BIG SUR COAST HIGHWAY MANAGEMENT PLAN

Guidelines for Vegetation Management

An Element of the Corridor Management Plan July 2003 Draft

Highway 1 along the Big Sur Coast
from San Carpoforo Creek in San Luis Obispo County
to the Carmel River in Monterey County
SLO-1-71.4/74.3
MON-1-0.0/72.3

U.S. Department of Transportation
Federal Highway Administration

Caltrans

Caltrans District 05

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1.0 Introduction

These guidelines support the Coast Highway management Plan (CHMP), which addresses the Highway 1 corridor along California's Big Sur Coast. This corridor extends 75 miles from San Carpoforo Creek in San Luis Obispo County (SLO-1-71.4) to the Carmel River in Monterey County (MON-1-72.3) (Figure 1). The goal of the CHMP is to preserve, protect and restore the unique qualities of the corridor while ensuring the continued safe and efficient operation of the highway.

Figure 1: Location map for the Big Sur Coast Highway Management Plan.

The CHMP constitutes a Corridor Management Plan (CMP) under the National Scenic Byways program of the Federal Highway Administration (FHWA). The CHMP also revises and updates the CMP prepared in 1996 for the route's designation as an All-American Road. The CHMP provides a framework for decision-making and guides overall management to ensure the long-term preservation of the corridor's intrinsic qualities in keeping with objectives of the Scenic Byways program.

The CHMP consists of a corridor management plan and three sets of management guidelines. The primary document provides comprehensive background information and an action plan to address issues associated with managing the highway corridor; the guidelines documents build on actions outlined in the management plan.

Vegetation management encompasses a variety of strategies for addressing issues and concerns related to plant life and habitat along the Big Sur Coast: the framing of views,

integrity of native plant communities, maintenance practices, and site restoration. The Guidelines for Vegetation Management present actions and practices available to the Department of Transportation (Department) as it manages vegetation along the scenic and biologically diverse corridor.

1.1 Background for the Guidelines

The most compelling reasons for undertaking a plan for the Big Sur corridor were issues related to landslides and highway repairs in the aftermath of 1998's El Niño storm events. However, when the Department of Transportation, resource agencies, area residents and other stakeholders convened to consider a responsive planning process, they identified a wider range of issues pertaining to management of the corridor. The totality of stakeholders' concerns would warrant preparation of a comprehensive corridor plan, the CHMP. The resulting CHMP effort has been a collaboration to identify and respond to the array of complex issues related to managing the corridor.

Among the additional issues identified by stakeholders early in the planning process were several pertaining to vegetation: views blocked by weeds or screen planting; habitat integrity threatened by disturbance or invasion of exotic plants; maintenance of vegetation along the roadway and drainage facilities; and re-vegetation after construction or storm events. Some of these issues are aesthetic in nature; others are based in resource protection; and still others are concerned primarily with maintaining a highway in a difficult, visually sensitive, biologically diverse environment.

In the course of investigating issue areas for the CHMP, stakeholders constituted themselves into various working groups according to members' expertise and primary interests. Vegetation-related issues fell within the purview of three of the working groups: the Scenic and Resource Conservation working group (views, native species, invasives and exotics), Maintenance Practices working group (roadside management, best practices), and Storm Damage Response and Repair working group (re-vegetation). This guidelines document presents information regarding the Department's approach to vegetation management in the Big Sur Corridor in the context of issues, values, and directions defined by the various working groups.

1.2 Purpose of Guidelines

The Vegetation Management Guidelines enhance and augment guidance provided by the Department's Maintenance Manual to address the unique character of the Big Sur coast and stakeholders' concerns and priorities. The guidelines are intended to:

- Address stakeholders' concerns regarding scenic views, protection and preservation of sensitive plant communities and wildlife habitats, removal and control of invasive exotic species, roadside maintenance and site restoration.
- Provide guidance for daily maintenance operations to protect, preserve, and restore corridor resources.
- Provide a common base of information for all interested stakeholders to consult regarding vegetation, roadside management and re-vegetation activities along the coast.

- Serve as a foundation for agreements between the Department and regulatory agencies to satisfy requirements related to certain actions in advance of need.

- Present a framework for monitoring the success of weed control and re-vegetation efforts within the corridor.

As a work in progress, the guidelines will serve as the record for new information about managing vegetation in the corridor as such information becomes available.

1.3 Stakeholder Participation

The process that led to the development of these guidelines was based in stakeholder participation. Technical sessions of three CHMP working groups--Scenic and Resource Conservation, Maintenance Practices, and Storm Damage Response and Repair--were major forums for this participation. Stakeholders including community representatives and the following agencies and organizations participated in working groups or provided information and comments regarding vegetation-related issues.

- Big Sur Land Trust
- California Coastal Commission
- California Department of Fish & Game
- California Exotic Pest Plant Council
- California Department of Parks & Recreation
- California Native Plant Society
- El Sur Ranch
- Monterey Bay National Marine Sanctuary
- Monterey Co. Agricultural Commissioner (War on Weeds Partnership)
- Monterey Co. Department of Planning & Building
- UC Big Creek Reserve
- US Fish and Wildlife Service
- US Forest Service

The working group sessions provided opportunities for stakeholders to articulate and prioritize problem issues, share information, identify information needs and work toward long-term solutions. Each of the working groups adopted principles to guide their deliberations. The guiding principles that are relevant to vegetation management activities are highlighted below:

Guiding Principles for Scenic and Habitat Conservation
1. Respect diversity, individuality, and character of place. 2. Minimize visibility of human activity. 3. Protect and restore native habitats and corridor natural, scenic, and cultural resources. 4. Pursue multi-party solutions to achieve success.

Guiding Principles for Maintenance Practices
1. Conduct maintenance activities in a manner that sustains the sensitive environment along the corridor. 2. Protect the public's investment in the highway with preventive care. 3. Ensure the functional integrity, safety and operation of Highway 1 for the traveling public. 4. Continually strive to apply the best available techniques for diverse maintenance activities.

Guiding Principles for Storm Damage Response and Repair
1. Respect travelers' needs for timely information on highway conditions. 2. Act immediately and responsible to protect or restore highway access. 3. Promote interagency solutions to prevent, anticipate, and respond to disruptions cause by storm event. 4. Pursue solutions that avoid or minimize overall environmental impacts and respect natural processes.

The Vegetation Management Guidelines reflect deliberations and recommendations of all three working groups.

1.4 Regulatory Context

Owing to diversity of the resources, the regulatory environment along the Big Sur Coast is complex. Each of the following agencies may have jurisdiction over aspects of corridor management activities:

- California Coastal Commission
- California Department of Fish & Game
- California Department of Parks & Recreation
- County of Monterey
- County of San Luis Obispo
- Monterey Bay National Marine Sanctuary
- National Marine Fisheries Service
- Regional Water Quality Control Board
- US Army Corps of Engineers
- USDA Forest Service
- US Fish & Wildlife Service

These guidelines are expected to provide the foundation for programmatic-type agreements for regulatory compliance for certain types of actions the Department performs.

1.5 Applicability and Authority

The Vegetation Management Guidelines apply to the 75-mile section of Highway 1 that extends from San Carpoforo Creek in San Luis Obispo County to the Carmel River in Monterey County.

These guidelines are consistent with directives contained in the Executive Memorandum on Environmentally Beneficial Landscaping, signed by President Bill Clinton on April 26, 1994 and Executive Order 13112 on Invasive Species, dated February 3, 1999 (see Appendix B). The Executive Memorandum calls for use of regionally native plants and employing landscaping practices and technologies that conserve water, minimize adverse effects on the natural habitat and prevent pollution.

Executive Order 13112 requires federal agencies to work to prevent the introduction and spread of invasive plant and animal species. As one of the federal agencies whose actions may affect invasive species, the FHWA is charged to the extent practicable not to authorize, fund or carry out actions likely to introduce or spread invasive species.

The Executive Order calls for programs and authorities to undertake the following:

- Prevent the introduction of invasive plant species
- Detect and respond quickly to and control the populations of species in an environmentally sound and cost effective manner
- Monitor populations of invasive species accurately and reliably
- Provide for the restoration of native species and habitat condition in affected ecosystems
- Conduct research on invasive species and develop technology to prevent the introduction and provide for environmentally sound control of invasive species
- Promote public education on invasive species and means to address them

The Department is a recipient of federal funds for planning activities and capital improvements. Efforts to produce and implement provisions of these guidelines, particularly as they pertain to protection of native plant communities and control of exotic species in the corridor, is consistent with the Executive Order.

The practical use of these Guidelines will institutionalize best practices for roadside maintenance practices and highway construction, whether planned or as part of an emergency action along the corridor. The guidelines are consistent with the Department's existing authority and responsibility to maintain and operate the highway. The guidelines do not alter any obligations to comply with state and federal environmental laws and regulations, nor do they imply any change in the authority or any agency with jurisdiction over specific actions.

2.0 Vegetation and Habitat

The Big Sur Coast is located within a geologically and biologically complex part of the Coast Ranges of mountains. Several coastal plains and terraces are found along this coast (Figure 1), yet the landscape is comprised of long stretches of abruptly steep slopes cut by the numerous canyons with creeks that carry water to the ocean. Although the overall climate of the area is Mediterranean, the Big Sur Coast is visited by characteristic and extremely localized weather patterns. Topography, geology, soils and weather together support a rich variety of plant life ranging from dry scrub and chaparral to moisture-loving coastal redwood forests. The information from this section is drawn from *Corridor Intrinsic Qualities Inventory: Natural Qualities* (Parsons Transportation Group, December 2001) prepared for the CHMP.

As shown in Attachment 1, geographical sections are used to denotee areas along the corridor. The sections outlined in Table 1 below were defined by the Scenic & Habitat Conservation Working Group and help provide name associations with the various reaches of the corridor.[1]

Section Name	**Boundary Features**			
	Begin	***P.M.***	***End***	***P.M.***
Ragged Pt	San Carpoforo Creek	71.4	SLO/MON Co. line	0.0
Gorda Coast	SLO/MON Co. line	0.0	Willow Creek	11.6
Pacific Valley	Willow Creek	11.6	Wild Cattle Creek	17.3
Lucia Coast	Wild Cattle Creek	17.3	Lucia	23.0
Big Creek Coast	Lucia	23.0	Rat Creek	30.8
Esalen Coast	Rat Creek	30.8	JP Burns	35.8
Partington Coast	JP Burns	35.8	Castro Canyon	43.1
Big Sur Valley	Castro Canyon	43.1	Andrew Molera	51.2
El Sur Ranch	Andrew Molera	51.2	Little Sur River	56.1
Bixby Coast	Little Sur River	56.1	Rocky Creek	60.0
Garrapata Coast	Rocky Creek	60.0	Malpaso Creek	67.8
Carmel Highlands	Malpaso Creek	67.8	Point Lobos	70.4
Point Lobos	Point Lobos	70.4	Rio Road	72.6

Table 1: Corridor sections of Highway 1 along the Big Sur Coast.

[1] Features are also identified by postmile, abbreviated by P.M. Postmiles identify the location along the highway, measured in miles, and increase from south to north; postmiles begin at 0.0 at county boundaries.

Figure 2: This view of the Pacific Valley along the southern Big Sur Coast is characteristic of the coastal terrace geography in this section of the corridor.

2.1 Plant Communities

Nineteen distinct biotic communities were identified as part of the corridor inventory for the CHMP and are briefly described below. With the exception of ruderal/disturbed and windrow, vegetation community nomenclature and descriptions are in accordance with the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986).

- Central coastal scrub
- Coastal sage-chaparral scrub
- Northern coastal bluff scrub
- Central maritime chaparral
- Central coast riparian scrub
- Central coastal cottonwood-sycamore riparian forest
- Upland redwood forest
- Monterey pine forest
- Monterey cypress forest
- California bay forest
- Coast live oak forest
- Northern foredune
- Central dune scrub
- Non-native grassland
- Coastal terrace prairie
- Ruderal/disturbed
- Windrow
- Riverine
- Intertidal

Central Coastal Scrub This community is typically found on exposed, often south-facing slopes with shallow, rocky soils. It is common along the western side of the Santa Lucia range between Monterey and Point Conception, usually below 2,000 feet. It is typically composed of fairly dense shrubs that are 3 to 6 feet tall. Characteristic species include coyote brush, California sagebrush, Coastal scrub provides essential resource for wildlife such as resting and escape cover, and foraging and breeding habitat. Examples of wildlife species typically found in this community include western fence lizard, California legless lizard, Pacific gopher snake, western toad Allen's hummingbird, Costa's hummingbird, spotted towhee, bushtit white crowned sparrow California vole and black-tailed jackrabbit. Due to the occurrence of the seacliff buckwheat as part of this community, it also provides habitat for the federally endangered Smith's blue butterfly. This plant community is prevalent throughout the corridor.

Coastal Sage-Chaparral Scrub This community is typically found within the southern portion of the corridor. It is intermediary between coastal scrub and chaparral. Characteristic species include California sagebrush, black sage, and poison oak. Examples of wild life species typically found in this community include California newt, side-blotched lizard, southern alligator lizard, Northern Pacific rattlesnake, wrentit, blue-gray gnatcatcher, orange-crowned warble, and California thrasher. Due to the potential for seacliff buckwheat to occur in this community, it also provides habitat for Smith's blue butterfly.

Northern Coastal Bluff Scrub This community is typically found on rocky, poorly developed soils, in areas of nearly constant exposure to winds with high salt content. It is composed of low growing scrub species, typically forming continuous or somewhat scattered mats. It is found at localized sites along the Monterey County coastline. Characteristic species include coastal onion, seaside amsinckia, seacliff buckwheat, coast buckwheat, sea-pink and Monterey Indian paintbrush. Species that may inhabit this community include Smith's blue butterfly, western fence lizard, side-blotched lizard, coast horned lizard, California vole, California mouse, deer mouse and black-tailed jackrabbit. White-tailed kite and red-tailed hawk are examples of raptors that may forage over this community. Northern coastal bluff scrub was documented at a single location, along the coastal bluffs between Bixby and Rocky creeks.

Central Maritime Chaparral This community is typically found on well-drained, sandy soils. It is a scrub of moderate to high cover dominated by manzanita and is found at scattered locations near Monterey. Fire appears to be required for reproduction. Characteristic species include Little Sur manzanita, shaggy-barked manzanita, Hooker's manzanita, coyote brush, ceanothus and golden bush. Little Sur manzanita often serves as an indicator species of this community in Big Sur. Yadon's rein orchid, a federally endangered species, is present in central maritime chaparral near the corridor study area. Examples of wildlife species typically found in this community include spotted quail, western fence lizard, Northern Pacific rattlesnake, ringneck snake, California whipsnake, Merriam's chipmunk, California pocket mouse, and raccoon. This community is found at three locations near Bixby Creek.

Central Coast Riparian Scrub. This community may be found in a variety of environments, such as low gradient reaches of rivers and streams, on seasonally flooded, saturated soils (Holland 1986, Sawyer and Keeler-Wolf 1995). Willow species dominate this community. It is typically located along and at the mouths of both perennial and intermittent streams of the South Coast Ranges, extending from the Bay Area south to the Point Conception vicinity. Characteristic species include arroyo willow, shining willow, Coulter's willow, and narrow-leaved willow. Central coast riparian scrub provides a wide range of resources to wildlife, such as movement and migration corridors, cover, water, and a variety of foraging opportunities. Examples of wildlife found in this community include Pacific chorus frog, California red-legged frog, two-striped garter snake, Townsend's warbler, Wilson's warbler, common yellowthroat, black phoebe, and Pacific-slope flycatcher. This community may also provide a number of essential resources for neotropical migrant songbirds.

Central Coastal Cottonwood-Sycamore Riparian Forest This community is found along floodplains of streams, canyons and creeks throughout the South

Coast Ranges. Characteristic species include big-leaf maple, black cottonwood, white alder, various willow species and western sycamore. Bird species that are characteristic of this habitat include Nuttall's woodpecker, black phoebe, western wood-pewee, California towhee and song sparrow. A number of species nest or roost in riparian communities and feed in adjacent vegetarian communities. This community provides a number of essential resources for neotropical migrant songbirds such as warblers, vireos grosbeaks, and flycatchers.

Upland Redwood Forest This community is usually found on shallow, well-drained soils, often on steep slopes of coastal canyons with in reach of summer fogs. Along the Monterey Coast stunted and wind-pruned stands are often created due to exposure. Characteristic species include coastal redwood, California bay, tanbark oak, big-leaf maple and western sword fern. Tanbark oak is susceptible to Sudden Oak Death. Wildlife species that may occur in this community include ensatina, Pacific slender salamander, Pacific giant salamander, western-screech owl, Allen's hummingbird, purple martin, acorn woodpecker, Steller's jay, Townsend's western big-eared bat, pallid bat, and dusky-footed woodrat. Within Monterey County, distribution of this community extends from south of Monterey nearly to the San Luis Obispo County line. The most substantial stands of upland redwood forest occur along the Big Sur River. Upland redwood forest also occurs at various other corridor locations, including Torre Canyon, Anderson Canyon, and Partington Creek.

Figure 3: Giant coastal redwoods of Big Sur lining the corridor near Captain Cooper School.

Monterey Pine Forest This community is restricted to well-drained, sandy soils within reach of the summer marine fog incursion. Monterey pines dominate this community, obtaining canopy coverage of up to 80 percent. Only three natural stands occur in California, the largest of which is located near Pt. Lobos State Reserve. This stand occurs within the project vicinity extending approximately 2.5 miles along the coast between San Jose Creek and Malpaso Creek. Monterey pine forest areas documented in the project corridor are potentially natural/native stands. However, Monterey pines have been widely planted, becoming naturalized throughout the project corridor. Other species commonly associated with this community include coast life oak. Within the corridor, this type of forest occurs in the vicinity of Pt. Lobos and the Carmel Highlands.

Figure 4: Monterey Pine forest near Point Lobos

Monterey Cypress Forest This community is restricted to rocky, granitic soils of coastal headlands and bluffs. It is usually composed of pure stands of Monterey cypress, with scattered dwarf shrubs and perennial herbs forming the understory. Only two small natural stands are documented near the project area. Other characteristic species of this community include California sagebrush, coyote brush, powdery dudleya and Douglas' iris. Species that may be encountered in this community include monarch butterfly, pine siskin, chestnut-backed chickadee, pygmy nuthatch, great horned owl, red-tailed hawk, and black-tailed deer. A native Monterey cypress forest is present within the project vicinity near Point Lobos; however, the Monterey cypress forest documented within the corridor south of Point Lobos are likely composed of naturalized individuals. The stand near Point Sur is composed entirely of naturalized individuals; the naturalized/non-native stands of Monterey Cypress present within the corridor should not be considered a sensitive plant community.

Figure 5: The Monterey cypress situated in its rocky, granitic soil along a coastal bluff.

California Bay Forest This community is typically found on moist, north-facing slopes, forming dense, wind-sheared stands on exposed coastal slopes, primarily within the southern portion of the corridor study area. The understory is usually poorly developed. California bay dominates while other subdominant species such as snowberry, and California blackberry may also be present. Its distribution extends from the Oregon border to northern San Luis Obispo County, along the Outer Coast Ranges. Wildlife species that may be found in this community include ensatina, Pacific slender salamander, arboreal salamander, rubber boa, sharp-tailed snake, coast mountain kingsnake, chestnut-backed chickadee, violet-green swallow, northern flicker, western gray squirrel, and California mouse.

Coast Live Oak Forest This community may be found along slopes as well as valley bottoms. Characteristic species include coast live oak, California bay and poison oak. The understory typically consists of a poorly developed shrub layer and an herb layer dominated by exotic grass species. Oak trees provide shelter, shade, and breeding habitat for wildlife, as well as acorns, which are an important food resource. This community may also be important to migrant songbirds and bird species feeding on insects in the bark and foliage. Examples of wildlife species found here include Pacific slender salamander, arboreal salamander, southern alligator lizard, Pacific gopher snake, Nuttall's woodpecker, white-breasted nuthatch, dark-eyed junco, oak titmouse, Virginia opossum, and raccoon. This plant community occurs primarily within the vicinity of the Big Sur valley.

Sudden Oak Death has caused the loss of large numbers of coast live oak, tanbark oak, and black oak trees. The disease has been confirmed at Pfeiffer Big Sur State Park the primary location of the community within the corridor.

Figure 6: Coast Live Oak.

Northern Foredune This community is typically found on foredunes, but may also occur on upper beaches. As plants become established, there is a reduction in the amount of blowing sand, allowing the dune to become partially stabilized. Perennial grasses dominate this community, while low, often succulent, perennial herbs and subshrubs serve as subdominants. It is distributed along the coast as far south as Point Conception in Santa Barbara County, occurring in areas of sand accumulation, including all locations where active coastal dunes exist.

Characteristic species include yellow sand verbena, beach-bur, beach evening primrose, sea rocket, and sea lyme-grass. Wildlife species that may occur in northern foredune include western snowy plover, Smith's blue butterfly, globose dune beetle and the California legless lizard. Coast buckwheat, a host plant of Smith's blue butterfly, is present along the dunes at the Little Sur River. Within the corridor study area, this community was documented along the coast south of the Carmel River as well as south of the Little Sur River.

Central Dune Scrub This community is found along the coast on relatively stabilized backdune slopes, ridges, and flats. It consists of low growing, scattered shrubs, subshrubs, and herbs that may develop considerable cover. Characteristic species include goldenbush, Chamisso's bush lupine, coastal sagewort, and California aster. Central dune scrub intergrades with other coastal communities, such as central coastal scrub, northern foredunes, and coastal sage-chaparral scrub (Holland 1986). Examples of wildlife that may occur in central dune scrub include California legless lizard, side-blotched lizard, western fence lizard, wrentit, and song sparrow. Central dune scrub was documented only once within the corridor study area during the field review. The occurrence was located on the dunes south of the Little Sur River.

Non-Native Grassland This community is typically found in valleys and foothills with fine-textured, usually clay soils, which may range from moist, possibly even waterlogged, during the rainy season to very dry during the dry season. It is primarily composed of non-native annual grasses; however, a number of native annual forbs ("wildflowers") may also be present during years of favorable precipitation. Characteristic species include Avena, Bromus, Italian ryegrass, California Poppy, and lupine. Wildlife species typically associated with grasslands include western skink, Pacific gopher snake, common garter snake, deer mouse, California vole, black-tailed deer, western meadowlark, and savannah sparrow. Grasslands also provide important foraging habitat for raptors such as the American kestrel, white-tailed kite, northern harrier, and red-tailed hawk. Non-native grasslands occur at various locations along the corridor. The grazed grasslands near Point Sur provide a representative example of this community.

Coastal Terrace Prairie Holland (1986) describes coastal terrace prairie as a dense, tall grassland dominated by perennial grasses. Most stands are quite patchy and vary in species composition, reflecting local variations in soil moisture. This community typically occurs on sandy loams on marine terraces within the coastal fog incursion zone (Holland 1986). Native grass species associated with coastal terrace prairies include oatgrass, tufted hairgrass, purple needlegrass, and blue wildrye. Other plant species that may be found in this community include sea-pink, velvet grass, checker mallow, and coast tarweed. The wildlife assemblage associated with this community is similar to that described above for non-native grassland.

Efforts to restore the coastal marine terrace along the seaward side of Highway 1 within Point Lobos State Reserve through prescribed burning have been largely successful. A variety of native grasses are now present within this formerly grazed land (L. Otter, personal communication). Native grasslands are a sensitive plant community, and as such, surveys conducted during the

appropriate bloom periods are needed to ensure that those present within the corridor study area are identified and mapped.

Windrow This community comprises various tree species that have been planted for ornamental or commercial purposes. Typically located in the vicinity of urban development, windrows can be found throughout most of the Big Sur coast. Commonly utilized species include Monterey pine, Monterey cypress, and various *Eucalyptus* species. Litter layers created by the exfoliated bark of *Eucalyptus* trees may provide cover for small vertebrate species, such as southern alligator lizard, gopher snake, and woodrats (Pearson 1988). Other species that may be encountered include raptors, red-tailed hawk, red-shouldered hawk, barn owl, great horned owl, chestnut-backed chickadee, and American crow.

Monterey pine, Monterey cypress groves, and Blue gum Eucalyptus may provide habitat for monarch butterflies. Known "butterfly tree" locations within and adjacent to the corridor study area near San Carpoforo Creek; Pacific Valley; Big Creek; Hot Springs Creek; Sycamore Canyon, west of Pfeiffer Beach; Point Sur; Point Lobos State Reserve; and Gibson Creek.

Figure 7: A windrow of Monterey cypress and Eucalyptus trees forming a backdrop to an open pasture.

Ruderal/Disturbed This community type encompasses urban development, highly disturbed vegetation communities, highly eroded/disturbed areas, erosion control areas, and active or fallow croplands. These communities are widespread within the corridor study area. These areas typically had a high incidence of exotic plant invasion. Commonly identified exotics included pampas grass, fennel, mustard, and French broom. Native and introduced animal species that often thrive in these urban habitats include western fence lizard, barn swallow, European starling, house sparrow, house finch, house mouse, raccoon, striped skunk, and Virginia opossum. Due to the potential for the occurrence of seacliff buckwheat on recently exposed/disturbed sites, potentially suitable habitat for Smith's blue butterfly may occur within this community

Croplands create habitats that may either be annual or perennial depending system and location. Examples of wildlife that have adapted to croplands include red-winged blackbird, Brewer's blackbird, American goldfinch, house mouse, and deer mouse.

Riverine Riverine environments may be associated with various terrestrial vegetation communities. The riverine environment provides resources for a large

assemblage of wildlife species. Anadromous fish, such as steelhead, use these waterways as migration/movement corridors, breeding habitat, and rearing habitat. Numerous insectivorous bird species, such as swallows, swifts, and flycatchers, forage over water. Other wildlife species that may be encountered include Pacific lamprey, Pacific chorus frog, foothill yellow-legged frog, southwestern pond turtle, western aquatic garter snake, two-striped garter snake, belted kingfisher, black phoebe, violet-green swallow, and bat species. The larger creeks within the corridor study area, San Carpoforo Creek and Big Creek for instance, exhibit many of these riverine characteristics. The Big Sur, Little Sur, and Carmel rivers best exemplify the riverine environments within the corridor study area

Intertidal The intertidal zone is the strip of shoreline between the land and the open ocean. During the high and low tides, this land is regularly covered and uncovered by the advance and retreat of the tides. Intertidal communities occur on sandy beaches, in bays and estuaries, and along rocky shorelines. Due to adverse conditions, hardy and adaptable plants and animals typically inhabit these areas. These species include the California brown pelican, pelagic cormorant, Brandt's cormorant, southern sea otter, harbor seal, northern sea lion, northern elephant seal, and a variety of invertebrates.

2.2 Sensitive Habitats

The various communities include the numerous special-status plant species that are present within the corridor. Among the rare plants in the area are the most beautiful jewel flower, Arroyo de la Cruz manzanita (Arctostaphylos cruzensis), adobe sanicle (Sanicula maritima), Hutchinson's larkspur (Delphinium hutchinsoniae), Arroyo Seco bush mallow (Malacothumnus palmeri lucianus), Little Sur manzanita (Arctostaphylos edmundsii), and Pacific Grove clover (Trifolium polyodon). Any negative effects to the plant communities in which these plants are found threatens the species themselves.

Specific plants and plant communities also support special status wildlife. Seacliff Buckwheat (*Eriogonum parvifolium*) is prevalent throughout the corridor. This plant is associated with central coastal scrub, coastal sage-chaparral scrub, coastal bluff scrub, coastal terrace prairie and other grassland communities. This plant is of special importance on the central coast of California, as it serves as a host plant for the federally endangered Smith's Blue Butterfly.

Figure 8: Seacliff buckwheat

One of the greatest threats to the butterfly is the invasion of non-native plant species within these plant communities. The focus on exotic plant control in the guidelines is

intended to reduce negative impacts to the buckwheat stands and the Smith's blue butterfly. In addition to planting more *E. parvifolium* plants, seeds from this species from sources where feasible, will be included in most re-vegetation and erosion control efforts. A second host food plant for the butterfly is Coast buckwheat (*Eriogonum latifolium),* which is less common in the corridor.

Wetland and riparian zones that contain rare aquatic or amphibious wildlife species exist along the corridor. Among these species are the South Central California Coast Steelhead, Tidewater Goby, California Red-Legged Frog, Foothill Yellow-legged Frog and California Tiger Salamander. Associated plant communities include Central Coastal Cottonwood/Sycamore Riparian, Central Coast Riparian Scrub and California Bay Forest. Ephemeral drainages, streams/creeks, rivers, seeps/springs, ponds and wetlands are considered riparian zones that require special attention during maintenance and construction activities.

2.3 Weeds

The diverse native plant communities in Big Sur are threatened by invasive non-native species. Invasive plants can destabilize native communities, affect sensitive habitat and block views. Effective vegetation management along the Big Sur Coast entails a significant weed control effort to avoid these effects.

Invasive plants have been characterized according to the degree of threat they pose to the integrity of sensitive or undisturbed natural habitat based on their rate of spread and degree of damage that each has caused or could potentially cause.

Primary Threats

Cape Ivy (*Delairia odorata)* invades all communities. The plant is engulfing native coastal scrub species on moist coastal bluffs and north-facing slopes and also occurs along a number of the corridor's prominent waterways including the Little Sur River and San Carpoforo, Dolan, Burns, Bixby, Rocky, Garrapata, Malpaso, and Wildcat Creeks. This plant forms a dense mat that completely smothers all underlying native vegetation. Cape ivy spreads very rapidly by vegetative means. If there are any viable root fragments left in the soil, they will re-root themselves and grow. This becomes a problem when attempting to remove the plant. The blooming period for this plant extends from February to June.

Figure 9: Cape Ivy leaves

Figure 10: Cape Ivy leaves and flower

French Broom (*Genista monspessulana*) is a woody perennial that is widespread throughout the corridor. It has a wide tolerance of soil conditions and thrives in the rocky soils of the Big Sur region. Seed production is prolific and seeds remain viable in the soil for years, creating a threat of re-infestation after many years. French broom forms dense, impenetrable thickets that invade and crowd out native vegetation. In summer months, plants dry out and become a fire hazard, which may especially be of concern in areas where thick stands have developed. French broom is currently present in communities that are associated with the Seacliff Buckwheat, which may further pose a threat to the Smith's Blue Butterfly. The blooming period for this plant extends from March to May.

Figure 11: French Broom flower

Figure 12: Young French Broom

Pampas Grass (*Cortaderia jubata*) is a widespread problematic invasive plant. The plant occurs throughout the corridor, but is less abundant north of the Big Sur Valley. This plant becomes highly competitive with native plants when seedlings are established, thus threatening ecological qualities of coastal and grassland sites, including areas with the Seacliff Buckwheat and Smith's Blue Butterfly. The plant's rapid growth and biomass, both above and below ground, allow it to out-compete native species for light, water, and nutrients. Due to its prolific production of small, light seeds, this plant is spread rapidly by wind, animals, or humans. The blooming period for pampas grass extends from July to September.

Figure 13: Mature Pampas Grass along the roadside.

Sticky Eupatorium (*Ageratina adenophora*) is a species that grows successfully in almost all communities present in Big Sur, but is most abundant in the southern part of the corridor. Areas that are most commonly infested are disturbed roadsides, Coastal Scrub and wetlands. In summer months, Eupatorium occupies the wet areas and displaces the native riparian species. This plant is also a threat due to the aggressive nature of spread, which is primarily by seed; it blooms most months of the year.

Figure 14: Sticky Eupatorium flowers.

Figure 15: Sticky Eupatorium leaves.

Secondary Threats

Fennel (*Foeniculum vulgare*) is a common invasive plant in the Big Sur region that quickly occupies highly disturbed areas, such as highway roadsides. When established, it can exclude almost all other vegetation. As an annual weed, at the end of its life cycle it leaves a large skeleton that becomes a fire hazard and an obstruction of the viewshed. This species has also become well established in areas that contain Seacliff Buckwheat and Smith's Blue Butterfly.

Figure 16: Lane of mature Fennel.

Figure 17: Young Fennel

Fountain Grass (*Pennisetum setaceum*) is a common landscape perennial grass that when growing outside the garden, crowds out other species, reducing opportunities for native establishment. This grass produces large numbers of wind dispersed seeds that can remain viable in the soil for well over six years. When dormant or dead, the leaves become dry and act as fuel for wildfires. Fountain grass will rapidly reestablish itself after wildfires or prescribed burning. The blooming period for fountain grass extends from July to October.

Figure 18: Bunched Fountain Grass.

Hottentot Fig Iceplant (*Carpobrotus edulis*) is an invasive species seen along the beach and dune areas of the corridor. This plant is most prevalent in the northern portion of the corridor, in particular along the dunes near the Little Sur River and the bluffs surrounding Garrapata Creek. In the past, especially, iceplant was commonly planted for erosion control on sandy slopes. This very hardy plant clings to the sandy soils along the roadside and spreads over the entire surface, out-competing any native vegetation. As with Cape ivy, iceplant spreads very easily by vegetative means, creating a problem when using removal techniques. The blooming period for Iceplant extends from May to October.

Figure 19: Hottentot Fig Iceplant flower.

Figure 20: Hottentot Fig Iceplant flower and leaves.

Italian Thistle (*Cardus pycnocephalus*) colonizes already disturbed habitats and displaces desirable forage and cover plants. This plant can germinate rapidly and in large numbers, creating breakouts of infestations. Italian thistle appears to be limited within the corridor. It is more prevalent in the northern portion at this time. As with many other invasive plants seen along the corridor, Italian thistle's seeds are dispersed easily by wind and can stay viable in the soil for many years. The blooming period for Italian thistle extends from April to June.

Figure 21: Italian Thistle flower and stem.

Kikuyu Grass (*Pennisetum clandestinum*) is a species that is well adapted to the coastal climate of Big Sur. Kikuyu grass is a commonly used landscape plant that has invaded disturbed roadside areas along Highway 1. Its current distribution is known to extend as far north as Little Sur Creek. This plant has rapid stolon growth and thatch formation. Kikuyu grass is very difficult to control because the stems re-grow very easily after common maintenance practices such as mowing. Each piece that is broken off and left on the soil can produce new shoots and root from the nodes. This plant can spread by seed in addition to spreading by stem sections.

Figure 22: Stolens of Kikuyu Grass.

Figure 23: Underside of Kikuyu Grass

Poison Hemlock (*Conium maculatum*) is a common species that has invaded roadsides as well as native communities in riparian woodlands and open flood plains of rivers and streams. Once established, plants colonize quickly, degrading the quality of sensitive habitats. This plant is especially troublesome in roadside areas where seeds that have adhered to machinery and vehicles are easily deposited. The blooming period for poison hemlock extends from April to September

Figure 24: Poison Hemlock flower and stem.

Figure 25: Poison Hemlock seedling.

Purple Star Thistle (*Centaurea calcitrapa*) invades and thrives in disturbed roadside areas and adjacent pastures, crowding out native vegetation. It produces a seed bank that is viable in the soil for years. The seeds can also remain dormant in the soil for long periods, giving rise to future infestations. The seedheads themselves pose a further problem, as they are easily broken off and dispersed by animals, moving water and vehicles. In addition, the seeds are well suited for sticking to rubber tires which makes them easily spread along the roadsides of Highway 1. Although not common in Big Sur, purple star thistle is an important species due to the invasive potential it has demonstrated in nearby areas.

Figure 26: Purple Star Thistle Flower.

Vinca (*Vinca* spp.) is an invasive plant that becomes established primarily in shady, riparian areas. It forms a dense carpet that nearly excludes all other species from growing in the area. Vinca can grow up and down trees, threatening their survival. It can also become a problem in drainage areas, where it grows in and out of drainage facilities, preventing proper drainage flow. This plant can be difficult to remove as it re-sprouts quickly after damage and spreads rapidly by stolons. The blooming period for vinca extends from March to July.

Figure 27: Vinca leaf and flower.

Figure 28: Vinca foliage.

Yellow Star Thistle (*Centaurea solstitials*) easily establishes itself in areas that are disturbed by road construction and maintenance. Although it has been documented in only six locations along the corridor, the plant has demonstrated its strong invasive potential in the surrounding region. Since road maintenance equipment and the undercarriages of vehicles easily transport the seeds, the plant poses a threat to the Big Sur corridor. The abundant seeds of yellow star thistle can remain viable in the soil for years, giving rise to future infestations. The plant has an extensive root system that reaches far into the soil profile and will out-compete shallow rooted native annuals in the summer. Common control practices, such as mowing, can be ineffective since the plant tops re-grow very easily. The blooming period for yellow star thistle grass extends from July to December.

Figure 29: Yellow Star Thistle flower.

Figure 30: Yellow Star Thistle seedling.

The most effective measures possible are employed to help control the spread of these weeds. Several manual, mechanical and chemical techniques have been considered as methods of management. These methods of control and constraints to their use are described in detail in section 4.1.

3.0 Objectives

The Streets and Highways Code Section 167 establishes the following priorities for the Department of Transportation:

1. Operations, maintenance and rehabilitation of facilities
2. Safety improvements
3. Congestion relief
4. Environmental enhancement and mitigation

With the possible exception of congestion relief, which is associated with more urban settings, these priorities are furthered through pursuit of the two principal objectives for vegetation management along the coast highway. The first objective, *preservation of a well-functioning highway facility*, addresses priorities pertaining to highway operations and safety; the second objective, *protection of corridor resources*, supports the priority of environmental enhancement and mitigation. The Department attempts to address these priorities through management activities that accord with the priorities of adjacent landowners wherever it is feasible and reasonable to do so.

The Vegetation Management Guidelines provide a framework for achieving these two objectives through maintenance and construction related activities within the corridor.

3.1 Preservation of Facility

To ensure highway operations and safety as well as visual quality along the corridor, vegetation around certain features must be maintained and controlled. Important features include pavement, roadside safety devices, waterways and drainages, signs, sight distance, and historic highway features. Generally vegetation management aimed at facility preservation entails removing or limiting the height of vegetation. The following are management considerations for each highway feature.

Pavement
Vegetation should be controlled where space exists for vehicles to pull over. Areas along roadsides should be controlled to facilitate maintenance equipment and clearance for both vehicle and bicycle/pedestrian traffic. Roadsides should be kept free of any vegetation overgrowth.

Roadside Safety Devices
Devices include guardrails and reflective markers. Vegetation should be controlled to maintain functionality of safety devices. Clearance may vary depending on maintenance methods used.

Waterways and Drainages
Facilities include bridges, culverts and roadside ditches. Vegetation and debris should be controlled as necessary to facilitate drainage. Methods include channel clearing, removal of vegetation and sediment, protection and repair from erosion, and removing encroachments that impede drainage.

Signs
For purposes of these guidelines, only highway signs are addressed. Vegetation should be controlled to facilitate safety device, based on maintenance method used.

Sight Distance
This is the "continuous length of highway ahead visible to the driver", which includes passing, stopping and decision sight distance.[2] Vegetation should be removed, pruned or mowed for horizontal curves and intersections as needed to ensure traveler safety.

Historic Highway Features
Features include rock masonry features, such as parapets, culverts, headwalls and drinking fountains. Vegetation around these features should be controlled as necessary to protect the integrity of the feature.

Figure 31: This rubble masonry wall along the Partington Coast section is a contributing feature of the Carmel-San Simeon Highway Historic District.

3.2 Protection of Corridor Resources

The diverse native plant communities in Big Sur are threatened by non-native species. The presence of these exotic plants causes the native communities to become less stable, and subsequently have the potential to affect sensitive habitats. To alleviate these potential effects, a heavy focus of these guidelines is on weed control. Preservation of ocean views along the corridor is also important; weeds are the primary target for this objective as well.

Protection of Habitat This objective entails protection of native and historic naturalized communities, especially those that serve as hosts for special focus or sensitive species and habitat. Any negative effects to these communities pose a threat to the plant and wildlife species that rely on them to survive. Because the primary and secondary weeds identified in Section 2.3 pose threats to valued plants and wildlife, control of these particular weeds is an important objective of vegetation management.

[2] *Highway Design Manual*- Department of Transportation

Protection of Views Views of the ocean and coastline from the highway are among the most highly valued qualities of the corridor. Open vistas, framed views of specific visual elements, and screening of certain man-made elements all contribute to the overall visual quality that has earned this section of coastline so many accolades. Federal, state and county policy emphasizes the importance of the preservation of views throughout the corridor.

The *Scenic Qualities Inventory* prepared for the CHMP, identified positive and negative features within a series of viewsheds along the highway. The Vegetation Management Guidelines address large-scale views and the methods to enhance the overall quality of the visual environment, while identifying particularly sensitive locations that may require extra attention.

The quality of views along the corridor have been analyzed by evaluating sections referred to as viewsheds, further broken down into landscape units. A viewshed is the visual envelope that a person can see while travelling on the road. A landscape unit is a sub-section of a viewshed that exhibits a cohesive visual character primarily based on vegetation, topographic or man-made elements. As noted in the *Scenic Qualities Inventory*, vegetation including tall weeds along the ocean side of the highway, dead or dying trees and stumps, non-native trees screening views, overgrown vegetation, and even lack of vegetation in areas that see high use by people can detract from experiencing viewsheds.

Vegetation and tree canopy play a positive role in framing views from the highway. In addition to the protection of scenic views, vegetation management objectives include protection of framing vegetation and forested canopy along the corridor.

Figure 32: Monterey Pines framing a view of the nearshore habitat along the Carmel Highlands section of the corridor.

4.0 Programs

As part of the highway maintenance program, general roadside practices support the vegetation management objectives: preservation of the highway facility, protection of habitat and protection of views. The Department's Maintenance Manual guides vegetation control activities.

In addition to regular roadside maintenance, disturbances from natural changes or brought by construction activities may also require re-vegetation. While habitat protection is an objective for both roadside and restoration activities, one focuses on controlling growth (trimming or mowing for height or removing weeds) while the other seeks regeneration of appropriate plant communities after a disturbance. Site restoration involves a multi-disciplinary team and may involve coordination with regulatory agencies as well.

4.1 General Roadside Practices

The statewide vegetation control policy outlines the various vegetation management approaches. These approaches include mechanical, manual, cultural, and chemical control methods. Specific best practices proposed for use along the Big Sur Coast are addressed in Section 5.0.

Statewide Vegetation Control Policies

Vegetation Control Section C2 of the Maintenance Manual (excerpted in Appendix F) recommends that management unit decisions should identify the minimum vegetation control necessary to ensure adequate safety and system preservation. Decisions should take future needs into consideration, as well as addressing short-term needs.

The policy encourages the growth of native vegetation along highway roadsides. Safety, aesthetics and compatibility with adjacent land use are the prime considerations in the proper maintenance of vegetation. Vegetation should be controlled where necessary for fire prevention, safety and reduction of noxious weed. Integrated vegetation management control alternatives should be considered on a site-specific basis.

Herbicides can only be used when authorized by a Pesticide Use Recommendation prepared by a licensed Pesticide Control Advisor (PCA). Fieldwork must be supervised by the holder of a Qualified Applicator's Certificate (QAC). These requirements are for work performed either by the Department's forces or by contract.

The 1991 Environmental Impact Report (EIR) on the Vegetation Control Program (excerpted in Appendix G) sets objectives of safe highway travel and the protection of natural resources, human lives, and property along and in the vicinity of the state highway system. The EIR states that more than one vegetation control need may apply to a given area. While these needs are applicable throughout the state, climate, soils, land use, and other regional factors determine the types and amounts of vegetation control needed in a particular geographic area.

The EIR requires the Department to assess the risks of herbicide application at a particular treatment site, including public and worker safety, threats to plant and animal

life, water, and soil. Use of the chemical method with the lowest potential toxicity at the lowest effective concentration and to protect non-target species is required.

Roadside Vegetation Management

The Department is responsible for controlling vegetation within the highway right-of-way. Target areas include cut ditches, the pavement edge, and unpaved areas such as shoulders, drainage inlets, culverts, guardrails, vista points and safety apparatus. Vegetation control is effected by mechanical, manual, cultural, and chemical control methods.

Mechanical Methods
Mechanical methods of vegetation management include activities such as mowing, burning and scraping. These practices are all performed with mechanical equipment that is not considered a hand tool. A majority of these practices can be done with equipment that allows for less labor-intensive work, making it more efficient.

Manual Methods
Control methods under this designation are those that require the use of hand tools, mechanical or non-mechanical. These can include, but are not limited to, string trimmers, chainsaws, hand hoeing, grubbing, pruning and hand pulling. Manual methods not using mechanized hand tools can be more labor intensive, however they are very useful and efficient when working close to sensitive resources that must not be disturbed.

Cultural Methods
Cultural methods are those that manipulate the environment so that plant growth may be improved. These can be preventative measures to ensure that no invasive species are introduced and that during projects, sensitive species and habitats are given special consideration. Examples of these types of activities include salvaging and storing plants, transplanting sensitive species out of the way of projects, identifying/flagging sensitive resources prior to work, and cleaning maintenance equipment thoroughly.

Chemical Methods
The Department is committed to reducing overall use of pesticides on a statewide basis. However, herbicides remain a necessary component of effective integrated vegetation management. Careful application can focus on target species. Herbicide application must balance successful results with the least impacts on surrounding desirable vegetation and the environment. Maintenance crews will exercise caution around sensitive species and habitats/communities and adjacent properties.

Burning is not used as a roadside vegetation control practice. However, natural fires help to renew soils, remove unwanted species and encourage the growth of native species, which compliments efforts of a restoration program.

4.2 Area-Specific Practices

Implementation of the best vegetation management practices for the 75-mile long corridor includes area-specific strategies and practices for sensitive locations. The objectives, constraints, and treatments will be described mile by mile along the corridor to facilitate protection of sensitive resources and awareness of special concerns. The output, based on the geographic information system developed for the corridor, will be produced as a set of maps for Maintenance and Construction crews.

Information will include identification of resources along the corridor that require special attention (objectives), and areas of special sensitivity (constraints) including sensitive habitat, historic features, riparian areas and special considerations for compatibility with adjacent properties. The available range of best practices for these locations will combine the objectives and constraints, providing a guidance tool for roadside managers when vegetation control recommendations are developed.

4.3 Site Restoration

Most restoration work is undertaken to facilitate site recovery after construction that results in ground disturbance; however, it may also be initiated at a site that has been disturbed by forces of erosion or land movements. This work is always site specific. By addressing potential erosion and slope stability, site restoration also helps preserve the highway facility. By restoring damaged habitat and removing noxious weeds, site restoration addresses and furthers the objective to protect habitat.

Site restoration is accomplished through a three-phase process: erosion control and site planning, re-vegetation, and maintenance. The program goals and objectives for site restoration in the Big Sur corridor are identified below.

Figure 33: A panoramic view of a restoration site at Landels-Hill Big Creek Reserve. This site received material from the Big Creek Slide of March 2000; the low-intensity approach to the re-vegetation here has been very successful.

<u>Program Goals</u>

- Manage slope instabilities
- Achieve consistency in restoration efforts
- Restore mature, native habitat to the extent possible
- Comply with environmental regulations and permits

Program Objectives

- Control soil erosion and prevent water pollution
- Preserve intact wildlife habitat along the Big Sur coast
- Manage sites for sensitive or important biological resources that need protection, enhancement, or restoration
- Manage disturbed sites to promote natural succession and to limit the spread of noxious weeds
- Ensure compatibility with adjacent land use practices and land management objectives
- Involve local expertise throughout the planning and implementation stages
- Provide adequate level of monitoring and maintenance following initial restoration to achieve program goals (approximately 3-5 years)

5.0 Best Practices for Roadside Management

A set of best practices for vegetation management was developed to ensure that all maintenance and construction practices are completed under the highest safety standards, for the traveler and maintenance personnel, and with the least impact to the environment and property.

5.1 Proposed Best Practices

Proposed best practices for management of trees, brush and weeds are listed below.

Trees

- Prune for stopping sight distance, visibility of highway signs and safety devices, and to provide overhead clearance at shoulder and traveled way.
- Pruning should be done in conformance with ANSI (American National Standards Institute) A300-1995, which are "intended as guides for federal, state, municipal and private authorities including property owners, property managers, and utilities in the drafting of their maintenance specifications[3]".
- Avoiding impacts to tree root zones, the existing soil surface should not be excavated, nor compacted, nor covered with any material in order minimize any impact.
- Dead trees within the right of way should be removed when required for safety or protection of property; this may include trees that have become unsafe due to a structural defect or that need to be removed to protect property or the traveling public.
- Topping of trees is discouraged and shall only be used if extreme height has made them a hazard. Removal should be considered as an alternative to topping, which in most cases would be the least desirable option.
- Volunteer seedlings within 9 feet from the edge of pavement should be removed promptly.
- Tree cutting and pruning tools should be disinfected after working in SOD infected areas.
- Chemical pesticides may be used in conjunction with other measures to control re-sprouting after mechanical pruning.

Brush

- Brush should be controlled up to 9 feet from the edge of pavement where possible
- Control brush for sight distance, to clear unpaved shoulder areas, and to protect the viewshed.
- Trim and remove brush selectively to encourage a natural appearance.
- Remove dead shrubs in right of way if sight distance and/or safety are jeopardized or for fire safety.
- Mowing should be utilized as the preferred method of control, unless other constraints require another method.
- Mowing should be scheduled after native plants have dropped their seed, so they may not be sacrificed.
- Chemical pesticides may be used in conjunction with other measures to control shrubs and brush as needed.

[3] *American National Standard for Tree Care Operations- Tree, Shrub, and Other Woody Plant Maintenance- Standard Practices*- National Arborist Association

Weeds

- Control of weeds will be done by means of manual, mechanical or chemical measures, depending on what best suits the specific maintenance area and plants to be managed.
- Use herbicides to control weeds where necessary
  - Select a spot spray or broadcast application depending on the percentage of weeds and presence of desirable vegetation
  - Use appropriate chemical for target species and time of application
  - When near riparian or wetland areas, use chemicals approved for those uses or as directed by regulators
  - Use chemicals in accordance to EPA labels to make sure they are being handled properly and safely
- Clean all maintenance and construction equipment thoroughly to reduce the spread and introduction of weeds.

Figure 34: An invasion of Pampas Grass covering a slope within the corridor.

5.2 Land Use and Property Ownership Considerations

Vegetation management, and specifically weed control, entails more than applying the most effective techniques to the individual threat species. The numerous land uses and multiple property owners, public and private along the Big Sur corridor introduce additional considerations. The Department's objective and intent is to conduct vegetation management activities in accordance with the priorities and wishes of adjacent landowners where feasible and not in conflict with other objectives of the Department.

Among the relevant considerations identified during the CHMP process, several pertain to the use of chemicals. The US Forest Service, which has significant land holdings in the corridor, has a no chemical herbicide application policy. For years, the Department did not spray at the edge of forestland. However, this roadside has become infested with invasive exotic species. Adherence to product restrictions and normal management practices will address concerns regarding method of application and the use of herbicides in areas near livestock.

Other priorities of property owners pertain to vegetation that could reduce visibility, the genetic integrity of local native plant populations, and the import or movement of soils that could contain seeds of invasive plants. The Department shares corridor property owners' concerns regarding sight distance at the numerous intersections of private roads and drives with Highway 1 and makes efforts to avoid situations where vegetation would cause a visibility problem. The three-phase process for site restoration presented in

Section 6.1 identifies several practices aimed at both bolstering native and naturalized vegetation and avoiding the import of noxious plants.

5.3 Application of Best Practices for Weeds

The Best Practices for Weeds identified in Section 5.1 above indicate that any of three methods may be appropriate for controlling invasive weeds, depending on the specific location on the highway corridor and the specific noxious species. The four primary threat species and 8 secondary threat species that have been identified in the project area should be addressed as follows:

Primary threats

Cape Ivy

Manual	Carpet rolling: turn vegetation over using a trowel and roll the mat over; remove roots from soil to prevent re-sprouting Hand pulling: utilize in areas with woody vegetation or when desirable native species are present; remove duff layer to help remove small pieces of ivy; native species may need to be mowed to effectively remove heavy ivy infestations
Chemical	Spray with a surfactant added to penetrate waxy cuticle; spray until the leaves and vines are wet but not dripping

French Broom

Manual	Hand pulling: used to destroy seedlings; most easily done after a rain when the soil is loose; plants should be pulled as soon as they are large enough to grasp but before seeds have been produced Hand hoeing: do while plants are still small by cutting off tops or stirring the surface soils to expose seeds and facilitate drying; objective is to cut off weeds without going too deep in ground, causing damage to roots of desirable vegetation; plants that are larger can be removed using a claw mattock Cutting: use of brush cutters, machetes, loppers, etc.; removes above ground portion of plant; cut plants before seeds are produced to prevent dispersal; not as effective, because the crowns can re-sprout Hand digging: removal of rootstock; suitable for small infestations or around sensitive species; all parts of roots must be removed to prevent re-sprouting
Mechanical	Chopping or mowing: plants can be trimmed back in areas of flat ground; faster and more economical way of removal; causes less soil disturbance; requires removal of rootstock to prevent re-sprouting
Chemical	In areas with small stands use selective spraying; for areas with severe infestations, use broadcast spray methods

Pampas Grass

Manual	Hand pulling: pull or dig out seedlings or small plants; remove entire crown to prevent re-sprouting Hand hoeing: for larger plants, use a pulaski, mattock, or long bladed shovel to remove clumps
Mechanical	Chopping or mowing: use a chainsaw or weedeater to expose base of plant; this can allow for better access to the crown for manual removal; cutting of the inflorescence is important to prevent seed dispersal; cut or mow before the plant has set seed
Chemical	Spot treat with a post-emergent herbicide at anytime of the year

Sticky Eupatorium

Manual	Hand pulling: hand pull or dig out the smaller infestations Hand hoeing: use a mattock to dig out plants, including the crown to prevent re-growth Cutting: can be done by slashing with a machete on heavy infestations; this can help reduce flowering and seedset
Chemical	Spot spray during Spring months, being sure to thoroughly spray crowns

Secondary Threats

Fennel

Manual	Hand hoeing: employ deep cultivation in the area by use of a mattock to loosen soil and remove small infestations
Chemical	Spot spray when the plant is actively growing but prior to flowering stage; thoroughly wet the crowns of the plant to help kill the following year's shoots as well

Fountain Grass

Manual	Hand pulling: remove entire plant when possible; best used in areas with small infestations Cutting: remove seed heads to reduce dispersal; immediately dispose to prevent further spread
Chemical	Spray infestations in the fall, as the chemical will be drawn down to the roots more efficiently at this time; this will help to kill the following year's shoots as well

Iceplant

Manual	Hand pulling: hand pull individual plants in small infestations, removing any buried stems Carpet rolling: large mats can be removed by loosening them from soil and rolling them up
Chemical	Spray herbicides with an appropriate herbicide anytime of the year, and mix with a surfactant to penetrate the plants waxy cuticle

Italian Thistle

Manual	Hand hoeing: most effective for small patches; be sure to sever the root 10cm below ground level; conduct in spring or early summer before seeds are produced Slashing: can be more effective than mowing because it destroys the aerial portion of the plant; conduct in spring to early summer
Chemical	Spot spray in February to March, being sure to wet plants thoroughly; most effective on larger infestations where there are no existing desirable plants

Kikuyu Grass

Manual	Hand pulling: remove entire plant and dispose of debris immediately to reduce spread
Chemical	Most effective to control new growth by spraying in spring or fall; if re-growth is seen, spot spray in fall

Poison Hemlock

Manual	Hand pulling: most effective when done prior to flowering; removal of entire root system is not necessary
Mechanical	Mowing: mow plants just before flowering; this will remove bolting material and prevent seed production
Chemical	To control the emergence of new sprouts, spray when plant is in a dormant stage; spray in early spring to control weeds that have already emerged; to control plants in the rosette stage, spot spray in early spring or late fall

Purple Star Thistle

Manual	Hand hoeing: use a pulaski to sever the roots of the plant; chop the root deep enough so that the crown is cut out (at least 3" below the base of the plant); remove the plant before seeds are formed
Mechanical	Mowing: less effective measure; if mowing must be done, do so when the re-sprouting ability is low
Chemical	Apply when plant is most susceptible before seeds are produced, which is just after the plant bolts but before flowers set seed in May; apply selective herbicides for use on large populations; be sure to apply directly to top of plant and careful to avoid dripping

Vinca

Manual	Hand pulling: effective on small infestations; most beneficial to remove all roots from soil to prevent re-rooting
Mechanical	Mowing: raise up runners by lifting with a rake and mow close to ground; remove all left over debris and roots by hand pulling
Chemical	Spray herbicides in early or late Spring when plant is actively growing; most successful when sprayed after plants have been damaged by mowing; use a surfactant to penetrate the waxy cuticle of the leaves

Yellow Star Thistle

Manual	Hand pulling and hand hoeing: most effective on small patches of infestation after plants have bolted but before viable seed is produced; detach all above ground stem material
Mechanical	Tillage: most effective on roadsides where no desirable plants are present Mowing: best on plants with a high branching pattern; should be used as a late season management tool, conducted at early flowering stage before viable seed production
Chemical	Spray before flowering in the early rosette stage; most successful when used on seedling plants

6.0 Best Practices for Site Restoration

Site restoration includes work undertaken to facilitate site recovery after construction activity or natural damage. Unlike basic vegetation maintenance, site restoration work is site specific.

6.1 The Three-Phase Process

Site restoration is undertaken in a three-phase process: site planning and erosion control, re-vegetation, and maintenance.

Phase I: Site Planning and Erosion Control

The objectives of the first phase are to control surface erosion, ensure compliance with statewide National Pollutant Discharge Elimination System (NPDES) permit, prevent further aggravation of unstable conditions and determine the appropriate level of re-vegetation for future phases.

Evaluate baseline conditions. A number of physical qualities including soil types, slopes and biological conditions must be assessed in order to determine the nature, severity and causes of existing erosion and to classify the stability of an area. This information will be the basis for selecting appropriate measures to correct conditions and predict the characteristics of future slide activity.

Re-vegetation may or may not be an appropriate corrective measure at a given site. The site information developed during this step allows for assessment of the potential for re-vegetation. In making this assessment, the Department will consider opportunities for duff and topsoil collection and plant salvage, presence of noxious weeds, the need for horticultural soil development, and conditions of surrounding plant communities.

An interdisciplinary team of representatives from Construction, Environmental Planning, Landscape Architecture, Geotechnical Engineering, and local expertise may all be involved in evaluating the baseline site information.

Identify site restoration goals. It is important for later site restoration phases, including monitoring and reporting, that site-specific re-vegetation goals as well as goal-achievement timelines be established. Both qualitative goals, such as visual continuity and habitat continuity, and quantitative goals, such as percent cover, density, and percent survival, may be appropriate. Goals may be modified, as needed, to respond to changing site conditions.

Conduct preliminary site planning. A site management plan will be developed that includes ongoing storm water management, erosion control, general options for re-vegetation, and establishment of weed control measures.

Ensure storm water management. Prior to undertaking any erosion control measures at a site, the appropriate storm water management plan will be developed in accordance with the Department's Statewide General NPDES permit (see Appendix E). This plan creates a program of treatments to reduce the discharge of pollutants associated with the storm water drainage systems that serve the highways and related facilities. The

plan includes Best Management Practices (BMPs) to reduce the potential for non-storm water discharge.

For disturbed areas greater than one acre a Storm Water Pollution Prevention Plan (SWPPP) will be prepared. For smaller projects, a Water Pollution Control Plan (WPCP) will be developed. These plans will evaluate and identify BMPs necessary to protect water quality during construction activities. The BMPs will be implemented to the maximum extent practicable and will satisfy the Best Available Technology/Best Conventional Technology requirement for construction activities.

Control erosion. Selection of erosion control measures is based on the consideration of individual site conditions (including the composition of adjoining vegetation), erosion severity, public safety, threat to roadway, and the potential for aggravating larger slope instability. Suitable measures will incorporate BMPs that may include a combination of non-vegetative and vegetative measures.

Examples of non-vegetative measures include the following: jute netting/erosion control blankets, fiber rolls, straw bales, and silt fences as well as measures that manage surface water runoff, such as detention basins and diversion structures. Vegetative measures may consist of container planting, planting of cuttings and/or seedlings, hydroseeding, or willow wattles. Only locally-occurring native species will be used.

Salvage plants and collect duff/topsoil. The potential for plant salvage and duff collection must be determined prior to beginning earthwork on a site. Duff should be free of undesirable weed species in order to be considered beneficial. Storage locations for both salvaged plants and duff must be identified. Temporary erosion control measures may be required at duff stockpiles.

Figure 35: A loader in the process of salvaging plant material and duff to be stored and used for the re-vegetation work after the Big Creek Slide of March 2000.

Establish weed control measures. Seasonal efforts to control relevant weed species should be identified and prioritized. Section 3.1 (Weed Control) of the guidelines can be followed, as they were formulated to include restoration efforts.

Determine appropriate site restoration strategy. Future site restoration phases are considered and specified in this step. Intensities of re-vegetation efforts will vary at each restoration site. Due to unforgiving environmental factors at some locations, it may be inappropriate (ecologically and/or financially) to implement intensive re-vegetation efforts. At such locations, site management may be limited to erosion control and

weeding. Where more favorable conditions exist, additional phases to establish vegetation would be initiated.

Phase II: Re-vegetation

Re-vegetation efforts are intended to facilitate the recovery of a native habitat. A successful effort (1) creates an environment that is suitable for natural and managed plant succession; (2) employs methods that are the best fit for site conditions and adjacent land use practices; (3) is cost effective; and (4) employs recommended methods and practices to plant pure native seeds and other plant materials.

Figure 36: Re-vegetation efforts at an area disturbed by storm damage and subsequent highway repair.

The re-vegetation phase includes four steps:

Determine re-vegetation approach. The three major approaches to re-vegetation vary by materials required and intensity of site manipulation:

- *Natural succession* utilizes low intensity re-vegetation methods and relies primarily on existing on-site amenities without importation of soil or seeds.
- *Managed succession*[4] relies on the introduction of pioneer species to develop site conditions that are conducive to the eventual establishment of climax species.
- *Accelerated climax community development*[5] is employed when the objective is to restore a site to a desirable climax (or near climax) native plant community, in a reduced timeframe. Accelerated climax community development is generally more expensive than managed succession because it involves more intensive plant propagation, planting and irrigation work.

[4] *Roadside Manual*- Washington State Department of Transportation
[5] *Roadside Manual*- Washington State Department of Transportation

Collect seed and cuttings. Seeds and cuttings are collected at restoration sites or adjacent undisturbed areas in order to identify appropriate species compositions for the desired plant community. Site-specific evaluations of both flora and fauna must be conducted to assure appropriate plant and seed selection. The corridor-level vegetation mapping and recommendations from the Vegetation Establishment and Management Study (VEMS)[6] serves as a reference document that may be consulted for guidance, especially for suitable slope exposures for different plant species.

Seeds and seed mixes should be selected based on purity, adaptability, performance and suitability for sustaining site-specific succession[7]. Frequently the site and soil conditions that require re-vegetation species differ considerably from those that existed prior to disturbance. Therefore, locally occurring plant material best adapted to perform at the site will be chosen. The following characteristics will be considered in selecting plants for restoration sites:

- Water, light and nutrient requirements
- Plant spacing requirements
- Physiological characteristics
- Response to competition
- Response to management techniques

When a higher level of re-vegetation is appropriate, such as accelerated climax community development, native seed will be collected from areas adjacent to the site to the extent feasible. Whether these seeds are used to propagate seedling plants or are applied as seeds, the Wildland Certification program run by the California Crop Improvement Association will be consulted to verify the source and purity of the seed.

Determine appropriate soil enhancement techniques. If determined appropriate for an individual site, soil enhancement techniques will be implemented. The import of topsoil is discouraged and will occur only if there are no other reasonable options. Soil development methods will be based on their suitability to the site habitat and the composition of adjoining plant communities. Suggested soil development methods include incorporation of soil amendments or legumes. Organic matter (compost) to improve soil structure, organic compounds such as humates and mycorrhiza to improve plant nutrient uptake, and gypsum, sulfur, iron and other amendments to correct soil chemistry, can all be used to enhance and develop soils. Legumes are plants that fix nitrogen in the soil, improve permeability, and provide cover on sites typically devoid of vegetation in order to increase nutrient availability at disturbed sites. The use of legumes is a practical and less time consuming method for harsh sites that equipment cannot access, or for sites where soil amendments alone cannot adhere to steep slope faces. A list of appropriate nitrogen fixing species, along with their application rates, can be found in Appendix C.

[6] *VEMS- Department of Transportation District-Level Guides to Plant Specifications for Erosion Control*
[7] *Chapter 3: Erosion Control and Re-vegetation Methodology-* WSI Report

Prepare site and plant. The intensity of efforts to establish plants on disturbed sites is determined by the re-vegetation approach that has been selected. The following options may be considered:

- Use of stored material from the site where pre-construction conditions allowed for duff and topsoil collection
- Use of native pioneer species in order to assist soil improvement and control surface erosion
- Installation of temporary (surface drip) irrigation systems at more intensively managed sites

Phase III: Site Maintenance

Successful site restoration requires a level of ongoing maintenance that varies with the selected approach. Site maintenance needs to correspond to the particular re-vegetation approach. The basic strategy of most maintenance programs is to manage against an invasion of weeds while desirable plants become established at the site. The important elements of maintenance are plant establishment, an effective weed control program, and ongoing site monitoring and reporting.

Establish plants. This step is critical to plant health. Plant establishment techniques such as proper irrigation, pruning, fertilizing, weed control, and plant replacement to encourage establishment of native plants are important in supporting restoration success.

Figure 36: A successful re-vegetation site near Big Creek, supporting the establishment of native plants through natural succession with no imported materials, seed or irrigation.

Control weeds. The reestablishment of native species is dependent on a weed control program that limits competition from invasive exotic species. Effective weed control has been identified as the key to the success of re-vegetation plantings as well as the reintroduction of species from adjacent native plant populations. To design a program that will eradicate undesirable plant species on a site certain parameters must be determined beforehand: (1) the primary target species, (2) the perimeter of the weed control area and (3) the level of weed control required. Timing and continuity of weed control measures are also critical to successful eradication.

Various weed control methods will be utilized at restoration sites depending on the target species, site conditions, adjacent land use practices and other factors. Recommended

Best Practices for controlling each of the four primary threat weeds and eight secondary threat species in the coastal corridor are identified in Section 5.2. If the use of herbicides is proposed, a recommendation from a licensed Pest Control Advisor will be required.

Finally, the equipment used to remove exotic plants can become an agent for their spread into new areas. In order to prevent this, it is important to clean all equipment of seeds and stem sections before the equipment is removed from infested areas.

Monitor This is an on-going process of observation and documentation. Monitoring is required to report the development and results of restoration, identify problems experienced at each restoration site, and provide ongoing recommendations for corrective measures needed to meet site restoration goals. The re-vegetation goal-achievement timeline developed in Phase I will be a key tool for monitoring and reporting progress and determining whether restoration efforts need to be continued in certain areas.

Reports from monitoring activities should be completed on a regular basis depending on the goals set for each restoration site, site sensitivity, and the phase of activity. For example, reporting may be more frequent during periods of high activity, decreasing during plant establishment and maintenance stages. The reports, which will be kept on file at the Department's District 5 offices, will be made available to stakeholders and the public.

6.2 Implementation Strategies

Successful site restoration will depend on adequate resources and support for implementation. In some cases, special expertise may be needed in addition to environmental monitors. Local expertise should also be enlisted as part of the implementation.

Monitoring and caring for new plantings throughout the establishment period is critical to the success of re-vegetation projects. The nature of work at some restoration locations may require a more focused effort than typically provided by construction, maintenance or storm damage repair contracts. The intent of the following descriptions of post-project and extra-project services and the role of an environmental monitor is to provide a platform from which to launch further evaluation and discussion of the creative funding, contracting, or staffing that will be necessary for the implementation of these guidelines.

Maintenance work at restoration sites may extend over several years to ensure the success of managed succession and accelerated climax development approaches. Services will also be required to provide for the ongoing care and maintenance of restoration sites. Such services include watering, weeding and replacement planting. On-going off-site services are required as well: the annual native seed collection to provide a viable native plant seed bank and plant propagation at an accessible nursery.

An environmental monitor would act as a liaison to the interdisciplinary team including Construction, Maintenance, Environmental Planning, Geotechnical and Landscape Architecture, and serve as the contact in external communication with the various permitting agencies. The monitor would be engaged in all stages of the project. Pre-project responsibilities of the environmental monitor would include assisting in the delineation of Environmentally Sensitive Areas, communicating information about permit

compliance, and serving as an advisor to the Resident Engineer. During construction the monitor will ensure that there are no discrepancies between environmental plans, restoration management goals and on-ground activities; make defensible decisions in the field; and serve as an advisor to the Resident Engineer. After the project is complete, the monitor will continue to oversee plant establishment at re-vegetation sites, monitoring, and reporting.

Consistent with objectives for collaborative planning, local expertise will be enlisted as an important resource for effective site restoration. The Department may request that the local chapter of the California Native Plant Society (CNPS) designate a representative.

6.3 The Role of GIS

A key requirement for all site restoration work is the availability of adequate and appropriate mapping resources. The linking of database resources with mapping capabilities that is offered by a geographic information system (GIS) can support site restoration work on the Big Sur Coast. GIS mapping technology has the potential to support all three phases of the site restoration program outlined above and to make a major contribution to implementing the program as well. At the site-specific level, GIS can be a powerful aid in developing and recording baseline data, understanding the potential and options for restoration at specific sites, and monitoring the results of a re-vegetation program. At the larger program level, GIS can assist in prioritizing sites for restoration and evaluating program success. All project mapping, should be annotated to show Environmentally Sensitive Areas.

7.0 Future Actions

The following recommendations should be pursued to further the objectives for vegetation management in the corridor:

- Effective weed control throughout the corridor requires a highly coordinated approach for success. The Department will continue to participate in the efforts led by the Big Sur Weed Task Force toward this end.

- Locations along the corridor in need of remedial site restoration should be carefully evaluated and work initiated to determine suitable approaches for individual site conditions.

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APPENDIX A - GLOSSARY

Accelerated Climax Community Development: re-vegetation approach that restores a site to a desirable climax (or near climax) native plant community, in a reduced time from what natural processes would take; this is generally more expensive than managed succession because it often involves more intensive plant propagation, planting and irrigation work

Certified Seed: source specific seed that has been tested for purity and germination rates

Chemical Control: application of herbicidal chemicals that either prevent the growth of or destroy existing plants

Climax Species: plant species representative of the adjacent plant community that indicate relatively stable site conditions and the restoration of native habitat

Control: the eradication, prevention or suppression of weeds

Duff: topsoil, leaf litter and surface organic matter that can help re-establish horticulturally suitable soils for re-vegetation efforts

Eradication: a control measure that completely eliminates a weed from a designated area

Environmentally Sensitive Areas (ESAs): areas identified as containing sensitive biological, historic, visual or cultural resources

Headwall: a type of inlet structure on a culvert that consists of a rigid vertical wall, usually of concrete or, if dating back to original construction in the 1920's and 1930's, rock masonry construction; headwalls provide a critical function for aiding smooth flow of water through the pipe

Managed Succession: re-vegetation approach that manipulates the introduction of pioneer species to develop site conditions that are conducive to eventual climax species establishment

Manual Control: removal and prevention of undesirable plants by activities such as weed pulling (by hand or with tools) or mulching; this can include the use of hoes, pruning shears and power operated hand tools such as chainsaws and string trimmers

Mechanical Control: techniques to remove the above ground portions of weeds such as mowing, brush cutting and weed cutting

Mowing: cutting brush and grasses mechanically. Typical equipment is a mower equipped with a rotary blade or chain flail mechanism, including mowers with articulating arms that can reach slopes.

Natural Succession Promotion: re-vegetation approach that utilizes low intensity methods that encourage natural succession and rely primarily on working with existing

on-site amenities with no soil or seed importation; may allow the temporary establishment of non-native, non-invasive weedy species in order to encourage site stability while native species begin to emerge and reestablish themselves

Parapet: a low rock (or rubble) masonry wall; along the Big Sur Coast, there are three styles of parapet walls and usually on top of rubble masonry retaining walls that were built with locally available materials during the original highway construction in the 1920's and 1930's

Pioneer Species: fast growing plants including grasses, forbs, perennials and legumes that control erosion and help set the stage for larger woody native plant encroachment

Plant Salvage: Collection, maintenance and transplanting of desirable plant species prior to construction activities

Post-Emergent Herbicides: chemicals to control weeds that are applied on established or actively growing plants; may include contact and systemic herbicides

Prevention: a control measure that stops weeds from becoming established in non-infested areas

Seedling: a woody perennial plant with less than a 4" diameter of at breast height (dbh)

***Sensitive Species*:**

Wildlife: species listed as threatened or endangered under the federal Endangered Species Act and California Endangered Species Act; those identified as a species of concern and protected by the California Department of Fish and Game

Plants: species listed as threatened or endangered under the federal Endangered Species Act and the California Endangered Species Act; species considered by California Native Plant Society to be rare, threatened or endangered in California and elsewhere

Suppression: a control measure that severely reduces weed populations to below non-economic or environmentally acceptable levels and stops or significantly reduces its spread

Tillage: agriculturally developed land. Typical equipment used is a tractor with tow-behind devices such as diskers and rippers.

Tree: a woody perennial plant with a dbh 4" or greater

Weed: any undesirable, invasive species found in, but not native to a particular area; also referred to as an exotic species

APPENDIX B – EXECUTIVE ORDER 13112

February 3, 1999

Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. *Definitions*

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, non-governmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Section 2. *Federal Agency Duties*

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (1) identify such actions;(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has pre-scribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Section 3. *Invasive Species Council*

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from sub-cabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Section 4. Duties of the Invasive Species Council

The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency

Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources,

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species,

(c) develop recommendations for international cooperation in addressing invasive species,

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species,

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health,

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education, and

(g) prepare and issue a National Invasive Species Management Plan as set forth in section 5 of this order.

Section 5. *Invasive Species Management Plan*

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying path-ways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk hat introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional

levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Section 6. *Judicial Review and Administration*

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs. (d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

/S/
William J. Clinton

THE WHITE HOUSE,
February 3, 1999
[FR Doc. 99-3184]

APPENDIX C – NITROGEN-FIXING SPECIES

NITROGEN FIXING SPECIES LIST AND RATES[8]			
SCIENTIFIC NAME	**COMMON NAME**	**APPLICATION RATE**	**APPLICATION**
*Lupinus albifrons**	Silver bush lupine	8-10 pounds/acre	Perennial, upright large stature grows in disturbed places associated with coast sage scrub. Used for re-vegetation on harsh sites and loose soil and fill sites.
*Lupinus arboreus**	Tree lupine	8-10 pounds/acre	Perennial, large stature grows in disturbed places associated with coast sage scrub. Used for re-vegetation on harsh sites and loose soil and fill sites.
Lupinus nanus	Sky lupine	4-6 pounds/acre	Annual, fast growing, diminutive flowering plant. Re-vegetation of roadside berms, cut and fill slopes.
Trifolium wildenovii	Tomcat clover	2-3 pounds/acre	Annual, fast growing. Re-vegetation of roadside berms, cut and fill slopes. Performs well on poor soil sites.
Trifolium gracillentum	Pinpoint clover	2-3 pounds/acre	Annual, fast growing. Re-vegetation of roadside berms, cut and fill slopes. Performs well on poor soil sites.
Lotus strigosus	Bishops lotus	2-3 pounds/acre	Short-lived annual. Grows well on disturbed cut slope locations and poor soils.
Lotus purshianus	Spanish clover	4-5 pounds/acre	Short-lived annual. Grows well on disturbed cut slope locations and poor soils in wooded locations.
Lotus benthamii	Bentham's lotus	4-5 pounds/acre	Perennial, low growing. Grows well on cut slopes and roadside berms.

*The use of these species should be exercised with caution. While they are successful as nitrogen fixing species, these large fast-growing lupines, if not properly managed, can crowd out smaller, more slow-growing plants that are also important for re-vegetation.

[8] *Chapter 3: Erosion Control and Re-vegetation Methodology, Table 3.6.* Amended by Department of Transportation March 2003- WSI Report

APPENDIX D – EROSION CONTROL STANDARDS

EROSION CONTROL STANDARDS[9]	
CLASSIFICATION	**SUGGESTED REMEDIATION**
Class 1: No soil loss or erosion; topsoil layer intact; well dispersed accumulation of litter from past year's growth plus smaller amounts of older litter	No action required
Class 2: Soil movement slight and difficult to recognize; small deposits of soil in form of fans or cones at end of small gullies or fills, or as accumulations at back of plant crowns or behind litter; litter not well dispersed or no accumulation from past year's growth obvious	-Re-seed (as per temporary erosion control or specific habitat) -Apply loose straw and/or "flakes" as needed, only to gullies and/or accumulation -Control or divert source of erosion
Class 3: Soil movement or loss more noticeable; topsoil evident, with some plants on pedestals or in hummocks; rill marks evident; poorly dispersed litter and bare spots not protected by litter	-Re-establish and compact surface grade in eroded areas -Re-seed (as per temporary erosion control or specific habitat) -Apply loose straw and/or "flakes" as needed -Control or divert source of erosion -Install straw wattles and/or silt fences
Class 4: Soil movement and loss readily recognizable; topsoil remnants with vertical sides and exposed plant roots; roots frequently exposed; litter in relatively small amounts and washed into erosion protected patches	-Re-apply and compact soil -Re-establish surface grade in eroded areas -Re-seed (as per temporary erosion control or specific habitat) -Apply loose straw and/or "flakes" as needed -Control or divert source of erosion -Install straw wattles and/or silt fence
Class 5: Advanced erosion; active gullies with steep sidewalls; well-developed erosion pavement on gravelly soils; litter mostly washed away	-Re-apply and compact soil -Re-establish surface grade in eroded areas -Haul in and place fill materials/rock -Apply loose straw and/or "flakes" as needed -Re-seed or re-vegetate -Control or divert source of erosion -Install straw wattles and/or silt fence

[9] *Chapter 3: Erosion Control and Re-vegetation Methodology, Table 3.3.* Amended by Department of Transportation March 2003- WSI Report

APPENDIX E – NPDES PROGRAM

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PROGRAM

On July 15, 1999, the State Water Resource Control Board (SWRCB) issued the "National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDR's) for the State of California, Department of Transportation (the Department)""(Order No. 99-06-DWQ, NPDES No. CA000003). The NPDES Permit regulates storm water discharges from the Department's properties, facilities and activities, and requires the Department's Construction program to comply with the requirements of the NPDES General Permit (Order No. 99-08-DWQ, NPDES No. CAS000002) issued by the SWRCB, to regulate discharges from construction sites that disturb 5 acres (ac) or more (in March 2003, the acreage threshold decreases to 1 acre). The NPDES Permit required the Department to develop and implement a Storm Water Management Plan (SWMP) (approved May 2001) that describes a program to reduce the discharge of pollutants associated with the storm water drainage systems that serve highways and highway related properties, facilities and activities.

The NPDES Permit does not prescribe numerical effluent limits for the Department's storm water discharges. Instead it requires the Department to implement Best Management Practices (BMPs) to reduce pollutants to the Maximum Extent Practicable (MEP) for industrial activities and the employ BMPs that meet the Best Conventional Technology (BCT)/Best Available Technology (BAT) criteria for regulated construction activities. Additionally, if it is determined that the Department's discharges are causing or contributing to an exceedance of an applicable water quality standard the Department will implement control measures to reduce pollutants in accordance with the SWMP and the NPDES Permit. The Department has identified three categories of BMPs for use:

- Category I BMPs- Technology-based pollution prevention controls to meet the MEP requirements for designing and maintaining roadways and related facilities

  Group A Maintenance BMPs: Applicable to all maintenance operations (i.e., litter pickup, street sweeping, etc.)

  Group B Design Pollution Prevention BMPs: Applicable to the design of new facilities or major renovations of existing facilities (i.e. permanent soil stabilization, ditch channel lining systems, etc.)

- Category II BMPs- Controls to meet BCT/BAT requirements on regulated construction sites

- Category III BMPs- Treatment BMPs to meet MEP requirements

The General Construction Permit requires the Department to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) for all construction activities that will disturb five acres or more of soil (1 acre as of March 2003). The SWPPP must address and evaluate the minimum required BMPs specified in the SWMP and the General Construction Permit. BMPs are implemented as determined appropriate during construction to reduce or eliminate the potential for a non-storm water discharge to occur to a surface body of water or the storm drainage system. For projects that do not meet the acreage criteria for a SWPPP designation, the Department requires the development and implementation of a Water Pollution Control Program (WPCP). The WPCP evaluates and identifies BMPs necessary to protect water quality during construction activities.

The Department's NPDES Permit and SWMP require the Maintenance Division to incorporate storm water quality management into its maintenance activities. The Department has developed guidelines that address the implementation of storm water BMPs during highway maintenance

activities and activities conducted at maintenance facilities. BMPs are implemented during activities to reduce the potential for a non-storm water discharge to surface bodies of water or to the storm drainage system to the MEP requirements prescribed by the Department's NPDES Permit and SWMP.

All vegetation control activities are conducted in compliance with the requirements of the Department's Vegetation Control Program. Activities conducted under the Vegetation Control Program include chemical weed control, mechanical weed control, tree and shrub pruning and tree and shrub removal. Each District is required to develop a vegetation management plan. The plan is developed to address the Department's need to eradicate noxious and invasive weeds and maintain fire control strips. The main components of the vegetative management plan include: 1. Enhance the use of appropriate native vegetation. 2. Apply herbicides in a manner that minimizes or eliminates the discharge of herbicides to receiving waters. 3. Restrict the application of nutrients to rates necessary to establish and maintain vegetation without causing significant runoff to surface waters.

APPENDIX F - MAINTENANCE MANUAL EXCERPTS

EXCERPTS FROM: *CALTRANS MAINTENANCE MANUAL*, CHAPTER C2 VEGETATION CONTROL

C2.04 Caltrans Vegetation Control Considerations

Caltrans vegetation control policy encourages the growth of native vegetation along highway roadsides. Safety, aesthetics, and compatibility with adjacent land use are the prime consideration in the proper maintenance of vegetation.

Native vegetation and trees on roadsides should be allowed to remain if they are compatible with the surrounding environment, safe highway use, and aesthetics. Vegetation helps to reduce driver fatigue, improves storm water quality by controlling erosion, and assists in maintaining slope stability.

Vegetation should be controlled where necessary for fire prevention, safety, and reduction of noxious weeds. Removal of vegetation is generally restricted to narrow band adjacent to shoulder edges and that necessary to provide sight distance and protection of highway appurtenances such as guardrails and signs. Integrated vegetation Management control alternatives should be considered on a site-specific basis.

It is desirable to retain native vegetation and trees on roadsides compatible with the surrounding environment for highway safety, aesthetics, erosion, and dust control. Vegetation helps to reduce driver fatigue, improves storm water quality; helps control erosion and maintain slope stability and enhances aesthetics.

Districts are restricted to the use of herbicides approved by the EIR. New herbicides may be added to that list only after conforming to the same risk assessment procedures and other considerations for herbicides approved by the original EIR. The maintenance Program maintains a list of approved products.

Roadsides should be managed on a site-specific basis. This method provides the flexibility to adequately adjust treatments to the wide variety of roadside conditions.

The Maintenance Manual states that herbicides can only be used when authorized by a Pesticide Use Recommendation prepared by a licensed Pesticide Control Advisor (PCA). Field work must be supervised by the holder of a Qualified Applicator's Certificate (QAC). These requirements are for work performed either by the Department's forces or by contract. The Maintenance Manual serves as a reference document to be consulted for all pesticide activity.

The 1998 Maintenance Manual, in Vegetation Control Section C2 (excerpted in Appendix F), recommends that management unit decisions should identify the minimum vegetation control necessary to ensure adequate safety and system preservation. Decisions should take future needs into consideration, as well as addressing short-term needs.

APPENDIX G – DEIR EXCERPTS

EXCERPTS FROM: *Draft Environmental Impact Report on Caltrans' Vegetation Control Program*

Available vegetation control methods

Two vegetation control methods are currently in major use along California state highways: broadcast herbicide application and mowing and manual cutting. The purpose of these treatments is most frequently to maintain a clear strip along the road shoulder. Herbicides are also widely used for spot applications to the bases of safety hardware (guardrails and signs) and landscape trees and shrubs. Both types of periodic herbicide applications are aimed at maintaining bare soil conditions.

Another vegetation control methods of potential use for California highways relies on displacing problem vegetation with preferred vegetation, while using herbicides and mowing on a nonperiodic basis for suppression of undesirable species or for growth control. This approach would require local experimentation to find suitable species for sites now kept free of vegetation.

Other methods of potential use include mulching with chips from cut vegetation, grazing goats or other animals, spot destruction of plants by heat from steam or flamethrowers, broadcast burning, introducing plant pathogens and insect predators to control specific exotic species, and, in a few situations, periodic disking and grading.

Significant Impacts of the Alternative Program and mitigation measures

All the vegetation control program alternatives could entail significant environmental impacts. Some potential health and ecosystem risks are significant for programs entailing use of chemicals, while safety risks to Caltrans personnel are significant for programs emphasizing mechanical and manual control methods. With one exception, however, all of the significant potential impacts can be avoided or adequately minimized by use of Caltrans' current protection measures or by adopting mitigation measures identified in this report. Mitigation measures for potential adverse health and ecosystem effects of certain chemicals include limiting their use when certain human activities or environmental conditions are present.

The increased traffic hazard to vegetation control workers under the no-chemical program alternative cannot be avoided or fully mitigated. This alternative would involve Caltrans personnel working in closed lanes on the roadway to remove vegetation manually from pavement cracks, joints, and edges.

A summary comparison of the effects of the alternatives appears in Table S-1. Many potential adverse effects described in Table S-1 would be avoided or effectively mitigated by Caltrans' existing protection measures. Remaining potential effects are considered significant impacts of some or all of the proposed program alternatives. These significant impacts, the alternatives under which they would occur, and the mitigation measures that are available to mitigate them, are summarized in Table S-2.

Both current protection measures and available mitigation measures are more fully described in Chapter 7 under "Mitigation Measures for Program Implementation".

Issues to be resolved

The major issue to be resolved is the choice of program from the program alternatives described above. This choice will be based on the findings contained in this report, public and public agency comments and recommendations, and cost and liability assessments developed by Caltrans

engineering and legal staff. The chief of the division of maintenance will determine which program to adopt.

The other issue to be resolved is Caltrans' choice of mitigation measures from those described in Chapter 7 of this document for potentially significant adverse effects or other effects of the selected program. In addition to the measures for mitigating potentially significant impacts summarized in Table S-2, the following measures are available to reduce the uncertainty about possible impacts of chemical methods that were not indicated by the risk assessment:

- limiting application rates of chemicals used in combination that may act synergistically;
- determining inert ingredients in all herbicide formulations and subjecting them to Caltrans' risk assessment if they are found to be of toxicological concern;
- requiring further evaluation of the dermal absorption rate and chronic toxicity threshold level for diuron and, if warranted by further risk assessment, limiting its use;
- through urinary excretion studies, verifying the efficacy of Caltrans protection measures in reducing worker exposures as assumed in the risk assessment and, if warranted, modifying the protection measures;
- monitoring exposure of Caltrans workers to highway pollutants and, if warranted, modifying exposures; and
- establishing chemical spray exclusion zones around school bus stops and other sensitive areas of concentrated human use, if requested by county agricultural commissioners.

Adoption of some or all of the mitigation measures described in Chapter 7 will depend on a determination of feasibility of Caltrans. If any measure directed at mitigating a significant impact is determined to be infeasible, formal findings to that effect will be prepared and a statement of overriding considerations made.

CHAPTER 2. PROJECT OBJECTIVES

The objective of Caltrans' vegetation control program is safe highway travel and the protection of natural resources, human lives, and property along and in the vicinity of the state highway system.

Program Need: Need for Vegetation Control on Caltrans' Right-of-Way

Caltrans controls vegetation to:

- protect roadbed integrity;
- preserve visibility of traffic, highway facilities, and wildlife;
- maintain designed vehicle recovery areas;
- promote road system drainage;
- minimize soil erosion and slope instability;
- inhibit ignition and spread of fire;
- control noxious weeds;
- eliminate damaged vegetation that my fall or spread plant diseases;
- maintain an attractive roadside appearance; and protect landscape plantings.

More than one vegetation control need may apply to a given area. While these needs are applicable throughout the state, climate, soils, land use, and other regional factors determine the types and amounts of vegetation control needed in a particular geographic area.

Visibility

Unobstructed views of road edges, traffic, safety hardware, and wildlife crossing roadways are essential to highway safety.

Road Edge. Road edge visibility is critical for motorists pulling off pavement. Motorists must be able to determine the pavement boundary and its condition to avoid hazards. The ability to see raised gores is also important; vegetation can impair such visibility and potentially lead to accidents or vehicle damage.

Traffic. Line-of-sight visibility is particularly important along both horizontal and vertical curves, where motorists must be able to see other vehicles traveling on the highway, and at highway intersections and entrances where motorist must be able to see vehicles crossing or entering the highway.

Safety Hardware. The ability to see reflectors, guardrails, and other safety hardware is important, particularly for motorists pulling off pavement. Directional and informational signs must also be visible to motorists. Highway maintenance workers must be able to inspect signs and safety hardware. Plant growth over safety hardware makes inspections and maintenance more difficult and time consuming. Eventually, vegetation must be cleared for painting, repair, and other maintenance activities.

Wildlife. Movements of larger animals, such as deer, pose a threat to motorists. Collisions can cause damage to vehicles, but sudden, evasive actions by drivers can lead to other accidents. In areas where road crossing by larger wildlife is frequent, visibility through vegetated areas beyond road shoulders is needed.

Control of Erosion

Vegetation plays a minor role in protecting soils from erosion. Soil erosion along roadways not only causes stream sedimentation and risks for aquatic ecosystems, it can result in deposition of sediment on the highway surface and adjoining lands or clogging of drainage facilities. Extreme erosion can induce instability in cutbacks and fills, raising the risk of slope failure during wet periods. Maintaining soil cover is especially important when overstory vegetation is removed to satisfy other described needs.

Control of Noxious Weeds

Noxious weeds are plants specified by the California Agricultural Code or declared by a county agricultural commissioner to be detrimental to agriculture or to public health, safety, and welfare. Control of designated noxious weeds is required by law and is the responsibility of the landowner on whose land they occur (Food and Agriculture Code, Section 5004). Noxious weeds are discussed in detail in Appendix A.

CHAPTER 3. ENVIRONMENTAL SETTING

Roadside Wildlife

Roadsides provide an environment with distinct features that may encourage the presence or absence of certain wildlife species in relation to surrounding areas. Salt used for ice control is attractive to mammals. Water ponded in drainage facilities is attractive to a wide variety of species, including amphibians such as salamanders. Roadside vegetation control favors low growing forbs and grasses that are attractive to ground-feeding birds, such as horned larks and dark-eyed juncos, and to California voles and California ground squirrels. The ROW habitat may also attract snakes and raptors because of the presence of small mammals. Vehicle travel may discourage the presence of certain species, however, such as deer. (Adams and Geis 1981.)

ROW fences provide perches for red-winged blackbirds, mourning doves, and western meadowlarks. Red-winged blackbirds are also attracted to marshy drainage areas. An increase in Brewers' blackbirds along highways has been attributed to their feeding on insects killed by cars. (Adams and Geis 1981.)

Chapter 4. Available Methods for Vegetation Control

DESCRIPTION OF AVAILABLE METHODS

Chemical Methods

Factors Determining Selectivity of Chemical Methods

Herbicides are manufactured in hundreds of different formulations and can be applied in many different ways. Four primary factors determine the types of plant species or plant lifeforms that will be killed or retarded by herbicides: chemical selectivity, application rate, plant growth stage at time of application, and application technique.

Chemical Selectivity. Each chemical has a distinct mode of action in plants, such as inhibiting photosynthesis or disruption meristementic growth. Because of physiological differences in plants, herbicides vary in the kinds of plants they affect; some only affect grasses and some only broadleaved forbs, whereas others, called "nonselective' will kill all types of plants when used at sufficiently high application rates.

In addition, some chemicals used by vegetation managers are growth regulators that do not kill vegetation but slow its rate of growth. Growth regulators are used on trufgrasses, groundcovers, shrubs, and trees to reduce height growth. Growth regulators are used on turfgrasses, groundcovers, shrubs, and trees to reduce height growth and the need for mowing and pruning. Application of plant growth regulators must occur at the proper time of year for the species treated.

Of 39 states responding to a Transportation Research Board survey question, 21 states reported that they used growth regulators (Transportation Research Board 1988). The Pennsylvania Department of Transportation (PennDOT) combines selective herbicides to control broadleaf forbs and growth regulators to reduce mowing frequency, in tank mixes applied to grasses ("Penn DOT" 1990). The Washington DOT applies growth regulators in October, April, and June to areas where mowing would normally be required three to five times per year. Mowing is performed 3-5 days after the October or April application to clean up dead material and provide a uniform height. Total height growth is approximately one-third of normal (Rydell and Wilson 1985). The Oregon

State Highway Division has found that growth regulators are particularly useful in small inaccessible areas that would other wise require frequent mowing.

In areas where no vegetation is desired, such as pavement cracks, a herbicide that controls a broad spectrum of vegetation is desirable. In clear strips, at safety hardware bases, and in drainage ditches, selective or nonselective herbicides are used, depending on whether many or few incompatible plant species need to be controlled by a particular treatment. For example, if desirable grasses exist in a treatment area, a selective herbicide that controls only broadleaf plants is used. If no vegetation is desired, nonselective herbicide is applied. Furthermore, if no vegetation is desired but only one or several species are present, a herbicide selective for those species is used.

In other ROW treatment areas where some vegetation is desirable, selective herbicides are used to control undesirable species, such as vegetation competing with landscape plantings, but do damage the preferred plants.

Application Rate. Herbicides vary in their effects, depending on the application rate used. Labels of registered herbicides specify application rates that maximize plant mortality under a broad range of conditions, while avoiding environmental or human health hazards. Lower application rates are often adequate to kill target species in specific sites or specific types of environments (McDiarmid pers. Comm./ Kuennen 1986). When low application rates are used, applications must be more precise and application equipment must be capable of applying exact amounts of herbicides (Kuennen 1986).

Spot Chemical Techniques. Spot chemical techniques consist of various ways to apply herbicides manually to individual plants or to small clumps of plants. These techniques afford a high degree or treatment selectivity because only specific plants are killed. Surrounding vegetation, for example low-growing vegetation on ROW sight lines, is not damaged and can be retained to maintain dense cover to prevent establishment of unwanted plants, such as tall-growing trees.

Spot chemical techniques are limited by the same factors that constrain manual techniques because both require worker access to individual plants being treated. A high density of unwanted plants and steep topography would lower the efficiency of spot chemical techniques and increase worker hazards. Spot treatments are most efficient when target plants are low in density and foot access to the site is not hazardous or difficult.

Spot chemical applications on highway ROWs use the following application equipment and techniques:

- hand gun or wand attached to truck-mounted herbicide tank and pumping system
- powered or nonpowered backpack and hand-held compressed-air sprayers
- granular herbicides applied to bases of undesired vegetation
- wick or roller-wiper application
- treatment of stumps of trees and large shrubs
- stem injection

ATTACHMENT 1: Corridor Map

Corridor Map

Guidelines for Vegetation Management

Attachment 1