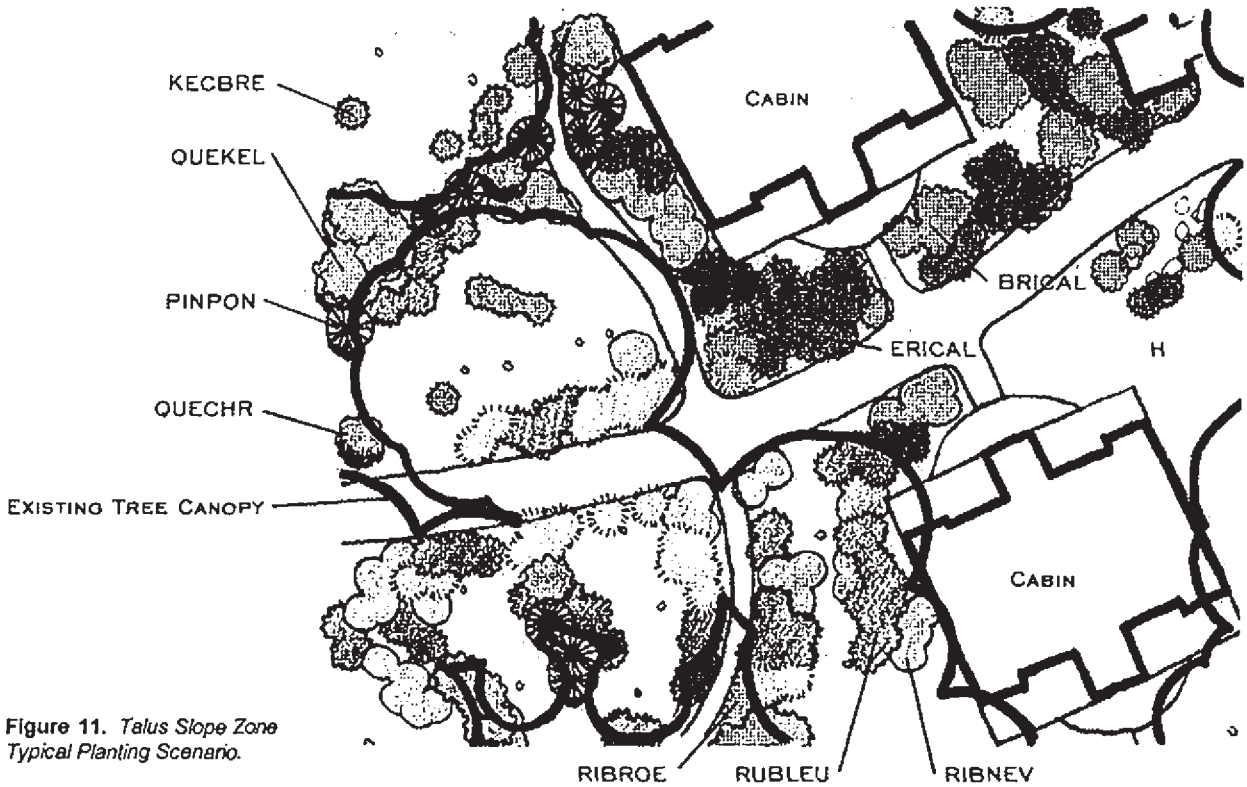


Figure 11. *Talus Slope Zone Typical Planting Scenario.*

Species Composition and Planting Layout

T2C- Calif. Black Oak/ Ponderosa Pine Canyon Live Oak

PINPON- Ponderosa Pine (*Pinus ponderosa*)
QUEKEL- California Black Oak (*Quercus kelloggii*)
QUECHR- Canyon Live Oak (*Quercus chrysolepis*)

S1A- Low Massing, open areas

BRICAL- California Brickellbush (*Brickellia californica*)
ERICAL- Yerba Santa (*Eriodictyon californicum*)
KECBRE- Bush Beardtongue (*Keckiella breviflora*)
RIBROE- Sierra Gooseberry (*Ribes roezlii*)

S1C- Medium Massing, understory

RIBNEV- Mountain Pink Currant (*Ribes nevadense*)
RIBROE- Sierra Gooseberry (*Ribes roezlii*)
RUBLEU- Blackcap Raspberry (*Rubus leucodermis*)

H- Standard Herbaceous Mix

Blue Wildrye (*Elymus glaucus*)
California Brome (*Bromus carinatus*)
Lupine (*Lupinus species*)
Buck Lotus (*Lotus crassifolius*)

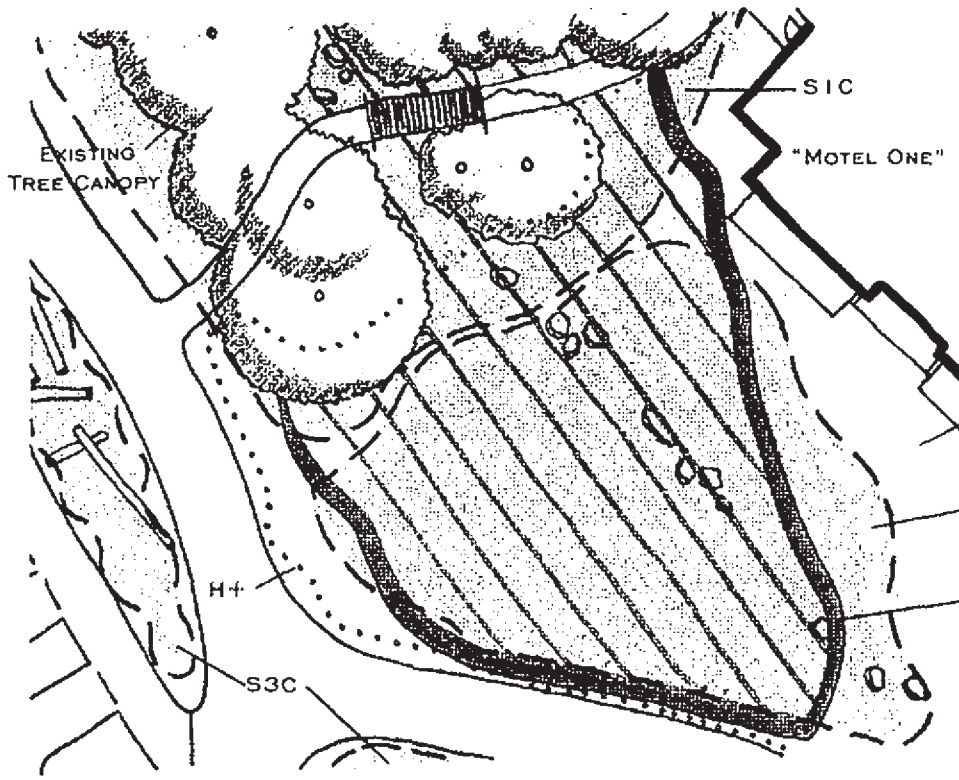


Figure 12. Developed (Transition) Zone Planting Designations.

Zone 2: Developed (Transition) Zone Typical Planting Scenario

Layers and Planting Designations

Tree Layer- Zone 2 Forest Cover Types

T2C- Calif. Black Oak/ Ponderosa Pine/ Canyon Live Oak

Shrub Layer- Zone 1 Shrub Understory Cover Types

S1C- *Medium Massing, understory*

Shrub Layer- Zone 3 Understory Cover Types

S3C- Medium Massing/ Screening, dry, open

Herbaceous Layer- Zone 2 Herbaceous Cover

H- Standard Herbaceous Mix
H+- Enhanced Herbaceous Mix

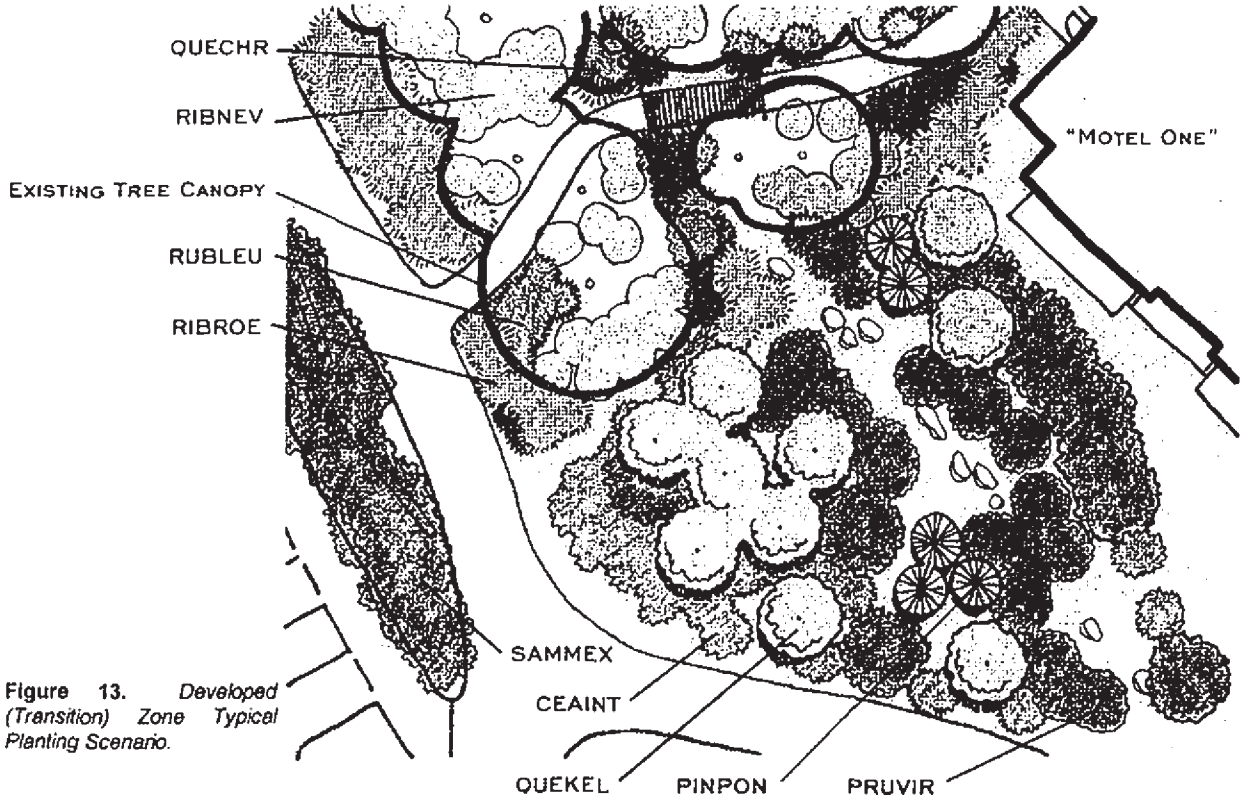


Figure 13. *Developed (Transition) Zone Typical Planting Scenario.*

Species Composition and Planting Layout

T2C- Calif. Black Oak/ Ponderosa Pine Canyon Live Oak

PINPON- Ponderosa Pine (*Pinus ponderosa*)
QUEKEL- California Black Oak (*Quercus kelloggii*)
QUECHR- Canyon Live Oak (*Quercus chrysolepis*)

S1C- Medium Massing, understory

RIBNEV- Mountain Pink Currant (*Ribes nevadense*)
RIBROE- Sierra Gooseberry (*Ribes roezlii*)
RUBLEU- Blackcap Raspberry (*Rubus leucodermis*)

S3C- Medium Massing/ Screening, dry, open

CEAINT- Deer Brush (*Ceanothus integerrimus*)
PRUVIR- Western Chokecherry (*Prunus virginiana var. demissa*)
SAMMEX- Blue Elderberry (*Sambucus mexicana*)

H- Standard Herbaceous Mix

H+- Enhanced Herbaceous Mix

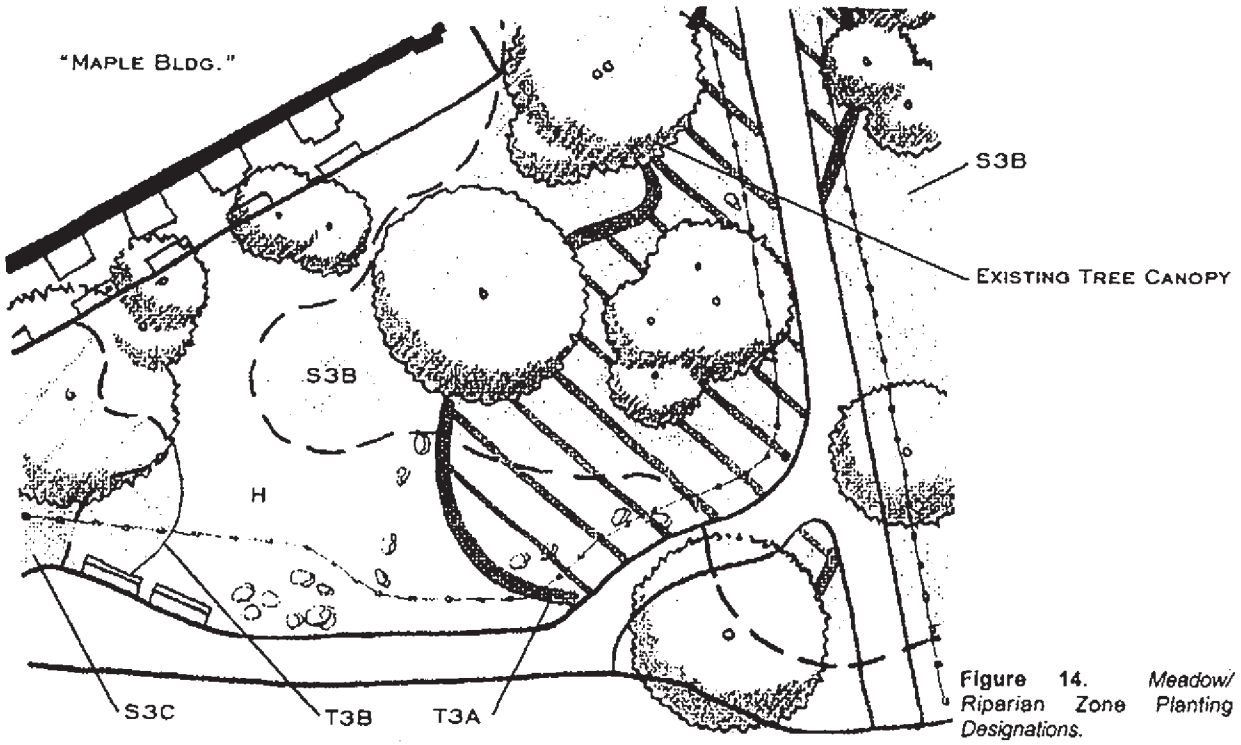


Figure 14. *Meadow/ Riparian Zone Planting Designations.*

Zone 3: Meadow/ Riparian Zone Typical Planting Scenario

Layers and Planting Designations

Tree Layer- Zone 3 Forest Cover Types

T3A- Big Leaf Maple/ Pacific Dogwood
T3B- Calif. Black Oak/ Big Leaf Maple

Shrub Layer- Zone 3 Shrub Understory Cover Types

S3B- Low Massing, moist, open to shady areas
S3C- Medium Massing/ Screening, dry, open

Herbaceous Layer- Zone 3 Herbaceous Cover

H- Standard Herbaceous Mix

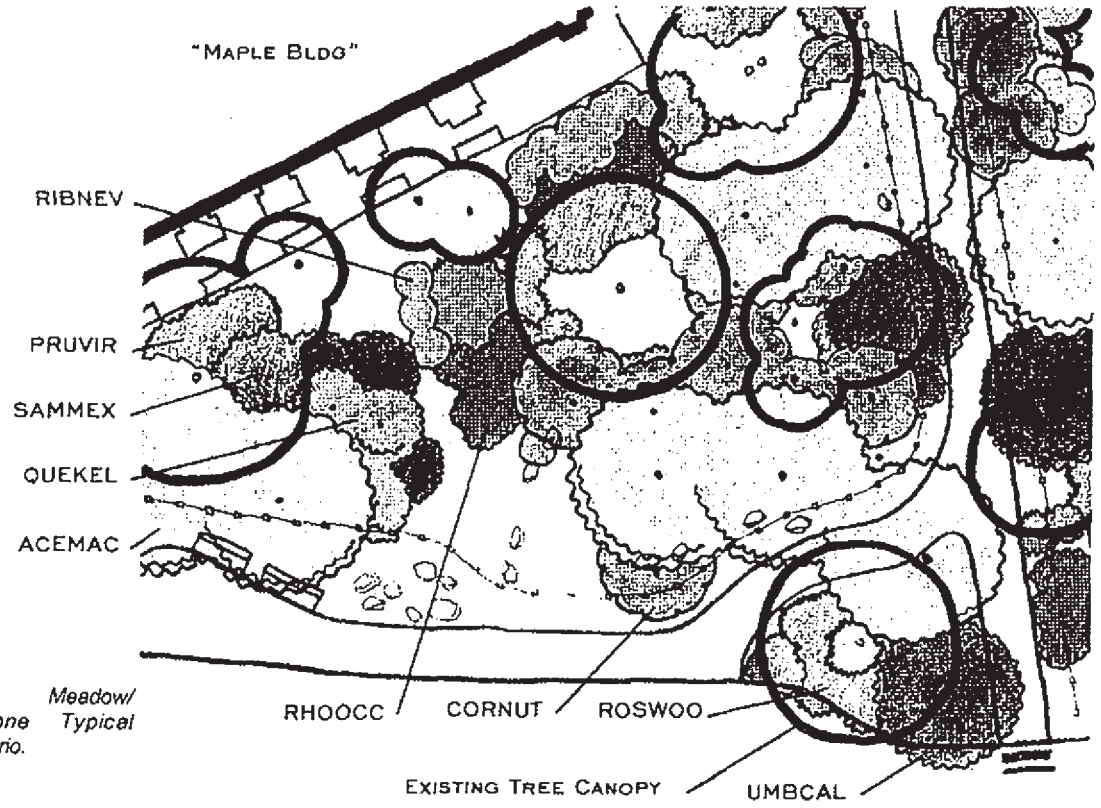


Figure 15. *Meadow/ Riparian Zone Typical Planting Scenario.*

Species Composition and Planting Layout

T3A- Big Leaf Maple/ Pacific Dogwood

ACEMAC- Big Leaf Maple (*Acer macrophyllum*)
CORNUT- Pacific Dogwood (*Cornus nuttallii*)
UMBCAL- California Bay Laurel (*Umbellularia californica*)

T3B- Calif. Black Oak/ Big Leaf Maple

ACEMAC- Big Leaf Maple (*Acer macrophyllum*)
QUEKEL- California Black Oak (*Quercus kelloggii*)

S3B- Low Massing, moist, open to shady areas

RHOOCC- Western Azalea (*Rhododendron occidentale*)
RIBNEV- Mountain Pink Currant (*Ribes nevadense*)
ROSWOO- Wood's Rose (*Rosa woodsii*)

S3C- Medium Massing/ Screening, dry, open

CEAINT- Deer Brush (*Ceanothus integerrimus*)
PRUVIR- Western Chokecherry (*Prunus virginana var. demissa*)
SAMMEX- Blue Elderberry (*Sambucus mexicana*)

H- Standard Herbaceous Mix

Native Seed Collection

Description. The collection of native seeds and cuttings is intended to provide source material for the propagation of site-specific, locally adapted native plant species for use in revegetation. These propagules have been custom collected from the project vicinity and represent the diversity of native vegetation found in adjacent natural communities which serve as models for the revegetation at the project site.

Approach. Park policy and natural resource management directives emphasize the importance of preserving the integrity of local flora and the genetic diversity of distinct plant populations within the Park. These directives dictate that plant material used for revegetation purposes within the Park be propagated from locally-collected germplasm and parent stock whenever practicable. For the purposes of this project, seed was collected primarily from within Yosemite Valley. Although a wide diversity of vegetative communities can be found there, the Valley can be viewed as a distinct ecological unit, within which individual species might share similar adaptations and environmental tolerances. The definition of the Valley as the seed collection zone for this project was adhered to with the exception of the inclusion of two species from the Merced River canyon, downstream of the Valley. These species are Spicebush (*Calycanthus occidentalis*) and Mockorange (*Philadelphus lewisii*) and are included primarily for their aesthetic value as attractive native specimens for use in formally landscaped areas of the Lodge facilities.

The selection of species for collection must consider the goals and approach of final revegetation activities. For the purposes of this project, species selection has focused upon those dominant native tree and shrub species which define the character of the local setting and which are appropriate for replanting. This selection considers the twofold goals of including those species known for their ability to colonize and establish quickly, and those later seral species which define the character of the vegetative communities being modeled. Grass collections have focused on species such as Blue Wildrye (*Elymus glaucus*), which is known for its ability to establish quickly and for their wide-ranging adaptability in a variety of environmental conditions. Forb collections have included primarily nitrogen-fixing legumes such as Lupine (*Lupinus species*) and Buck Lotus (*Lotus crassifolius*), known for their preference for colonizing disturbed sites. Wildflower species were included in the collections in order to enhance herbaceous coverage and to provide diversity in certain landscaped areas.

Hand Collection Methods. Hand collection tools and techniques are numerous and reflect the type of seed being collected. All of the species included in this Revegetation Plan, with the exception of a few grasses, were collected by trained seed collectors using hand collection techniques. Cones and the seeds of trees were collected using pole pruners and tarps. Berry pickers, combs, tarps, and hands were used to collect the seed of various shrubs and forbs. Scythes, scissors, and clippers were employed to gather grass and forb seed. Seed collected by hand enjoys the benefit of being relatively pure, consisting primarily of seed of the target species with little unwanted material. This purity will usually translate into an easier cleaning process, during which pure seed is separated from other materials for the purpose of storage.

Mechanical Collection Methods. A portable "seed stripper" unit was used to gather grass seed in larger stands of desired species. This method is most effective in fairly pure stands of native grass, where varying heights of grasses and seed do not interfere with the efficiency of the unit. Under favorable conditions, this collection method can yield a great deal of seed with relatively little effort. The automated nature of this method makes it difficult to specify a single species for collection and can yield seed which needs greater care during the cleaning process to isolate the pure seed.

Seed Processing and Storage. To date, all seed collected in the Park has been packaged and shipped immediately to the BRI facility in Corvallis. Proper bagging and labeling allow the seed to be properly entered into the inventory database upon arrival; identified by species, collection location, client, and other relevant information. Newly arrived seed is separated and allowed to dry and is cleaned by various methods dependent upon the seed type. Cleaned seed may be allowed to dry further to reach an ideal moisture content for storage. Processed seed is then placed into properly labeled containers and placed in cold storage at temperatures just above freezing. This method of storage is ideal but will not protect the viability of all seed indefinitely. The ability to store and maintain seed viability will differ from species to species.

Figure 16. *Using A Portable "Seed Stripper" To Collect Grass Seed.*

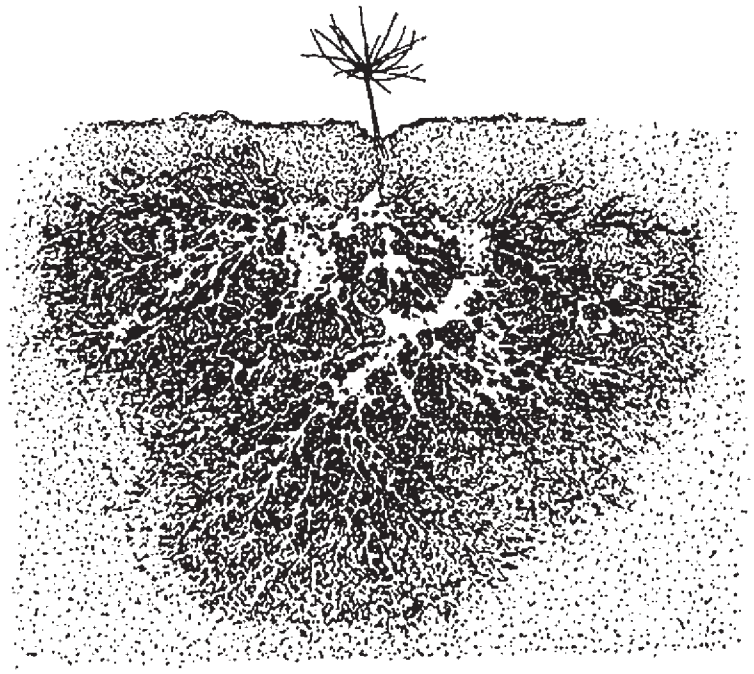


Figure 17. *The Effective Root System Of A Seedling Colonized With Mycorrhizal Fungi.*

Mycorrhizae Collection and Culture

Description. The mutually beneficial relationship formed between mycorrhizal fungus and plant roots is an ancient association that is thought to have been responsible for the evolution of land plants. Mycorrhizal fungi populations are among the major victims of land disturbance. These populations can be re-established, however, and the numerous benefits of mycorrhizal associations can be obtained by inoculating seedlings before transplanting to disturbed sites. The benefits of mycorrhizal associations to plants include enhanced availability and transfer of nutrients, alleviation of drought stress, and increased resistance to root diseases.

There are three basic types of mycorrhizal associations: endomycorrhiza; ectomycorrhiza; and ericoid mycorrhiza. Endomycorrhizal fungi grow mainly inside developing roots and are also known as Vesicular and Arbuscular Mycorrhiza, or VAM. These mycorrhizal fungi can not survive without host plants. Ectomycorrhizal fungi produce a hyphal mantle which surrounds the outside of the roots. Ect-endomycorrhizal associations are a special case, as exemplified by *Arctostaphylos* species. These mycorrhizal fungi form a mantle which both surrounds the outside of the root and grows into the root cells. Ericoid mycorrhizal fungi function like endomycorrhizal fungi but do not form the typical VAM structures within the host roots. Plants belonging to the *Ericaceae* family form associations with ericoid mycorrhiza.

Approach. The majority of native plants propagated for the revegetation project at the Yosemite Lodge will be inoculated with locally collected, site-specific endomycorrhizal fungi. The replanting of mycorrhizal plants in disturbed soils is intended to address the restoration of soil health as well as aboveground native plant communities. Plants will be inoculated only with endomycorrhizal fungi collected from surrounding native plant stands within Yosemite Valley. Outside sources of commercial ectomycorrhiza inocula or other ectomycorrhizal fungi will not be introduced into revegetated areas.

Identification of Culture Needs. Plant species to be propagated for this project have been evaluated for their mycorrhizal associations. Much of this information has been gleaned from prior experience, literature sources, and experts in the field of mycology. Current culture and production capabilities allow BRI to culture site-specific mycorrhiza for endomycorrhizal and ect-endomycorrhizal plant species only. Commercial sources are available for endomycorrhizal inoculation but will not be considered on this project due to the desire to utilize only site-adapted and local genetic sources.

Soil and Fungi Collection Procedures. Within the overall collection zone defined as Yosemite Valley, plant communities were grossly categorized to include Oak Woodland, Floodplain Forest, and Meadow types. These communities formed the basis for identifying soil collection needs and roughly correspond to the revegetation zones defined in this project.

It is theorized that each designated community type has endomycorrhiza propagules which correlate to the individual species within that community. Within each community type, three soil samples were collected from different geographic locations. Samples were collected directly from the root zones of known endomycorrhizal species. Soil was also collected from grassy areas whenever possible as grasses have a large, fine root mass with the largest potential volume of endomycorrhiza spores and propagules. Soil collected for ect-endomycorrhiza cultures, for example *Arctostaphylos* culture soils, were taken directly from the rooting zone of the host plant and included a large quantity of live root material. The three samples from each community type were later combined to produce a "cocktail" of inocula from species within that community type.

Soil collectors bag the soil samples in impermeable plastic bags, label them with the date, location, zone and associated species, and ship them to the BRI facility in portable coolers to maintain proper temperatures. Each soil collection is catalogued and stored just above freezing in a walk-in cooler until they are sieved for culturing.

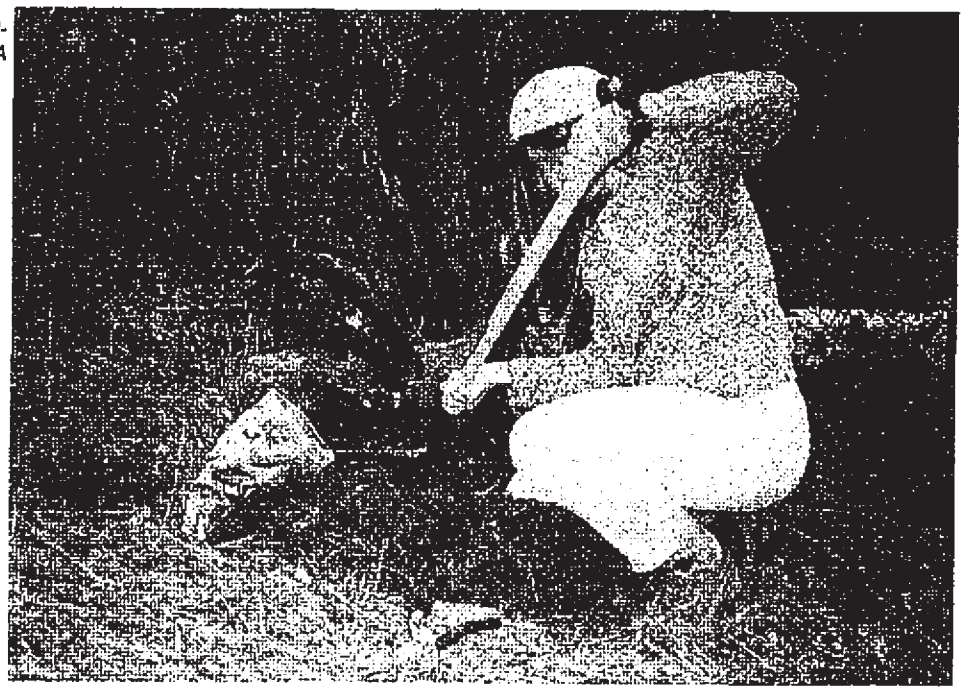


Figure 18. *Collection of Ect-endomycorrhize Soils From A Host Arctostaphylos Plant.*

Endomycorrhiza Culture Methods. BRI is currently using two methods for culturing endomycorrhiza. The first method uses the field soil and associated roots directly to colonize containerized host plants such as sudan grass, onion, or big bluestem. These host plants are selected for their ability to grow rapidly and produce a voluminous root mass. Cultured spores will eventually be separated from the roots of these host plants, negating the possibility that the host plants will persist during seedling propagation or outplanting. A one-inch band of field soil and root pieces is placed in the top 2/3 of a 10 $in.^3$ seedling container filled with a standard potting mix. Host plant seeds are sown into these tubes and allowed to grow until root tight. These colonized seedlings are then transplanted into the center of a sterilized one- or two-gallon pot filled with potting mix. Additional seeds of the host plants are sown into the remainder of the pot and will eventually be colonized via the transplanted seedling.

The second method involves wet sieving the field soils through a series of progressively finer sieves. Spores of endomycorrhizal fungi measure between 45 and 90 micrometers and will be trapped by these screens. Pathogenic fungi spores tend to be much smaller and will pass through and not be trapped. The trapped material, called spore isolate, is decanted and examined under a dissecting microscope for the presence of spores. This isolate is then transferred to sterilized 4" pots filled with general potting mix. The culture host plants are then sown into these containers. These plants are allowed to grow until colonized and root tight, at which time they are transplanted into larger containers as in the first culture method described.

During the culture period, plants are fertilized with a mycorrhiza-friendly solution when necessary, and grown under high intensity lights with a 16-hour photoperiod. Each culture pot is tested for colonization at the end of the culture period using methods described by Brundrett, et al., 1996. Successful cultures are allowed to dry in order to enhance spore production and increase spore viability. When sufficiently dry, each culture is labeled, inventoried, and placed in cold storage until needed for seedling inoculation.

Ect-endomycorrhiza Culture Methods. Because ect-endomycorrhiza can only be cultured on its specific host, collected ect-endomycorrhiza soil is banded into sterilized one-gallon pots and three 10 $in.^3$ seedlings of host plants such as *Arctostaphylos* or *Rhododendron* are transplanted into the container. These plants are grown under the same fertilizer and culturing regime as the endomycorrhizal cultures. Unlike endo cultures, ect-endo cultures must be kept alive and used fresh as inocula. Therefore, these cultures are not dried and stored but rather kept alive until needed for inoculation.

Inoculation and Propagation of Seedlings. Individual seedlings are inoculated at the time of sowing according to the appropriate plant community and mycorrhiza type for that species. Each endomycorrhiza culture is evaluated for spore content and spore density after harvesting. A target inoculation rate of a minimum 100 spores per seedling is used. The dried inocula is banded into each seedling container, which are then sown with the appropriate seed and propagated under mycorrhiza-compatible conditions. Because of the lack of a method for estimating the density or propagule content of ect-endomycorrhizal inocula, fresh inocula is divided equally among the seedlings to be inoculated, and banded into each individual seedling container. These seedlings are also propagated under mycorrhiza compatible conditions until outplanting.

Colonization Rate Evaluation. Prior to final shipment, seedlings are tested and microscopically evaluated for the presence of endomycorrhizal structures, again using methods described by Brundrett et al. A percent colonization value is assigned to each seedlot following random sampling. Outside mycological consultants have advised BRI against assigning an arbitrary numerical "success" or "failure" percent colonization rate as this does not necessarily correlate with mycorrhizal success or effect on plant growth. Rather, a given seedlot will be labeled as mycorrhizal if mycorrhizal structures have been seen in any sampled plant within that lot. The same methods will be used to determine colonization in ect-endomycorrhizal seedlings, the only difference being a visual rather than a microscopic evaluation.

Seedling Propagation

Description. Planting stock used for this revegetation project will include custom-grown containerized seedlings of site-specific native plant species. Container grown seedlings have intact root systems which are protected by the containers in which they are grown and are in many cases superior to other types of plant stock such as bare-root. Containerized seedlings maintain an intact, active root system protected against mechanical injury and dehydration, are appropriate for long-term storage and shipping, and have been shown to outperform bare root plants when outplanted in harsh environments.

Approach. For the purposes of this project, the majority of plants will be propagated from seed collected locally within Yosemite Valley. In the rare case of species for which seed has proved difficult to obtain, locally collected cuttings will be utilized for vegetative propagation. Using local propagule sources will ensure that the plants produced will be derived from local genetic stock and site-adapted to local environmental conditions.

Growing techniques will emphasize the aspects of plant morphology which ensure successful establishment. Rather than striving for height growth, the critical factor in the survival of outplanted seedlings is the root system. Containerized seedlings allow for healthy root growth and facilitate a range of treatments from fertilization and pest management to the pruning of roots and shoots. Seedlings will be grown to the highest quality in terms of root system, seedling height/caliper/branching and root:shoot ratio.

Seed Treatment. The seed of many native species requires specific and often complex environmental cues such as scarification, stratification, and after-ripening to which they must be subjected to before they will begin to germinate. Seed to be propagated is stratified and treated according to species using techniques developed through prior experience, inference from the native ecosystem, or experimentation. Often, even for a single species, these treatments may vary from region to region, or between climatic zones. Upon commencement of germination, treated seed is transported to the greenhouse for sowing into containers.

Greenhouse Production. Seedling containers are washed, sterilized, and filled with potting media and mycorrhizal inoculum if required. For the purposes of this project, seedlings will be grown in either 10 $in.^3$ or 20 $in.^3$ containers, depending upon species. Treated seed is then sown into these containers and kept moist until germination begins. Newly germinated seedlings are maintained under optimum growing conditions where temperature, light, and humidity are closely controlled. Seedlings receive periodic applications of customized, balanced fertilizer solutions and are pruned as necessary. When seedlings have attained optimal height and root development, they are transferred to the shadehouse to "harden off" to ambient conditions.

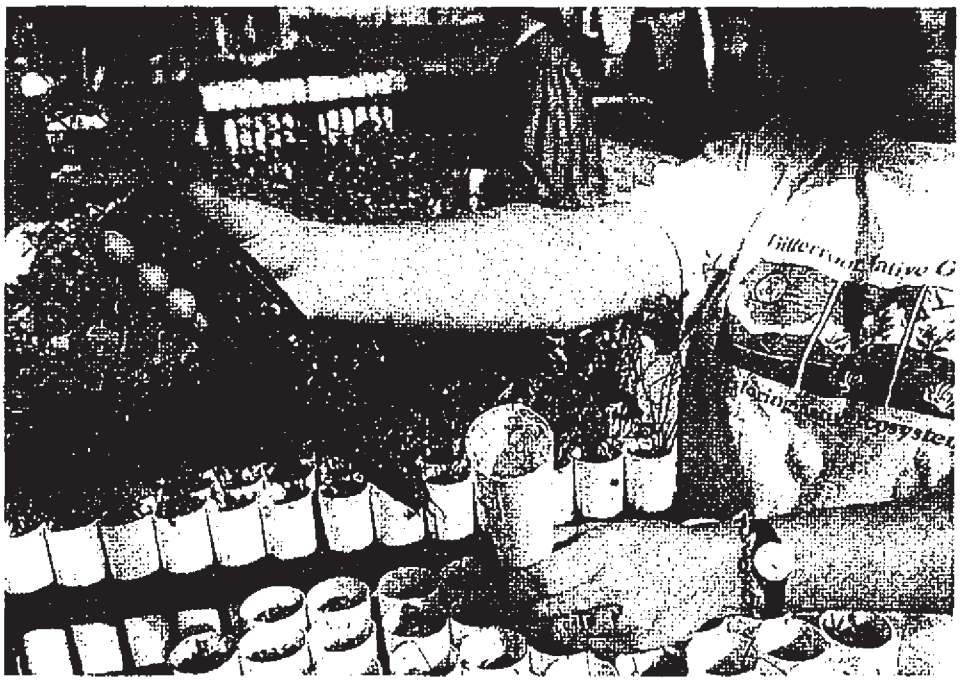


Figure 19. *Containerized Native Plant Seedling.*

Shadehouse Production. The purpose of the shadehouse is to allow seedlings to continue growing under ambient environmental conditions and to provide for long-term storage. The shadehouse structures have the ability to provide irrigation, shade, and protection from extreme cold to the seedlings, as well as allow for convenient maintenance. Plants stored in the shadehouse will become "hardened off" and be induced into dormancy with the onset of the fall season. This dormancy is key to the establishment success of outplanted seedlings.

Propagation Timeline. The production of native plant seedlings should be initiated at least one full year prior to outplanting. Some species may require two years to properly attain size standards. This lengthy lead time is dictated by the complex seed treatments and slow-growing habits of some native species. For the purposes of this project, planting stock which will be outplanted in seedling sizes will be propagated two years prior to planting time.

Large Container Plant Production

Description. In order to address the desire for a reasonably mature landscape at the time of planting, the majority of plants for this project will be nursery grown to larger specimen size. Large container plants are defined as equivalent to a standard one-gallon plant and may attain 12" to 18" height.

Approach. All large container plants produced for this project will be grown in "Deep One" containers, designed to increase the ability for plants to form deep root systems. The dimensions of the Deep One are 4"x4" wide x14"deep, a root volume roughly equivalent to a standard one gallon plant. The design of the container, however, works to train developing roots downward, to be airpruned upon exiting a hole in the container bottom. In drier sites, such as those on this project, this is a significant advantage over traditional containers in that roots will not spiral at the bottom of the container, inhibiting establishment success and drought tolerance. The root morphology and root ball shape of plants grown in Deep One containers give the plant an advantage in being their planted deeply, able to establish taproots quickly, and increasing the plants ability to survive seasonal drought.

Nursery Production. Containers will be cleaned, sterilized, and filled with a potting mix blended with sand to facilitate easy drainage, to which slow-release fertilizers and micronutrient amendments will be added. The seedlings will be planted into these containers in the fall season, following one year of growth in the greenhouse and shadehouse. Plants will be grown outdoors in a maintained area lain with weed barrier fabric. Plants will be watered and kept free of weeds until time of delivery. Plants meeting delivery standards will be root tight (easy to extract from containers, roots should hold intact after being pulled out of the containers), have good caliper and morphology, and be free of pathogens and diseases.

Production Timeline. A lead time of two to three years is required to grow Deep One plants to standards. Plants will develop as seedlings for one year before being potted up to the larger size, where they will continue to grow for one additional year. For this project, seedlings intended for large container production will be propagated two years prior to planting time.

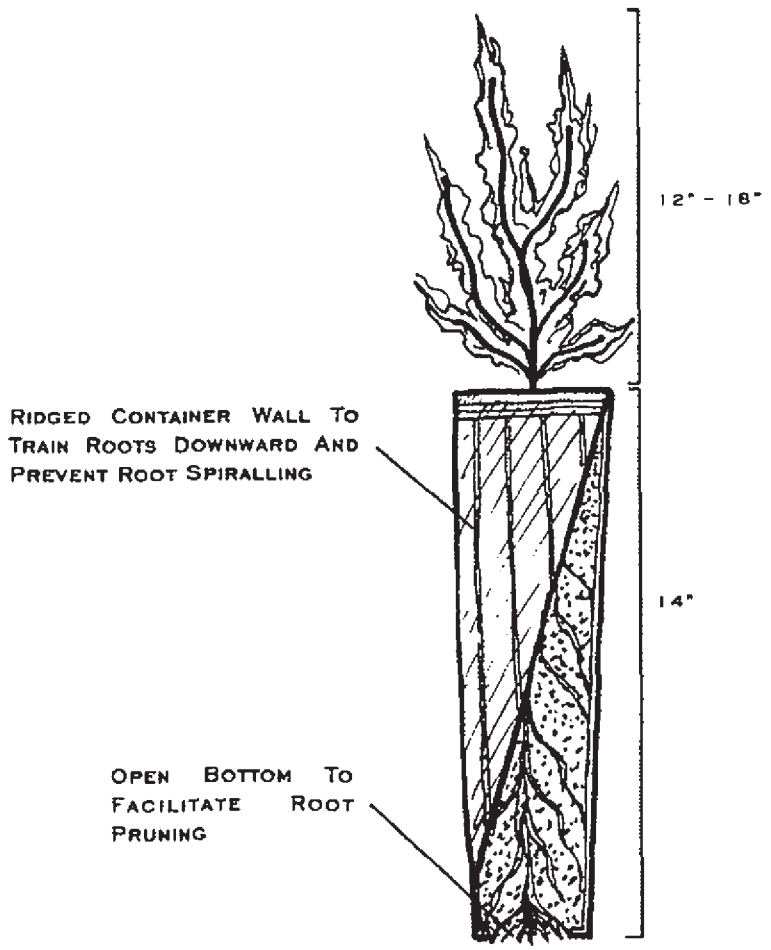


Figure 20. *Cut-Away View Of A "Deep One" Large Container Plant.*

Specimen Tree and Screening Shrub Production

Description. The revegetation design specifies areas designated for the establishment of a tree canopy, under which shrubs, grasses, and forbs are to be planted. Specimen-sized trees will be planted in these areas to allow a reasonable head start toward canopy establishment. Planting larger trees will also provide an instant landscape effect, helping to renaturalize the site and lessen the impact of construction activities. Other specific areas of the project are designated as requiring mature vegetation to provide screening and privacy to lodging units. These screening shrubs will be grown to a larger size to provide these benefits at the time of planting. Specimen trees and screening shrubs are defined as equivalent to a twenty-five gallon ball and burlap plant, and may attain heights of 3' to 6'.

Approach. All specimen trees and screening shrubs produced for this project will be field-grown in "Growbag" root control bags. The Growbags used will be 16" diameter and roughly equivalent in effective root volume to a twenty-five gallon plant container. Growbags utilize a root control barrier fabric which allows fine roots to exit the bag into the surrounding soil, increasing the effective root volume of the plant. As thicker roots develop, the barrier fabric serves to girdle and prune the exiting root. This ability causes the plant to respond by forming new, finer roots. The root control bag promotes the development of a fibrous root system, free from spiraling and appropriate for transplanting. Because the barrier fabric increases the effective root volume, the plant is able to attain sizes larger than that possible in a standard large container, while retaining equal ease of transplanting.

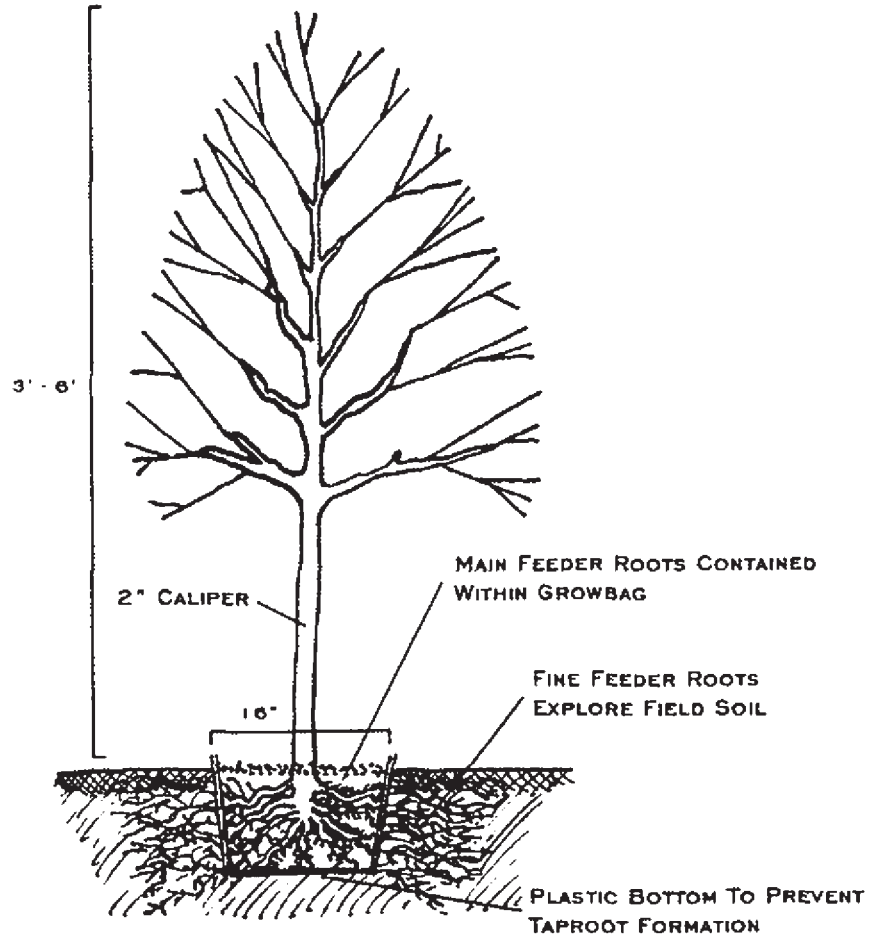


Figure 21. *Detail of Field-Grown "Growbag" Specimen Tree.*

Nursery Production. Specimen trees and screening shrubs will be field grown by placing the plant container into an augered hole. Holes will be augered into field soils in rows at 4' spacing. The Growbag will then be filled with a potting mix similar to that for large container plants described above. Seedlings will be transplanted into individual containers during the fall season following one year of growth in the greenhouse and shadehouse. Specimen trees will be staked as necessary and the field will be lain with weed barrier fabric to maintain the plants in weed free soils. Plants meeting delivery standards will be root tight (bag should show fine roots exiting, roots and bag form a compact ball), have good caliper and morphology, and be free of pathogens and diseases.

Production Timeline. A lead time of three to four years is required to grow Growbag plants to standards. Plants will develop as seedlings for one year before being potted up to the larger size, where they will continue to grow for a minimum of two additional years. For this project, seedlings intended for Growbag production will be propagated three years prior to planting time.

Plant Delivery

Plants grown to standard will be conditioned to a relatively hardy state before delivery by manipulating light conditions, fertilization, and watering. Plant materials will need to be transported to a staging area in Yosemite Valley, ideally for one month prior to installation to ensure proper hardening off and adjustment to the local climate.

Plant Salvage

Description. Plant salvage is an activity which is appropriate in areas scheduled for demolition where avoidance and preservation of existing vegetation is not possible. The primary objective of plant salvage is to rescue individual species of concern, mature specimens of slow-growing species, or "source plants" from which vegetative propagation may be conducted.

Approach. One of the primary concepts in the design of the new facilities is the incorporation of existing stands of native vegetation into the siting of constructed elements. Given this, unmitigatable losses of vegetation are expected to be minimal.

No plant salvage activities are currently planned within construction areas. Areas scheduled for demolition were surveyed for candidate plants and options for salvage methods were discussed. It has been determined that for the purposes of this project, any potential losses of desirable vegetation can be mitigated by replacement by propagated plant materials. This decision is due in part to the relative high cost of salvage compared to nursery propagation, considering adequate lead time and site-specific seed of the desired species is on-hand.

Seeding

Description. Interim seeding is intended to provide temporary erosion control and dust suppression through the establishment of native grass and forb coverage on recently disturbed areas of demolition and construction. Rapid establishment of grass coverage can aid in the amelioration of poor or compacted soils, as well as help to prevent the establishment of exotic weeds in newly disturbed areas. The term "Interim Seeding" assumes that there may be a period of one or more seasons between the commencement of construction activities and final revegetation of the entire project site. Final revegetation activities will include an additional application of grass, wildflower and forb seed in strategic areas where added diversity and enhanced landscape aesthetics are desired.

Approach. Interim seeding will be performed as quickly as practicable following the completion of final construction and final grading activities within specific areas of the project. These areas are identified in **Figure 9, Revegetation Phasing Plan**. Newly constructed areas will be seeded during the following appropriate season, roughly defined as late Fall through Winter (October 15th – February 28th) and subject to direction by Park Natural Resources staff. This initial seeding is intended to protect vulnerable disturbed areas and to initiate the process of recovery and native vegetation establishment.

Final seeding will be performed during the final revegetation phase of the project. Specifically, seeding will occur following the completion of all site planting, in identified areas of pre-exisiting seeded herbaceous cover.

Site Preparation. Completion of final sitework requires the construction contractor to apply a layer of hydromulch on all soils and bare ground disturbed by grading or construction activities. This hydromulch is intended to protect and stabilize soils until interim seeding can occur. Site preparation for the interim seeding application will consist of raking this hydromulch layer to break up any persistent crust and allow for maximum soil contact of the newly applied seed. Given the anticipated elapsed time of a season or two between hydromulch application and interim seeding, the hydromulch layer is expected to have degraded significantly and not present an obstacle to seeding success.

Raking will be accomplished by hand in those areas where hand broadcast methods will be used. In areas to be seeded by mechanical broadcast methods, a small rake attached to the rear of an ATV will be used.

Application. All disturbed and exposed soils within the project construction area will be seeded using a combination of hand and mechanized broadcast techniques. Manual seed spreaders will be employed in small or difficult to access areas. A small, four-wheeled ATV with a spreader attachment will be used in large contiguous areas where access and manueverability is possible. This initial seeding will consist of native grass and forb species (see Revegetation Treatment "H"), and is intended to protect vulnerable disturbed areas and to initiate the process of recovery and native vegetation establishment

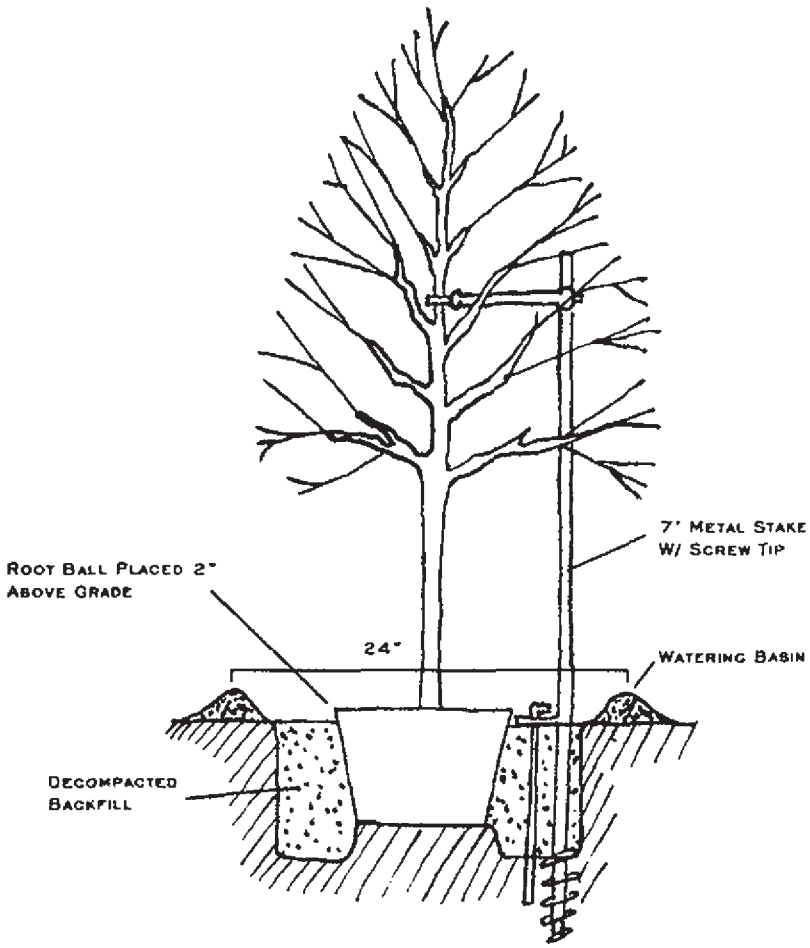
Final seeding will be applied by hand broadcast techniques, as seed will be added to enhance areas of pre-existing seeded cover and newly planted trees and shrubs. The term "pre-existing seeded cover" is defined as the previously applied interim seeding cover of native grasses and forbs. Since the interim seeding will have been applied to all disturbed areas within the project site, final revegetation plantings and seeding will occur in areas where this seed mix has become established. The final seeding application of wildflower, grass and forb species (see Revegetation Treatment "H+") will be applied in areas where diversity and enhanced aesthetics are desired.

Fertilization. Soil tests will be performed on final graded and prepared soils in order to gather basic agronomic fertility information. These tests are intended to provide baseline information from which target fertilization rates can be calculated. Soil tests will not be intended to investigate questions of soil toxicity or possible pollutant content. It is currently estimated that a standard application of an organic, slow-release fertilizer such as Biosol Mix™ (7-2-3) or the equivalent will be broadcast at a "light" rate of 800 lbs./acre to facilitate vegetation establishment. This standard application rate may be modified to address soil fertility in specific locations given the probable compaction, poor structure, and infertility of exposed subsoils in demolition areas without pre-existing vegetation.

Mechanical Planting

Description. Specimen trees, screening shrubs, and large container plants will be planted by mechanical means to ensure soil decompaction and proper depth of planting holes. An equipment-mounted auger will be utilized to vertically drill planting holes into final graded soils. A 16" auger will be used for planting the specimen trees and screening shrubs (Growbags) and a 6" auger will be used for large container (Deep One) plants. The auger will be mounted on a "bobcat"-type tractor.

Figure 22. *Specimen Tree Planting and Staking Detail.*



Approach. The locations of specimen trees, screening shrubs, and large container plants will be staked or flagged prior to planting. The equipment will first be fitted with the large auger and all Growbag planting holes will be drilled. Next, the auger will be changed and all of the Deep One planting holes drilled. No holes will be augered beneath the "dripline" of existing tree canopies in order to avoid root damage to mature trees. Holes will be drilled vertically and slightly deeper than the container to be planted in order to decompact the native soils. Any root pieces encountered in the hole which are greater than 3" diameter or greater than 20" in length will be removed or cut cleanly off. The plant will be placed in the hole with the crown of the plant at existing grade. Unamended backfill consisting of native soils will be used to fill the planting hole and will be firmly tamped into place. A shallow watering basin will be constructed to the same width as the planting hole. Plants shall be planted straight with the root balls firmly anchored in the native soils. All trees will be staked for support and both trees and shrubs may be caged for protection dependent upon location.

Hand Planting

Description. Containerized seedlings will be planted by hand to ensure proper placement and maximum survival. Experienced and professional planters will utilize "hoedad" tools to plant seedlings amongst newly planted trees and shrubs.

Approach. A combined planting of seedlings and larger container sized plants is intended to enhance the naturalistic appearance of newly planted areas by providing a diversity of plant sizes and ages. Seedlings will be planted in proximity to newly planted trees and shrubs to help infill and expand stands of planted vegetation. Seedlings may also be carefully planted underneath existing tree canopies in designated areas. Understory plantings will maintain an appropriate distance from the trunk and not be planted in contact with large existing roots. A planting hole in which root material is found will be backfilled and abandoned and the plant placed in another location. Seedlings will be planted straight and vertical, with the crown placed at existing grade, and lightly tamped into place. Care will be taken to avoid air pockets in the planting hole or "J"-rooted plants. Seedlings will be firmly planted and will not pull easily from the planting hole. A 12" scalp and watering basin will be constructed around the plant. Some seedlings will be protected by rigid plastic tree protectors depending upon the location.

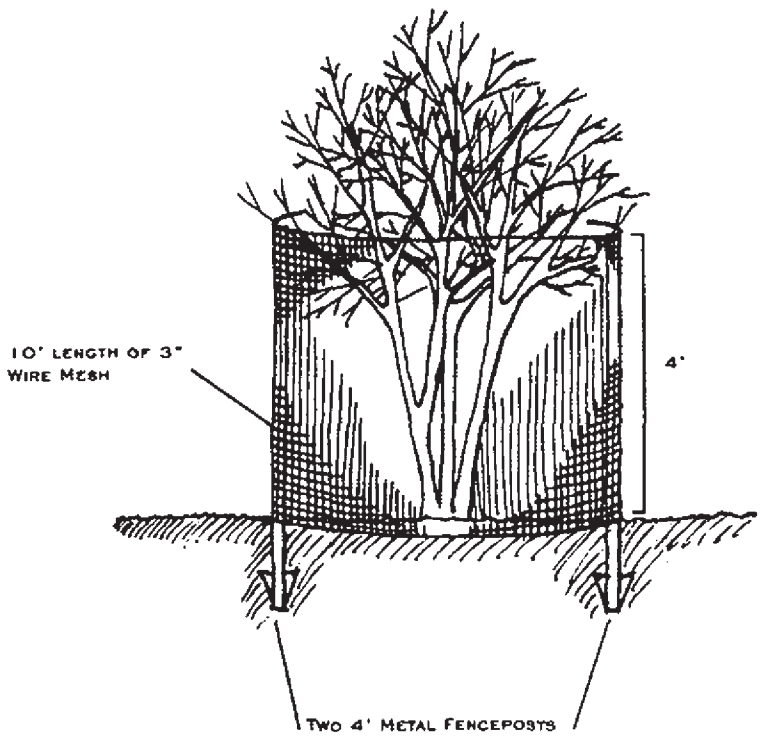
Figure 23. *Hand Planting a Native Plant Seedling.*

Plant Protection

Description. In some newly planted areas of the project it will be necessary to physically protect individual plants from damage to enhance survival and establishment success. Protection will be provided primarily in response to the location of the plant and the likelihood of trampling or damage by pedestrian traffic. In fringe areas of the project which are adjacent to natural areas, some protection may be provided to individual plants that may be susceptible to deer browsing.

Approach. Individual plant protection will be utilized in areas which are not already protected by site fencing or other barrier treatments. Specimen trees and screening shrubs will be protected by constructing tree cages made from a 10 foot length of 3" wire mesh looped and joined together. Cages will be anchored to the ground by driving two 4' metal fenceposts on opposite sides of the trunk and attaching the wire. Cages will be left indefinitely until the tree is judged to have established and grown sufficiently as to not be at risk of injury. Seedlings and large container plants will be protected by placing a rigid plastic tree protector around the plant. Tree protector tubes are available in 3 1/2" and 7" diameter sizes for both outplanted seedlings and large container plants. The tree protector will be anchored to the ground by driving a wooden stake into the soil next to the plant and attaching the plastic tube. Tree protectors will be left in place for one year following planting and then removed.

Figure 24. *Plant Protection Cage Construction.*



Care and Maintenance

Description. New plantings will be cared for and maintained for a period of one year following planting. Maintenance and care will consist of providing periodic irrigation, regular health monitoring checks, and plant replacement in the event of mortality.

Approach. Planting maintenance will focus upon providing conditions which favor the establishment of native vegetation and which prepare the plantings for the ultimate cessation of supplemental watering and care. At the end of the maintenance period, plantings should be well established and able to survive the environmental conditions of the site without intervention. Supplemental irrigation will serve to extend the "shoulders" of the moist season. This means that watering will commence 4-6 weeks prior to the onset of winter rains and will continue up to two months after the cessation of spring rains. During the winter season, irrigation may be supplied to the plantings should unusually long periods occur between rains, such as in a drought year. Plantings will not be irrigated during the summer months, except for the possibility of providing moderate amounts of water in cases of extreme drought or extended hot weather. Plants adapted to arid climates survive the summer months by ceasing activity and inducing dormancy. This dormant period is important in maintaining the health and adaptability of individual plants. Problems related to overgrowth and disease can be caused by providing too much supplemental water during the winter months and by extending longer periods of growth through the summer months. For native plants adapted to the local climate, an irrigation approach which closely mimics natural rainfall patterns will ensure the greatest ratio of success and long-term establishment.

The amount of supplemental water to be applied will involve close observation of climate conditions and rainfall patterns, as well as symptoms and general health of individual plants. In general, native plants adapted to arid climates can tolerate periodic availability of moisture and can be brought to the initial wilting stage before providing additional irrigation. Likewise, the onset of dormancy in the summer should not be seen as the decline in health of that individual plant. Ultimately, a familiarity with the local climate, the native species planted, and their native habitat preferences will be critical to making informed observations and judgements as to the health of the plantings.

Supplemental Irrigation. Individual plants will be deep watered by a slow soaking with a hose. Water will not be allowed to pool in the watering basins for long periods and the roots of individual plants will be allowed to dry between waterings. These irrigation techniques are important to the health of native species which are adapted to periodic drought and can be susceptible to diseases such as root or crown rot if kept unnaturally wet for extended periods. In general, a deep watering schedule of three to four weeks will be followed throughout the moist season as described above. Since all of the species planted will be native plants found in the surrounding landscape, watering needs are forecasted to be minimal to moderate.

Plant Health Surveys. A site visit and plant health survey will be conducted on a regular three-month interval for one year following planting. These surveys will be conducted by a trained plant pathologist and will include checks for symptoms of disease or poor health. Following each survey, results will be recorded and any remedial actions suggested. The purpose of these surveys will be to identify any potential establishment problems or obstacles immediately while treatment of the cause may still be an option.

Plant Replacement. In the event of mortality, individual plants will be replanted in the same location. Should the cause of mortality appear to be susceptibility to "root rot" fungus, the replacement plant will be relocated to avoid potential contact with infected root material. An additional 10% of the total quantity of plants produced will be reserved for replacement purposes. Should mortality run higher than 10%, lost plants will be replaced either by a higher number of smaller plants or not replaced until substitutes can be grown to the proper size.

Establishment Monitoring

Description. Qualitative evaluation of revegetation results will be employed to track the establishment progress of newly planted areas. This evaluation will be based on the visible results of plant growth and overall coverage. Monitoring will consist of observations made immediately following final planting, once during the height of the growing season, and again one year following planting.

Approach. Baseline observations made following planting will consist of as-built drawings and strategically located photopoints. A small number of representative areas will be chosen for the as-built drawings. These representative areas will include formally landscaped areas, natural habitat restoration areas, difficult to reclaim areas, and other locations where plant survival information would be especially useful or characteristic of the project as a whole. As-built drawings will approximate the locations of individual plants within a given area, noting the range of species and sizes, and their relation to other features of the area. Comparison of the as-built drawing to the established site at a later date can provide a basic idea of the overall results across the project site. For each area documented with an as-built drawing, a series of photopoints will be established following Park guidelines to provide a visual complement to the drawings. Photopoints will also be chosen at different areas across the site which are particularly characteristic of the project as a whole. These photopoints will be recorded again during the height of the following growing season. A final recording will occur at the end of the monitoring period of one year following planting. Photopoints will portray the visual results of plant establishment and cover and should provide a basic idea of the rate of establishment and landscape development across the project site.

Cost Estimation

Project Timeline Assumptions. For the purposes of developing a cost estimate for the overall project and for individual items covered in this plan, assumptions must be made regarding the timeline for implementation. The timeline assumptions made for this estimate include:

Seed Collection- The majority of seed collection has been accomplished during the 1997-1999 seasons. Additional seed collection may be performed during the 2000 season in order to address shortfalls in seed inventory or losses in seed viability during storage time.

Mycorrhizal Collection and Culture- All mycorrhizal collections were conducted during the 1997 season. Bulking and culture of those collections was performed between the Fall of 1997 and Spring of 1998 in order to provide inoculum for plants grown for various revegetation projects within Yosemite Valley. These cultures all tested positive for the presence of trapped spores and were all considered to include viable inocula. This inocula has been dried down and stored in a cooler until such time as plant propagation commences. Species-specific cultures of ect-endomycorrhizal inocula have continued to be cultured on the actively growing roots of host plants kept under nursery conditions. While it is anticipated that the spores will survive the storage process, it is possible that they may experience a loss in viability. For this reason, it may be necessary to collect additional cultures and perform additional bulking during the 2000 season.

Specimen Tree and Screening Shrub Production- Project cost estimates assume that plant production will commence in early 2000 for large specimen plants. Plants will be started as seedlings in early 2000 and field planted in the Fall of 2000. These plants will then be grown for two years in the field attaining specimen size. Large specimen trees will be ready for delivery Fall, 2002.

Seedling and Large Container Plant Production- Unit costs for these plants assume that a second round of seedling production will commence in early 2001. Seedlings intended to be grown up to large container sizes will be potted up in the Fall of 2001. These plants will then be given approximately one year to attain size standards. The remainder of plants intended to be delivered as seedlings will be held over for the following year and are not anticipated to grow significantly as seedlings can be held up to one year without adverse effects to plant morphology or delivery standards. All seedlings and large container plants will be ready for delivery Fall, 2002.

Interim Seeding- Costs for interim seeding assume that the construction of this project will commence during the Winter of 1999. Interim seeding will be conducted on all areas where building construction and final sitework has been completed. Seeding of completed areas will take place during the subsequent appropriate season. Current estimates include an interim seeding application during the Fall of 2000 and again in the Fall of 2001.

Final Seeding- Final seeding will address the addition of various forb species to areas already seeded during the interim seeding phases. This final seeding will occur immediately following final planting, currently estimated to occur in the Fall of 2002.

Planting Installation- Costs for the planting of all plants, including specimen trees, screening shrubs, large container plants, and seedlings, are based on the assumption that this work will be conducted in the Fall of 2002.

Care and Maintenance and Establishment Monitoring- The maintenance and monitoring period is to extend one year following installation of all plantings. Given the assumption that final planting will occur in the Fall of 2002, the maintenance period will conclude in the Fall of 2003.

Additional Seed and Mycorrhizal Collection. This item is estimated at approximately $20,000 to be utilized during the 2000 season.

Plant Propagation. The current planting design includes the following estimates for plant sizes and quantities:

1,787 Specimen Trees- $91,200
3,246 Screening Shrubs- $137,925
6,693 Large Container Plants- $48,775
5,728 Seedlings- $14,750

The total cost estimate for custom native plant propagation is $292,650.

Plant Delivery. This item is estimated at 5% of the total plant cost, or $14,635. This estimate includes any costs associated with preparing a staging and holding area in the vicinity of the project.

Interim and Final Seeding. Seeding is estimated to occur in three phases. Estimated acreages and costs include:

Fall, 2000 Interim Seeding– 21.25 acres- $25,150
Fall, 2001 Interim Seeding– 7 acres- $9,385
Fall, 2002 Final Seeding– 4.75 acres- $6,900

The total cost estimate for all seeding activities is $41,435

Planting, Staking, and Plant Protection. Planting cost estimates include mobilization and materials costs and are assumed to address the staking of all trees and the protection of 50% of the individual plants. Estimated costs include:

Mobilization– $15,000
Planting Specimen Trees and Screening Shrubs– 5,033 plants- $50,585
Planting Large Container Plants– 6,693 plants- $33,600
Planting Seedlings– 5,728 plants- $8,600
Staking- $28,715
Protection- $112,490

The total cost estimate for all planting activities is $248,990.

Care and Maintenance and Establishment Monitoring. This item includes maintenance irrigation, plant replacement, periodic montioring, and documentation of establishment success. Cost estimation is based on a fee of $10,000/ acre for a period of one-year following final planting. Total cost for this item is estimated at $285,000.

TOTAL PROJECT COST ESTIMATE- $902,710

Appendix A: Product Information Sheets and Details

NEW

BIOSOL MIX

GENERAL DESCRIPTION

MANUFACTURE:

During the manufacture of various antibiotics, enzymes, proteins, etc. a nutrient broth is extracted from the active ingredients. The broth then undergoes a second fermentation of 20 - 24 hours in which the dissolved nutrients are bound in a bacterial biomass. The biomass is then separated with decanters and bentonite is added. The mass is then dried at 110 - 130 ° C for approximately 4 - 6 hours. Then it is mixed with a 50% fungal biomass (see Biosol general description, please note that potassium magnesia is not added to Biosol Mix), granulated and filled into 55 pound (25 kg) recyclable plastic bags.

Biosol Mix may be used in similar applications as Biosol with the exceptions of Organic Farming.

Biosol Mix is sterilized and free of weed seeds.

COMPOSITION:

94% fungal and bacterial biomass , 6% water

NUTRIENT RATIO:

N-P-K = 7-2-3

Specifications:

Organic Substance	>70%
Carbon/Nitrogen Ratio	4:1
Nitrogen (total)	7%
Nitrogen (water soluble)	0.5%
Phosphorus (P_2O_5)	2%
Potash (K_2O)	3%
Calcium (CaO)	1.05%
Magnesium (MgO)	0.66%
Sodium (Na_2O)	1.7%
Chloride water soluble (Cl)	0.05%
pH Level	approximately 5.4

Heavy Metal Contents:

Copper (Cu)	mg/kg of DS	11,8
Iron (Fe)	mg/kg of DS	1,865
Nickel (Ni)	mg/kg of DS	5,25
Chromium (Cr)	mg/kg of DS	6,0
Lead (Pb)	mg/kg of DS	2,25
Cadmium (Cd)	mg/kg of DS	0,092
Zinc	mg/kg of DS	65,0

Please note: The heavy metal contents are within the tolerance limits for animal feed.

Properties:

Slow release of the organically bound nitrogen provides sufficient supply of this vital nutrient to plants. There is a positive effect on the formation of humus, root mass, and the living microbial biomass. This results in far lower concentrations of nitrate in ground water than mineral fertilizers.

APPLICATION:

REVEGETATION OF DISTURBED SOILS WITH LOW HUMUS CONTENT:

Mining Reclamation, Road Cut Revegetation, High Altitude Revegetation

- Biosol Mix is used for both primary and secondary fertilization.
- Biosol Mix stimulates micro organisms.
- It can be dry broadcasted or applied with a Hydroseeder. There is no appreciable difference in the results.
- Biosol Mix should always be applied topically.

Application Rates: 800 - 1,800 lbs. per acre, primary fertilization.
600 - 1,000 lbs. per acre, secondary fertilization.

Golf Courses

The lasting efficiency of Biosol Mix is particularly advantageous.

Application Rates: 2,000 lbs. per acre for fairways per year.
1,000 lbs. early spring, 1,000 lbs. late fall.

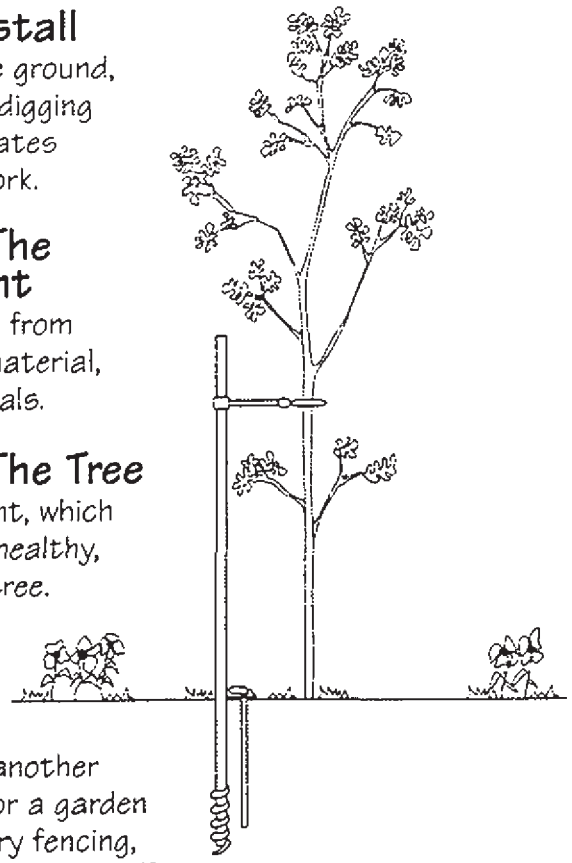
Lawns, Gardens, Flowers, Trees, etc.

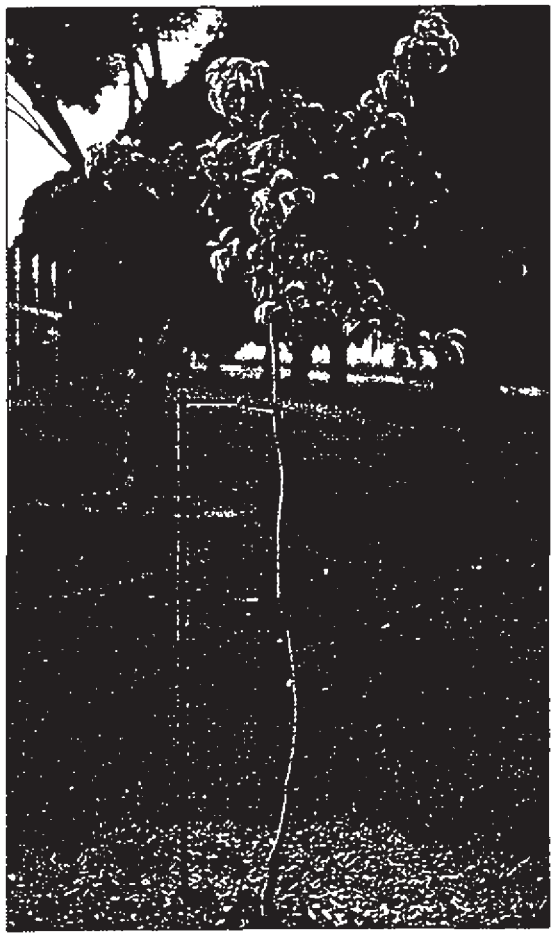
Biosol Mix will not burn vegetation but should be watered in (if possible) for best results. It is safe to apply in areas where animals and children may play.

The Reddy Stake™ System

U.S. Patented

- **Easy To Install**
  Screws into the ground, no pounding or digging required. Eliminates backbreaking work.
- **Good For The Environment**
  Reusable, made from 30% recycled material, no toxic chemicals.
- **Good For The Tree**
  Allows movement, which helps create a healthy, well-developed tree. See the tree, not the stake.
- **Reusable**
  You can stake another tree or use it for a garden trellis, temporary fencing, or banner post. It has multiple uses.





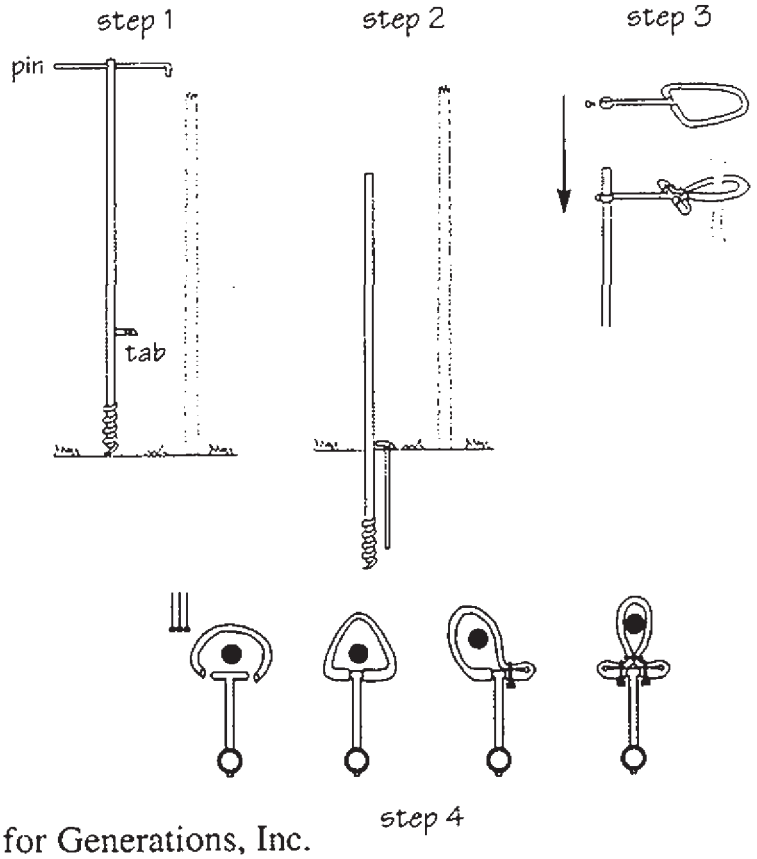
Tree Stake Installation

1. Place the Reddy Stake 12 inches away from the tree on the windward side. The tree should be 1 to 3 inches away from the T-bar. Insert the pin through the hole in the top of the Reddy stake and twist.

2. Twist the Reddy Stake until the tab is even with or just below the ground. Drive the pin through the hole in the tab and into the earth.

3. Slip the T-bar over the top of the Reddy Stake and tighten the bolts at the desired height.

4. Place the UV resistant tubing around the tree and fit it over the ends of the T-bar. Attach zip ties as shown in picture.



Utilities Underground Service Alert: 1-800-642-2444

Screw Tight Post Division of Decorations for Generations, Inc.

2224 So. Daubenberger Road • Turlock, CA 95380 • Ph: 209-634-7791 • Fax: 209-634-0298 • Made in the U.S.A.

Prices Subject to Change
Effective January 1, 1998

Field Grow Containers

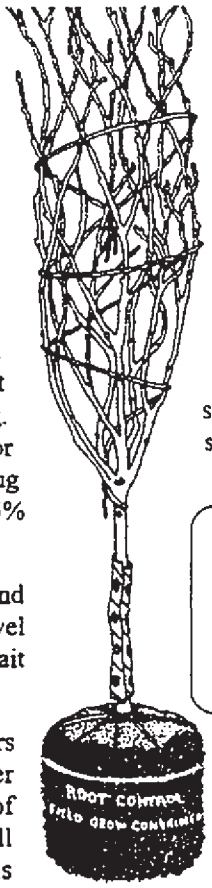
Field Grow Containers are a new concept in growing nursery stock with these money saving advantages:

- Harvest without expensive equipment
- Cheaper transportation (smaller root ball)
- Less transplant shock
- Longer digging season

Stock grown in Field Grow Containers doesn't become root bound like stock left too long in pots. When a root encounters the bag it doesn't circle. The root partially penetrates the fabric and is pruned by the bag. Small feeder roots grow through the bag while major roots stay inside the bag. When bag grown stock is dug it retains 75% of the root system compared to 25-35% with traditional B&B methods.

Plants are harvested faster and with less labor and without expensive equipment. One man with a shovel can harvest a tree in 5 minutes. You don't have to wait until conditions are right to ball trees.

The root ball of stock grown in Field Grow Containers is much smaller than that of B&B trees. A 2.5" caliper tree might be grown in an 18" bag with a ball weight of 150 lbs. The same size B&B tree might have a 30" ball and weigh 380 lbs. The smaller, lighter root ball is much easier to handle and cheaper to transport.



The bag must be removed from the tree when it is planted in its permanent home. Bag grown trees will require more careful staking because of its smaller root ball.

Planting sleeves should be purchased with bags. It is a fiberglass form with handles. It is placed inside the bag when filling to insure a flat bottom and straight sides. If you want a nice ball when you harvest, you must form a nice ball when you plant.

Tough Bottom containers are used by growers who ship their stock. This bag is stronger and is better for shipping and rough handling.

All orders are drop shipped from the factory and must meet the following conditions:

1. **All prices are F.O.B. New Orleans, LA.**
2. **Bags must be ordered in multiples of 25.**
3. **Minimum order, mix or match sizes, is 100 bags.**

If you would like more information, please ask for literature and our free video tape on using Field Grow Containers.

Bag Size Plastic / Tough Bottom	Approx. Gallons to Bag Size	Approx. Wall Height	Approx. Ball Weight
10"	10	11"	30 lbs.
12"	15	11"	50 lbs.
14"	20	13"	85 lbs.
16"	25	13"	105 lbs.
18"	30	15"	150 lbs.
21"	45/65	15"	250 lbs.
24"	65/100	17"	300 lbs.

CHOOSE THE RIGHT DIAMETER

TREE PRO'S panel design allows you to create the best diameter to fit your application. Each panel linked together, automatically, gives you an additional stake support.

	TREE PRO	LANDSCAPE PRO	GARDEN PRO
Diameter	3½"	7"	10½"
# of Panels	1	2	3
Height	8",12",24",36",48",60",72"		12",24",36"

Even larger diameter protectors can be created by adding as many panels as needed.

CHOOSING THE RIGHT HEIGHT

	8"	12"	24"	36"	48"	60"	72"
Garden							
Small Transplants	X	X					
Large Transplants		X	X				
Tomatoes		X	X	X			
Roses		X	X	X			
Other Garden Plants		X	X	X			
Trees							
Conifer / Shrubs	X	X					
Fruit			X	X	X	X	X
Nut				X	X	X	X
Hardwood				X	X	X	X
Landscape		X	X	X	X	X	X
Ornamentals		X	X	X	X	X	X

EASY INSTALLATION

1. Just fold the protector in half matching the holes on the side.

2. With the holes matched, slide the Lock-Tie through both holes at once and close the tie with 2 or 3 clicks. Then slide the protector over the tree, the ties over the stake and tighten the ties.

SIMPLIFIED MAINTENANCE

1. In seconds you can open your ***TREE PRO*** to perform maintenance.

2. In seconds you can create a window allowing your tree to harden off.

TREE PRO is perfect for all applications, large or small.

TREE PRO increases growth by as much as 7 times. Grow a healthier, straighter tree while protecting your tree from deer, weather, rodents, pets, weedeater, mulch, chemicals, lawn mower, etc.

TREE PRO protects small transplants (trees or garden plants) from weather, rodents, pets, etc.

GARDEN PRO protects and increases growth of large garden plants. Winterize roses.

LANDSCAPE PRO protects the base of your trees from rodents, mulch, weedeaters, lawn mowers, pets, etc.

Appendix B: Selected References

Acree, Lisa Nemzer. 1994. *The Plant Communities of Yosemite Valley – A Map and Descriptive Key.* Technical Report NPS/WRUC/NRTR-94-01. Cooperative National Park Resources Studies Unit, University of California at Davis. Davis, California.

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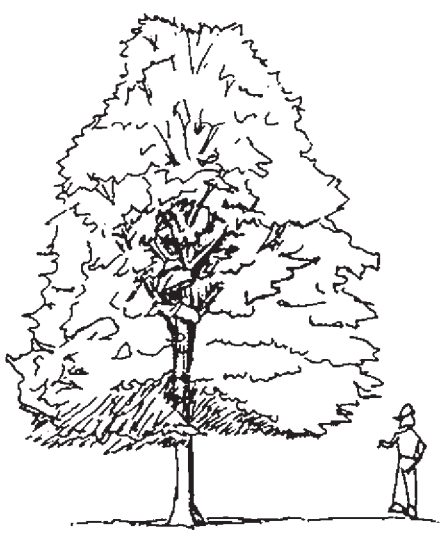
Appendix C: Native Plant Profiles

American Dogwood (*Cornus sericea*). Medium to tall, fast growing deciduous shrub, 5-12' tall, 4-6' wide. Attractive red stems with white blooms in June- July followed by clusters of white-blue berries. Occurs below 9,000 feet in canyons and mountain slopes in moist places. Endomycorrhizal.

Use in Revegetation- American Dogwood is a riparian species which is well suited for streambank restoration, where it provides a dense, deep-binding root structure. It is also found as a shrub component on wetland margins where it provides excellent wildlife habitat. In landscaped areas, American Dogwood can be used as a dense hedge or as screening.

Big Leaf Maple (*Acer macrophyllum*). Tall deciduous tree, 50'-100'. Blooms in April-May. Showy fall color. Common along streambanks and in canyons below 6,000 feet.



Use in Revegetation- Big Leaf Maple is appropriate for use in the re-establishment of riparian and floodplain forest communities. The tree is also commonly found as an understory component of forests in moist or shady conditions. It is an attractive native specimen for use as a shade tree in landscaped areas.

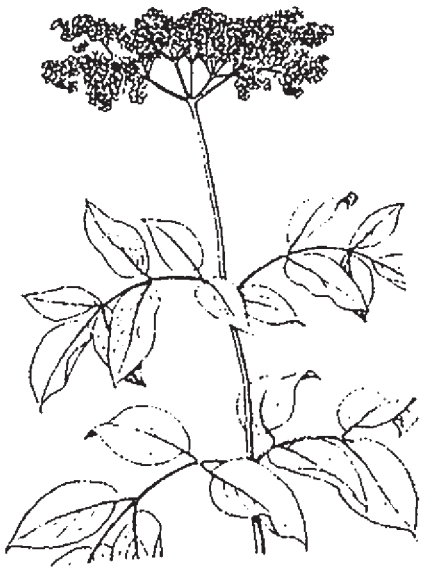
Bigelow's Sneezeweed (*Helenium bigelovii*). Medium perennial herb, growing in groupings. Yellow flower, blooming June-August. Abundant in moist meadows below 8,000 feet.

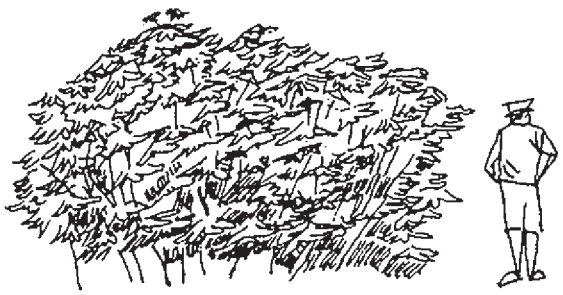
Use in Revegetation- Sneezeweed is appropriate for use in re-establishing meadow communities. It can add interest and diversity to a grass/forb seed mix in open, moist areas.

Blackcap Raspberry (*Rubus leucodermis*). Medium deciduous shrub. Underside of leaves and stems white-colored. Blooms May-June with pinkish flowers, followed by deep red berries. Inhabits hill slopes, canyon flats, and streambanks in mountainous areas. Endomycorrhizal.

Use in Revegetation- Blackcap Raspberry is appropriate for revegetation in moderately moist areas such as the margins of meadows and in the understory of floodplain forests where it provides good wildlife habitat and forage. Its tangled and spined branches can serve as a pedestrian deterrent in areas of high visitor use.

Blue Elderberry (*Sambucus mexicana*).
Large deciduous shrub to small tree, 4-10' tall. Multi-stemmed shrub. Blooms in May-July with cream colored, umbrella shaped flower heads followed by large clusters of dark blue berries in late summer. Found in chaparral and open places in montane coniferous forests, up to 10,000 feet. Endomycorrhizal.





Use in Revegetation- Blue Elderberry can be used to revegetate disturbed, open places with poor, droughty soils. It is an excellent wildlife habitat species appropriate for replanting in dry upland settings. In landscaped areas, Blue Elderberry can serve as an attractive hedge or screen in sunny, open areas.

Blue Wildrye (*Elymus glaucus*).
Erect, tall perennial grass. Spreading growth. Widely distributed throughout the West in open woods and dry hills at low to medium altitudes. Endomycorrhizal.

Use in Revegetation- Blue Wildrye is an excellent native grass for use in seeding for erosion control and providing rapid vegetative coverage in disturbed areas. It establishes quickly and can provide a "nurse crop" to aid in the establishment of other native plantings. It is appropriate for use in most areas but will persist better in relatively

Buck Lotus (*Lotus crassifolius*).
Medium perennial forb. Yellowish flower, June-Aug. Occurs in chapparal, pine or mixed woodlands and margins, roadsides and other disturbed places below 7,000 feet. Endomycorrhizal.

Use in Revegetation- Buck Lotus is a leguminous forb which can be used to ameliorate disturbed areas by providing a nitrogen source in poor soils. Buck Lotus rapidly colonizes disturbed areas in open and sunny areas.

Bush Beardtongue (*Keckiella breviflora*).
Small, deciduous shrub. Small, pinkish-white flower May-Aug. Inhabits dry, rocky foothills and lower mountain slopes of the Sierra Nevada. Endomycorrhizal.

Use in Revegetation- Keckiella colonizes open, disturbed areas and can be used as a pioneering species on revegetated sites. It inhabits areas of poor, droughty soils and can form a nearly continuous, dense cover.

California Bay Laurel (*Umbellularia californica*).
Large shrub to tall evergreen tree, 40-80' tall. Dark green foliage, aromatic when crushed. Creamy-white blooms in early spring, March-May, followed by deep purple fruits. Common to canyons, valleys and

Use in Revegetation- Bay Laurel forms the dense understory of forest types in moister locations. It is an appropriate species for replanting riparian and floodplain forests in a variety of habitats. In landscaped areas, Bay Laurel may be used as a dense shade tree or for screening due to the tendency of the canopy to extend almost to the ground.

California Black Oak (*Quercus kelloggii*).
Large deciduous tree, 50-100' tall. Showy fall colors. Acorns provide forage for many animal species. Inhabits slopes, valleys, woodland and coniferous forests of California below 7,500 feet. Ectomycorrhizal.

Use in Revegetation- Black Oak is an important component of floodplain and upland forests in Yosemite Valley. The extensive stands found within the Valley are unique among the Sierra Nevada. Black Oak inhabits upland/meadow interface areas where access to groundwater allows the species to withstand periods of seasonal drought.

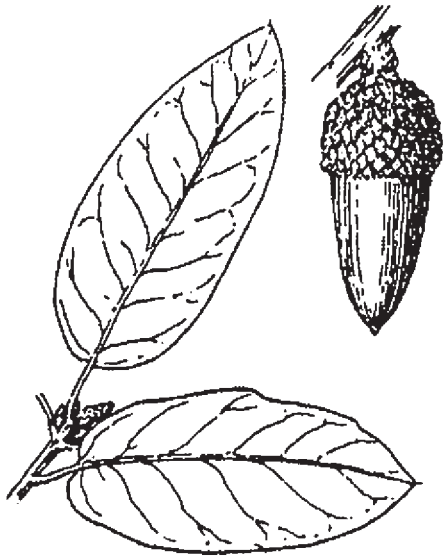
California Brickellbush (*Brickellia californica*).
Small, deciduous shrub, 1.5-3.5' tall. Green and purple flowers, June-Nov. Inhabits dry, gravelly streambeds and dry slopes between 4,500 to 8,000 feet along the western slopes of the Sierra Nevada.

Use in Revegetation- Brickellbush colonizes open, disturbed areas and can be used as a pioneering species on revegetated sites. It inhabits areas of poor, droughty soils and can form a nearly continuous, dense cover.

California Brome (*Bromus carinatus*).
Erect annual or mostly biennial, rhizomatous grass. Found on open ground and open woods at low to mid-elevations. Endomycorrhizal.

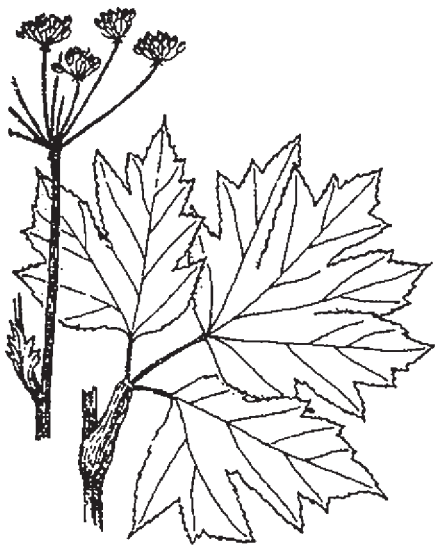
Use in Revegetation- Calif. Brome can be used in seeding for erosion control and providing rapid vegetative coverage in disturbed areas. It is appropriate for use in most areas but will persist better in relatively open areas such as meadows and forest clearings.

Canyon Live Oak (*Quercus chrysolepis*). Medium shrub to large evergreen tree, 10-80' tall. Acorns provide food for many animal species. Common in chaparral and foothill woodlands below 8,500 feet. Ectomycorrhizal.



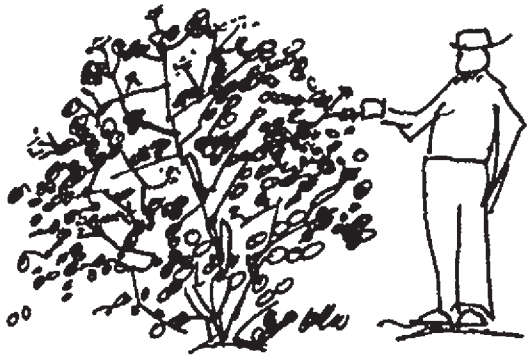
Use in Revegetation- Canyon Live Oak forms a dense woodland on canyon and talus slopes, establishing on poor, rocky soils. In Yosemite Valley, the species is also usually found as an understory component of woodlands at the interface of talus slopes and the Valley bottom.

Cow Parsnip (*Heracleum lanatum*). Large perenial herb, 2-12' tall. White umbrella shaped flowers, April-August. Deep tap root. Common in wet meadows below 8,000 feet.



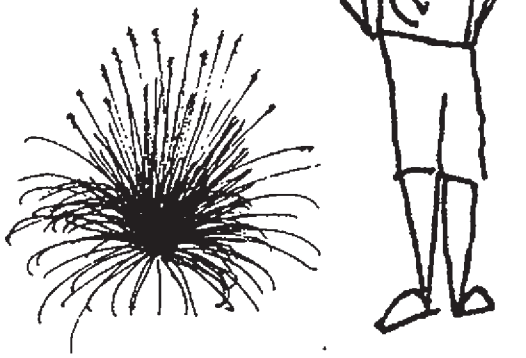
Use in Revegetation- Cow parsnip is appropriate for use in re-establishing meadow communities. The plant's large stature gives it a striking presence in moist meadows.

Deer Brush (*Ceanothus integerrimus*).
Tall semi-deciduous shrub; 6-10' tall, 4-10' wide. White or blue flowers, May-July. Found on mountain slopes, ridges and flats in chaparral and open forest communities between 2,500 and 7,000 feet. Endomycorrhizal.



Use in Revegetation- Deer Brush is a major component of chaparral communities and establishes well in dry areas. The species regenerates rapidly following wildfire and is an important transitional species in recovering woodlands.

Deergrass (*Muhlenbergia rigens*).
Medium perennial bunchgrass; 1-4' tall, 1-4' wide. Found on dry or open ground, hillsides, gullies, and open forest. Endomycorrhizal.



Use in Revegetation- Deergrass can form a dense understory coverage at the margins of oak groves and meadows, a habitat that has been greatly reduced in Yosemite Valley. The species is also found in sandy or dry washes. Deergrass is highly prized in landscaped areas as an ornamental bunchgrass.

Dragon Sagewort (*Artemisia dracunculus*). Medium perenial herb, 1-2' tall. Yellowish flowers, on dark green foliage, July-September. Common in dry exposed areas below 9,000 feet.

Use in Revegetation- Sagewort rapidly colonizes disturbed soils in open, sunny areas. The species can be used to provide quick, persistent cover on droughty sites. The species will easily reseed itself where established.

Harford Melic (*Melica harfordii*).
Tall, slender perennial, bunch grass. Blooms July-Aug. Inhabits open dry woods and slopes. Endomycorrhizal.

Use in Revegetation- Harford Melic tends to be found as scattered individual plants, rather than forming a continuous herbaceous coverage. It is appropriate for use in forest understory and open disturbed areas, ideally in combination with other grasses and forbs.

Lupine (*Lupinus species*).
Medium perennial forb. Purple flower, May-July, followed by pea-shaped seed pods. Common to many diverse habitats from open or disturbed areas and burns, to moist areas in woodlands, shady and open areas below 10,000 feet. Endomycorrhizal.

Use in Revegetation- Lupine is a leguminous forb which can be used to ameliorate disturbed areas by providing a nitrogen source in poor soils. Given the large number of lupine species which grow in a variety of habitats, species selection should focus on the type of site to be revegetated. Lupine is also an attractive addition to wildflower or grass

Meadow Goldenrod (*Solidago canadensis*).
Medium perennial herb, 1-3' tall. Bright yellow, bottle-brush shaped flowers, July- September. Common in moist open areas and fields, below 8,000 feet.

Use in Revegetation- Goldenrod is appropriate for use in re-establishing meadow and grassland communities. It can add interest and diversity to a grass/forb seed mix in open, dryer areas.

Mock Orange (*Philadelphus lewisii*).
Medium deciduous shrub, 4-10' tall. White aromatic flowers, May-July, followed by small, five lobed seed pods on slender red shoots and greyish, smooth barked branches. Sparse along west slopes, canyons and forest openings; above 1,500

Use in Revegetation- Mock Orange is useful for revegetating slopes and open areas in sunny locations. It is also found to a lesser degree in drier forest understory locations and is appropriate for replanting in these forest types.

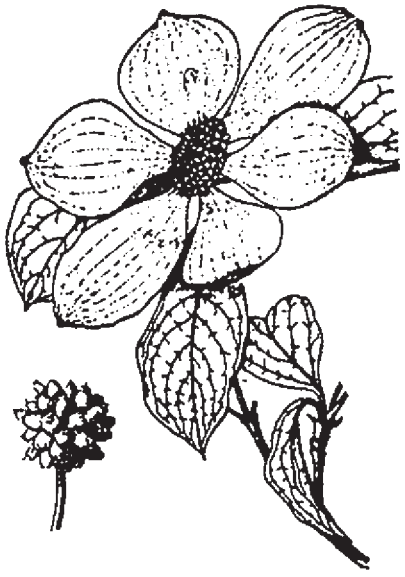
Mountain Pink Currant (*Ribes nevadense*).
Medium deciduous shrub, 2-8' tall. Pinkish flower, April- July. Occurs in moist places and along streams in the Sierra Nevada. Endomycorrhizal.

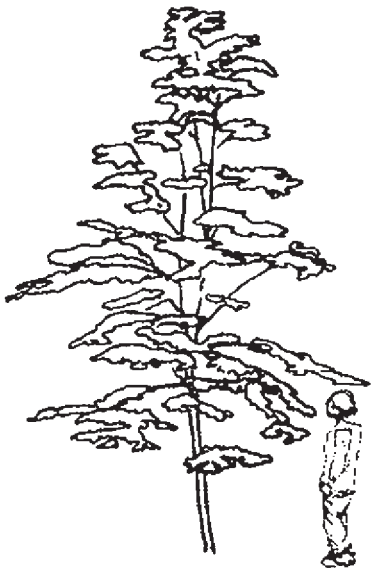
Use in Revegetation- Pink Currant is useful for establishing shrub cover along streambanks and forest understory communities. The flowers and foliage of this species makes it attractive for use in landscaped areas.

Needle Grass (*Achnatherum lemmonii*).
A slender perennial, bunch grass found on dry, open ground or open woods. Endomycorrhizal.

Use in Revegetation- Needle Grass tends to be found as scattered individual plants, rather than forming a continuous herbaceous coverage. It is appropriate for use in forest understory and open disturbed areas, ideally in combination with other grasses and forbs.

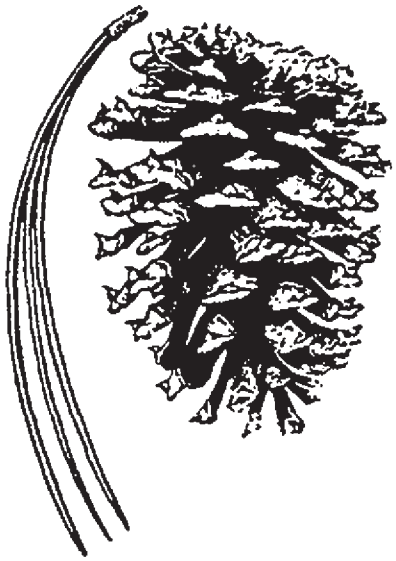
Pacific Dogwood (*Cornus nuttallii*).
Small deciduous tree, 10-30' tall. White flower, May-June, followed by green to red seed clusters. Found in riparian woodlands and Ponderosa Pine forests along the western slopes below 6,000 feet. Endomycorrhizal.





Use in Revegetation- Pacific Dogwood is appropriate for replanting along streambanks and as a mid-story tree in moister locations. It is an exceptionally attractive tree for use as a specimen in landscaped areas.

Ponderosa Pine (*Pinus ponderosa*).
Tall coniferous tree, 60-130' tall. Large bark plates, vanilla-like aroma. Inhabits dry and open slopes in a variety of soil types. Ectomycorrhizal.

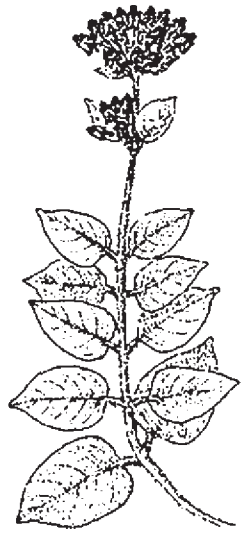


Use in Revegetation- Ponderosa Pine is a major component of forests in drier locations. As such, it is important for use in replanting forest cover in open, dry locations.

Rydberg's Penstemon (*Penstemon rydbergii*).
Small, perennial forb. Bluish-purple flower, May-August. Found in moist meadows and streambanks, generally in montane to subalpine forests below 10,000 feet. Endomycorrhizal.

Use in Revegetation- Penstemon is appropriate for use in re-establishing meadow and grassland communities or in the understory of various forest types. It can add interest and diversity to a grass/forb seed mix in sunny areas.

Showy Milkweed (*Asclepias speciosa*).
Large perennial herb, 1-4' tall. Reddish flowers, May-July followed by large, woolly seed pods, releasing feathery, parachute-like seeds. Milky sap attracts the Monarch butterfly.

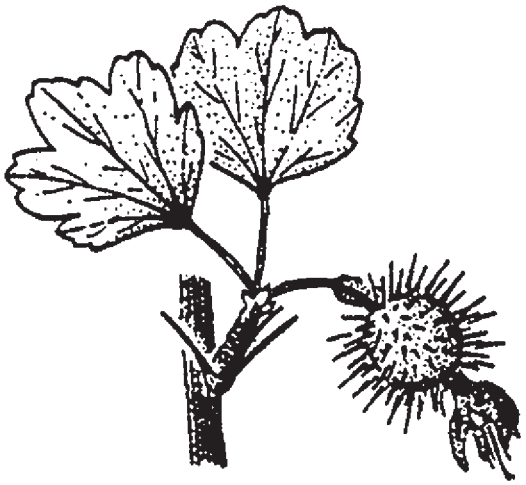


Use in Revegetation- Milkweed is appropriate for use in re-establishing meadow and grassland communities. It can add interest and diversity to a grass/forb seed mix in sunny areas.

Spice Bush (*Calycanthus occidentalis*).
Small to medium deciduous shrub, 4-12' tall. Maroonish aromatic flowers, May-July, followed by thimble-shaped brownish seed pods. Found in moist, shady places along streams and canyon slopes, like the shady banks of the Merced river; generally below 1,500 feet. Endomycorrhizal.

Use in Revegetation- Spicebush is useful in re-establishing shrub cover in moist forest understory locations. It is an attractive specimen in landscaped areas due to the striking flower and scented foliage.

Sierra Gooseberry (*Ribes roezlii*).
Small deciduous shrub, 3-6' tall. Whitish flower, June-July, followed by red, pulpy berries. Common in canyons and on mountain slopes from 3,500 to 8,500 feet in the Sierra Nevada.



Use in Revegetation- Gooseberry is appropriate for planting in open, dry areas and in the sparse understory of Ponderosa Pine forests. The spiny stems of this plant make it useful as a pedestrian deterrent in areas of high visitor use.

Tincture Plant (*Collinsia tinctoria*).
Small annual wildflower. 1- 4" tall, carpet-like growth habit. Creamy-yellow flowers, June-August. Found in rocky, dry mixed woodland and coniferous forest between 2,000 and 8,000 feet. Endomycorrhizal.

Use in Revegetation- Tincture Plant is appropriate for use as a wildflower species in the understory of various forest types. It can add interest and diversity to a grass/forb seed mix in shady areas.

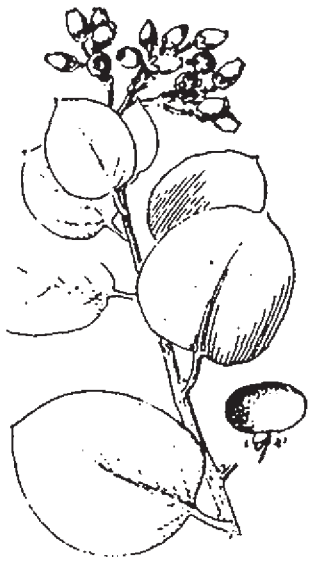
Western Azalea (*Rhododendron occidentale*).
Medium deciduous shrub, 2-10' tall. Pinkish-white flower, May-July. Found in understory of forests, along streams and moist canyon slopes, between 3,500-7,500 feet. Ect-endomycorrhizal.

Use in Revegetation- Azalea is useful in re-establishing shrub cover in moist forest understory locations. It is an attractive specimen in landscaped areas due to the profusion of showy flowers.

Western Chokecherry (*Prunus virginiana var. demissa*).
Medium deciduous shrub to small tree; 8-12' tall, 6-8' wide. Pinkish flowers, May-June, followed by deep red, pulpy berries, providing food for many bird species. Endomycorrhizal.

Use in Revegetation- Chokecherry can be used to revegetate moist floodplain areas, streambanks and drainages. It is an excellent wildlife habitat species owing to the abundance of fruit produced. In landscaped areas, Chokecherry can serve as an attractive hedge or screen in sun or partial shade.

Whiteleaf Manzanita (*Arctostaphylos viscida*). Medium evergreen shrub, 4-12' tall. Whitish-rosey flower, Feb-April, followed by globular, brownish fruits. Smooth reddish, papery bark, and angular branches. Widely distributed throughout chaparral communities between 2,000 to 5,000 feet. Ect-endomycorrhizal.

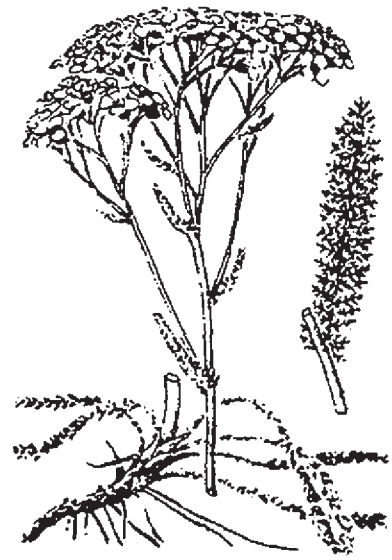


Use in Revegetation- Manzanita is a major component of chaparral communities and drier forests and establishes well in dry soils. The species regenerates rapidly following wildfire and is an important transitional species in recovering woodlands.

Wood's Rose (*Rosa woodsii*). Small deciduous, thorny shrub, 3-4' tall; 3-4' wide. Pink flowers, May- August, followed by red hips, or seed pods. Valuable to many animal species. Occurs on moist wooded slopes and shrub lands. Endomycorrhizal.

Use in Revegetation- Wood's Rose is a good species for planting in open, dry areas. It is especially useful in stabilizing slopes, where its sprawling branches and creeping roots help to bind soils. The attractive flowers and hips make it a desirable plant to include in landscaped areas. Wood's Rose can also be used for barrier plantings

Yarrow (*Achillea millefolium*).
Medium perennial herb, 1-3' tall. White or yellow, umbrella shaped flowers, atop stalks with grey-green, lacy, felt-like foliage, June-August. Found in forests belts, open areas and meadows above 2,500



Use in Revegetation- Yarrow is appropriate for use in re-establishing meadow and grassland communities. It can add interest and diversity to a grass/forb seed mix in open, dryer areas.

Yerba Santa (*Eriodictyon californicum*).
Medium evergreen shrub, 2-8' tall. Purplish flowers, May-July, followed by four-lobed fruit capsule. Aromatic leaves when crushed. Found in dry habitats of the foothills and lower mountain slopes of the Sierra Nevada below 5,000 feet. Endomycorrhizal.

Use in Revegetation- Yerba Santa is appropriate for planting in open, dry areas and in the sparse understory of Ponderosa Pine forests.