2.26 CALIFORNIA SCRUB OAK

Species: California Scrub Oak (*Quercus berberidifolia*)
Federal Status: None
State Status: Mandatory CEQA Analysis
CNPS Status: None
Science Advisors Group: None
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: No

CONSERVATION GOAL

1. Protect and manage California scrub oak-dominated chaparral and coastal sage scrub vegetation communities to maximize the likelihood of their physiographic representation in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects adequate amounts and physiographic representations of California scrub oak-dominated chaparral and coastal sage scrub.
2. Formulate a HRMP to provide for long-term protection and management of the California scrub oak-dominated chaparral and coastal sage scrub vegetation communities.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for California scrub oak focuses on conservation at the landscape, vegetation community level.

Subarea 1 Impacts

The proposed Covered Activities would result in impacts to 284 acres (10 percent) of California scrub oak vegetation communities (*Figure 204-M*), all of which are scrub oak chaparral. Of these impacts, 281 acres are in the RMV PAs and three acres are impacted as a result of infrastructure construction, operation, and maintenance/repair.

Temporary impacts would occur to about 2 acres of scrub oak chaparral.

Subarea 1 Conservation

A total of 2,233 acres (80 percent) of scrub oak chaparral and scrub oak-sagebrush combined would be conserved in the Habitat Reserve (*Figure 204-M*). An additional 265 acres are in Subarea a SOS on NAS Starr Ranch, for a combined conservation of 2,498 acres (90 percent).

The largest areas of contiguous scrub oak chaparral in the eastern portion of Subarea 1 in Caspers Wilderness Park and on RMV lands would be in the Habitat Reserve (*Figure 204-M*).

ADAPTIVE MANAGEMENT PROGRAM

Stressors

The stressors for California scrub oak are the same as those identified in *Part I, Chapter 7* for chaparral and coastal sage scrub. The main environmental stressor identified for chaparral and coastal sage scrub is fire, although over-grazing, exotic species and drought are also identified, but considered less significant stressors.

Goals and Objectives

The overall goal is to protect and manage California scrub oak-dominated chaparral and coastal sage scrub vegetation communities to maintain their physiographic representation in the Habitat Reserve.

Part I, Chapter 7 identifies several adaptive objectives for chaparral and coastal sage scrub, as briefly summarized here.

Objective 1: Maintain the physiographic diversity of chaparral and coastal sage scrub in the Habitat Reserve.

Objective 2: Restore and enhance degraded chaparral and coastal sage scrub in the Habitat Reserve to maintain net habitat value.

Objective 3: Conduct monitoring of chaparral and coastal sage scrub to track long-term habitat value.

Objective 4: Manage fire regimes such that a natural diversity of age stands and resprouters/obligate seeders is maintained throughout the Habitat Reserve and prevent type conversion to annual grassland.

Objective 5: Control exotic invasions of chaparral and coastal sage scrub, especially along the urban-Habitat Reserve interface, and along roads and utility corridors.

Regional and Subregional Management Information Needs

- Fire effects on scrub-oak dominated chaparral and coastal sage scrub communities.

- Non-native species impacts on scrub-oak dominated chaparral and coastal sage scrub communities, such as along paved and dirt roads and utility easements.

Level of Management and Monitoring Priority - Low

The Habitat Reserve includes 80 percent of the mapped scrub oak-dominated chaparral and sage scrub in the planning area, and combined with scrub oak on Starr Ranch, 90 percent of the scrub oak dominated communities will be in Habitat Reserve and Subarea 1 SOS (see *Figure 204-M*). Virtually all of the scrub oak in the RMV portion of the Habitat Reserve is in the San Mateo Creek Watershed in the Gabino, La Paz and Talega sub-basins, which will not be dedicated to the Habitat Reserve for several years. Most of the scrub oak communities on RMV in the San Juan Creek Watershed are in PAs 3, 4 and 5. Prior to dedication of areas in the San Mateo Watershed to the Habitat Reserve, these areas will be subject to wildland fire management and the Grazing Management Plan. Beyond the potential fire and cattle-related stressors, no significant impacts to the scrub oak communities are anticipated.

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted primarily at a habitat landscape level.

Monitoring Variables

Listed below are suggested habitat-based monitoring variables. The detailed monitoring program for the California scrub oak will be developed by the Reserve Manager and Science Panel.

1. Relative cover of different native plant species
2. Proportion of exotic plant species/native plant species
3. Fire history and stand age.

Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

At this time no specific management actions for California scrub oak have been identified. Fire management intended to maintain a natural diversity of age-stands of chaparral and coastal sage scrub will benefit California scrub oak. The timed rotational grazing regime of the coordinated GMP will also help protect California scrub oak. Through the monitoring program, specific management actions may be identified in the future, including, but not limited to:

- Controls on exotic invasive species, especially in vulnerable areas such as existing and planned paved roads, dirt roads and utility easements; and

- Site-specific habitat restoration in degraded areas triggered by natural or human-induced events (*e.g.*, frequent fires).

These actions will be at the discretion of the Reserve Manager and Science Panel.

Potential Target Studies

No Habitat Reserve-specific potential target studies of California scrub oak have been identified at this time. However, the Reserve Manager and Science Panel may recommend target studies in the future based on a demonstrated stressor (*e.g.*, frequent fire).

SPECIES ACCOUNT

Rangewide and Regional Status

California scrub oak is a fairly common component of chaparral communities in much of western California and south into Baja California, Mexico, and has been referred to as the "default" scrub oak in California (Nixon 2002). It occurs in the following floristic provinces (Hickman 1993): North Coast Ranges from Tehama County south; Sierra Nevada Foothills; Tehachapi Mountains; Central Western California; Southwestern California; and Baja California. California scrub oak is found mostly below 5,000 feet and through much of its range in occurs along the outer coast and in the Transverse and Peninsular ranges of southern California. In Orange and San Diego counties it is absent from the immediate coast, where it is replaced by, or hybridizes with, the rare Nuttall's scrub oak (*Q. dumosa*).

Subregional Status

California scrub oak has been mapped in the study area, including the CNF, in the context of the general chaparral vegetation community, with the subassociations scrub oak chaparral, scrub

oak-sagebrush, and scrub oak-sage scrub where it occurs as a dominant or co-dominant species (Gray and Bramlet 1992). Scrub oak chaparral is dominated by California scrub oak with *Ceanothus* spp., toyon (*Heteromeles arbutifolia*), laural sumac (*Malosma laurina*), *Rhamnus* spp., birch-leaf mountain mahogany (*Cercocarpus beteloides*), and flowering ash (*Fraxinus depetala*). Scrub oak-sage scrub is a mix of scrub oak and coastal sagebrush (*Artemisia californica*) and scrub oak-sage scrub is a mix of scrub oak and coastal sage scrub species other than coastal sagebrush (Gray and Bramlet 1992). The planning area supports 2,834 acres of scrub oak chaparral and 177 acres of scrub oak-sagebrush. The CNF supports 2,602 acres of scrub oak chaparral, 42 acres of scrub oak-sagebrush and 13 acres of scrub oak-sage scrub.

The majority of scrub oak chaparral in the planning area is located in Subarea 1, with 2,612 acres (92 percent), with most occurring on RMV (1,284 acres), followed by Caspers Wilderness Park (982 acres), NAS Starr Ranch (254 acres), Donna O'Neill Land Conservancy (46 acres), O'Neill Regional Park (45 acres), and the Upper Chiquita Conservancy (2 acres) (*Figure 204-M*). The largest patches of scrub oak chaparral in Subarea 1 are located in the Verdugo Canyon and Lucas Canyon sub-basins, just north of the Lucas Canyon sub-basin, and in upper Bell Canyon (*Figure 204-M*).

The 177 acres of scrub oak-sagebrush occurs mostly in Subarea 1 (170 acres); 80 acres in Caspers Wilderness Park, 77 acres in O'Neill Regional Park, 12 acres on NAS Starr Ranch and less than 1 acre on RMV (*Figure 204-M*).

Biological Considerations

California scrub oak is commonly found in chaparral and woodland vegetation on dry slopes, hillsides, foothills, canyons, and mountains on a variety of soils. California scrub oak can establish dense thickets that exclude other understory plants. It also occurs in discrete patches that are interspersed with trees, grasses, and other shrubs. It typically takes a shrub form typically 6 to 15 feet tall, but occasionally is arborescent (tree-like) with multiple trunks.

The taxonomy of scrub oaks is complex because different species appear to hybridize wherever they come into contact (Nixon 2002). Nixon informally classifies California scrub oak as member of the "California scrub white oaks," an apparently closely related set of species that have a similar small lobed leaf form that as a group may have derived from lobe-leaf ancestors (Nixon 2002). Identification of the different California scrub white oaks is based on both morphological differences and habitat. For example, diagnostic morphological features of California scrub oak include "the typical usually 7-8 rayed flat stellate trichomes of the lower leaf surface (in contrast to twisted, erect rayed flat trichomes of *Q. dumosa sensu stricto* and the much larger erect, straight trichomes with fewer rays, found in both varieties of *Q. durata*)…" (Nixon 2002, p. 14). The closely associated, but now very rare, *Q dumosa* (Nuttall's scrub oak),

occurs “only in very restricted habitats in low hills near the coast, often on very loose sandstones or granitics, in association with species often referred to as “soft chaparral,” as opposed to the “hard chaparral” of *Q. berberidifolia* in higher and more interior localities.” (Nixon 2002, p. 13).

2.27 CHAPARRAL BEARGRASS

Species: Chaparral Beargrass (aka Chaparral Nolina) (*Nolina cismontana*)
Federal Status: None
State Status: None
CNDDB Rank: G1S1.1
CNPS Status: List 1B.2
Science Advisors Group: **3**
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: Yes

CONSERVATION GOAL

1. Protect and manage chaparral beargrass in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects five of the six documented locations of the chaparral beargrass

2. Formulate a HRMP to provide for long-term protection and management of chaparral beargrass.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for chaparral beargrass focuses on the known locations in the Subarea in the Talega sub-basin, which are the only known locations in Subarea 1.

Subarea 1 Impacts

The proposed Covered Activities potentially would impact the single location of chaparral beargrass south of the Northrop Grumman facilities (*Figure 178-M*). This location is in the PA 8 development envelope and is assumed to be impacted.

Subarea 1 Conservation

The cluster of five chaparral beargrass locations in the eastern portion of the Talega sub-basin comprising an *important population/key location* would be conserved in the Habitat Reserve (*Figure 178-M*).

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Identified stressors on the chaparral beargrass include conversion of habitat to agriculture, residences, and frequent fire. Of these, the stressor relevant to management of chaparral beargrass in the Habitat Reserve is fire management because the closest proposed development to the chaparral beargrass is PA 8, the outer development envelope of which is more than 2,000 feet west of the beargrass population (*Figure 178-M*). Implementation of the Wildland Fire Management Plan and regular monitoring of the population will address this issue.

Goals and Objectives

The overall goal is to protect and manage chaparral beargrass in the Habitat Reserve.

This goal will be met by the following objectives:

Objective 1: Periodic monitoring of the documented chaparral beargrass population. It is recommended that the population be monitored every three years following initiation of monitoring when the area is dedicated to the Habitat Reserve.

Objective 2: In the event of a fire in the area supporting the chaparral beargrass population, post-fire surveys will be conducted annually for at least five years to determine this species' response to fire.

Objective 3: In the event of a fire in the area supporting the chaparral beargrass population, new fires in this area will be suppressed to the extent feasible.

Regional and Subregional Management Information Needs

Very little information is available for chaparral beargrass from which to base a management program. The USFS identified protection of the species from frequent fire as a management issue, for example, but no scientific information is available on the relationship between the species and fire frequency to support this management approach. General regional and subregional management information needs for this species related to conservation and management include:

- General life history of the species;
- More complete study of the species' taxonomy and relationship to other *Nolina* species such as *N. parryi*.
- Fire effects and management.

Level of Management and Monitoring Priority – Medium

Virtually nothing is known about chaparral beargrass beyond geographic and elevation distribution and edaphic associations (*e.g.*, CNPS 2005; Hess and Dice 1995). For this reason, even though chaparral beargrass is an evergreen shrub that probably has relatively little year-to-year variation, it is recommended that this species be monitored at three-year intervals once the area supporting the population (the Talega sub-basin) has been dedicated to the Habitat Reserve. Annual monitoring for at least five years is recommended in the event of a fire in the area supporting the population to better understand the species' response to fire.

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted primarily at a species-specific level.

Monitoring Variables

Listed below are suggested species-specific monitoring variables for chaparral beargrass. The detailed monitoring program for the chaparral beargrass will be developed by the Reserve Manager and Science Panel.

1. Number, size and health status (*e.g.*, new vegetative growth, flowering) of chaparral beargrass individuals
2. Proportion of exotic plant species/native plant species in the vicinity of chaparral beargrass.
3. Fire history and stand age in area(s) supporting chaparral beargrass.

Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

At this time no specific management actions for chaparral beargrass have been identified because little is known about the species such as its life history and response to stressors. Fire is considered to be significant stressor on this species and post-fire annual monitoring is recommended to determine the species' response. In the absence of fire, the beargrass will be

monitored at three-year intervals. The Reserve Manager and Science Panel will determine what, if any, management actions are required to protect this species.

Potential Target Studies

No Habitat Reserve-specific potential target studies of chaparral beargrass have been identified at this time. However, the Reserve Manager and Science Panel may recommend target studies in the future based on a demonstrated stressor such as fire.

SPECIES ACCOUNT

Rangewide and Regional Status

Chaparral beargrass (aka chaparral nolina and cismontane nolina) is a shrub species of the Liliaceae family that is endemic to cismontane southern California. It occurs in the coastal foothills in xeric coastal sage scrub and chaparral on sandstone and gabbro soils in San Diego, Orange, Riverside and Ventura counties. Some locations in San Diego and Orange counties lie on the boundary with Riverside County, and locations in Ventura County are close to the borders with Los Angeles and Santa Barbara counties, so it would not be surprising for this species to occur in additional areas in those counties as well. The known elevation range of chaparral beargrass is 140 to 1,275 m (460 to 4,180 ft).

The Jepson Manual (Hickman 1993) does not recognize *Nolina cismontana* as a distinct species and mentions it as "undescribed" in the description of *Nolina parryi.* However, based on an examination of "*N. parryi*" specimens from desert and coastal areas Hess and Dice (1995) determined that the desert and coastal specimens differed in certain morphological traits such as leaf number and width, stem length, panicle length and diameter and bracht size. Hess and Dice (1995) proposed the name *Nolina cismontana* for this "undescribed" species to reflect its occurrence west of the mountain ranges. The CNPS and CNDDB have adopted this taxon and designated the species as sensitive.

Chaparral beargrass is a CNPS List 1B species with a Threat Code of "2." List 1B indicates that chaparral beargrass is rare, threatened or endangered throughout its range. Threat Code "2" indicates that the species is fairly endangered in California (20-80 percent of occurrences threatened). It is considered to be threatened by development, agriculture, road construction, and recreational activities (CNPS 2005). Reiser (1994), for example, states that chaparral beargrass is declining in the Pala region from conversion of habitat to agriculture and residences, and in the Santa Ana Mountains from residential development. The USFS identified protection of the species from too-frequent fire as a management issue. Chaparral beargrass has no state or federal status.

Table 2-40 summarizes the known occurrences of chaparral beargrass.

TABLE 2-40
DISTRIBUTION OF CHAPARRAL BEARGRASS IN SOUTHERN CALIFORNIA

County	General Locations
Orange	East of Live Oak Canyon Road; south of Hamilton Truck Trail; several locations along western flank of the Santa Ana Mountains; Hot Springs Canyon/western San Juan Trail; Claymine Canyon; south-facing slopes in Talega Canyon east of Northrop Grumman
Riverside	Cleveland National Forest in Corona area
San Diego	Northeast of Gregory Canyon on south-facing slopes above San Luis Rey River; Hwy S-16 north of Pala; upper Borrego Canyon; Magee Truck Trail northeast of Mt. Olympus; west of Trujillo southwest of Magee Truck Trail; east of Ranchita; western slope of Viejas Mountain
Ventura	Medea Creek south-southeast of Simi Peak; foothills of Santa Ynez Mountains near head of Santa Ana Valley

Subregional Status

The NCCP database for chaparral beargrass includes two general areas for the planning area. A single location is located in the Foothill-Trabuco Specific Plan area between Live Oak Canyon Road and Trabuco Oaks Drive. Two locations are in the Talega sub-basin, one individual just east the Northrop Grumman facility and a cluster of five individuals in the eastern portion of the sub-basin (*Figure 178-M*). The cluster of five individuals in the Talega sub-basin is an *important population* in a *key location* because of the rarity of this species. Survey data for the Foothill-Trabuco Specific Plan Area are incomplete and, based on general habitat conditions in the area, it is likely that chaparral beargrass is present in other areas. If the species occurs in this area in any substantial populations, they may be considered *major* or *important populations* in *key locations.*

Biological Considerations

The chaparral beargrass is a yucca-like perennial succulent with a 1-1.5 m (3.3-4.9 ft) flower stalk that blooms from April to June. No published literature on the life history of this species is available.

According to Rieser (1994) chaparral beargrass often occurs on eroded Cieneba soils in Orange County, on Los Posas soils at the San Luis Rey River site, and on the Lodo, Calleguas-Arnold complex, and Anaheim soils at other sites.

Reiser (1994) states that chaparral beargrass is declining in the Pala region from conversion of habitat to agriculture and residences, and in the Santa Ana Mountains from residential development. The USFS identified protection of the species from too-frequent fire as a management issue.

Protection Recommendations

- Protect the location with five individuals of chaparral beargrass in the eastern portion of the Talega sub-basin.

Management Recommendations

- As part of the fire management program, protect chaparral beargrass from too-frequent fire.

2.28 COAST LIVE OAK

Species: Coast Live Oak (*Quercus agrifolia*)
Federal Status: None
State Status: Mandatory CEQA Analysis
CNPS Status: None
Science Advisors Group: None
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: No

CONSERVATION GOAL

1. Protect and manage coast live oak-dominated vegetation communities (coast live oak woodland, coast live oak forest, and coast live oak riparian forest) to maintain their physiographic representation in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects adequate amounts and physiographic representations of coast live oak-dominated vegetation communities.

2. Formulate a HRMP to provide for long-term protection and management of the coast live oak-dominated vegetation communities.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for coast live oak is vegetation community-based because a detailed oak tree inventory has not been conducted in Subarea 1 or elsewhere in general in the NCCP planning area (exceptions would be project-level oak inventories). Oak woodland and forest are combined for the conservation analysis because the only difference between the two communities is percent canopy cover.

Subarea 1 Impacts

The proposed Covered Activities would result in impacts to 629 acres (17 percent) of coastal live oak woodland and forest and coast live oak riparian forest (*Figure 203-M*). The breakout for impacts to the coast live oak communities is 65 acres (5 percent) of coast live oak riparian forest and 564 acres (24 percent) of coast live oak woodland and forest.

Subarea 1 Conservation

A total of 2,572 acres (69 percent) of 3,712 acres of coast live oak woodland and forest and coast live oak riparian forest would be conserved in the Habitat Reserve and 517 acres (14 percent) are in Subarea 1 SOS, for a total conservation of 3,089 acres (83 percent) of the coast live oak vegetation communities (*Figure 203-M*). For coast live oak woodland and forest, 1,418 acres (61 percent) would be in the Habitat Reserve and 353 acres (15 percent) are in SOS. For coast live oak riparian forest, which is included in the riparian total, 1,155 acres (84 percent) would be conserved in the Habitat Reserve and 164 acres (12 percent) are in Subarea 1SOS.

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Stressors of coast live oak-dominated vegetation communities that will be considered for adaptive management include:

- Habitat fragmentation
- Fire
- Cattle-related impacts
- Exotic species
- Hydrology
- Geomorphology
- Human uses and recreation
- Precipitation
- Disease

Habitat fragmentation resulting from urban and agricultural development as a stressor on coast live oak vegetation communities is a precursor to most of the other stressors listed above.

Fire is a key stressor of coast live oak communities. Oaks are adapted to wildfires and oak recruitment appears to depend on relatively frequent fires (*e.g.*, McClaran and Bartolome 1989). Although fire can kill the tops of seedlings and saplings, they can resprout in the first year after a fire. In addition, Fry (2002) found that scorching of oaks was positively correlated with the crown damage and the likelihood of resprouting. On the other hand, a high intensity fire can severely damage or kill mature trees. Fires that cause trunk scars can make the tree more susceptible to disease (Fry 2002). Also, if fires occur too frequently, ground cover can become dominated by annual grasses that compete for available surface water and affect acorn recruitment and growth.

Grazing and browsing can have both detrimental and beneficial effects on coast live oak communities. On the one hand, cattle and mule deer browse on seedlings and saplings, and thus depress oak recruitment. In addition, trampling of soils in the winter results in soil compaction that reduces their ability to absorb water or seeds. On the other hand, managed grazing can control the proliferation of annual grasses and invasive weeds that compete with oak seedlings and saplings for available surface water and soil nutrients, as well as reduce the risk of "laddering" fires than can kill oaks.

A major stressor of coast live oaks is altered hydrology. Subsurface de-watering or prolonged drought may affect the viability of mature coast live oak that is thought to utilize the water table in some areas by developing deep taproots (Calloway 1990). Loss of available surface water has a detrimental effect on the sprouting of seedlings (Stephenson and Calcarone 1999). Alternatively, over-watering resulting from urban run-off and summer irrigation or very wet precipitation cycles (or some combination of the two) can make oaks more susceptible to various oak root diseases resulting from water mold fungi such as *Phytopthora* (Raabe 1990). In conjunction with altered hydrology, altered geomorphology through alterations of sediment transport and deposition can stress coast live oak riparian forest.

Although not specifically listed above as a stressor to be considered for management, predation on acorns, seedlings, and saplings can have substantial effects on coast live oak communities. For example, ground squirrels, deer mice, scrub jays, and acorn woodpeckers prey on acorns, while pocket gophers, cattle, and deer consume seedlings and saplings. Although most of these predators are native species, and presumably oaks have evolved in their presence (*i.e.*, these native predators are examples of *intrinsic drivers*), in combination with non-native predators such as cattle, and other *extrinsic drivers* such as exotics, altered hydrology, and short fire intervals and/or intense fire, the predation pressure on acorns, seedlings and saplings may exceed the ability of the oak woodland system to withstand these stressors. That is, the system may be pushed beyond its natural resilience.

Similarly an extensive set of management and monitoring actions are stated in *Part I, Chapter 7, Sections 7.11.3* through *7.11.5* that includes periodic monitoring of the oak communities, a "long list" of potential monitoring sites, standardized monitoring methods, identification of focal species for monitoring, and a description of a case-by-case restoration program implemented at the discretion of the Reserve Manager and Science Panel.

Goals and Objectives

There are two main goals for the conservation and management of coast live oak communities in the Habitat Reserve:

- Maintain the physiographic diversity of coast oak vegetation communities in the Habitat Reserve.
- Restore coast live oak communities and enhance their quality in the Habitat Reserve such that the net habitat value of the existing coast live oak system is preserved.

The following objectives would be met to achieve these conservation and management goals:

Objective 1: Implement Conservation Strategy to protect and manage approximately 2,572 acres of coast live oak communities in the Habitat Reserve (actual acreage will vary in relation to natural and anthropogenic environmental effects such as wildfires and drought).

Objective 2: Remap vegetation communities in Habitat Reserve within two (2) years of executing IA to establish a baseline for long-term tracking of the Reserve.

Objective 3: Update vegetation community map at 5-year intervals.

Objective 4: Collect regional climate, weather and air quality information to examine potential correlations between vegetation and population changes and environmental variables.

Objective 5: Conduct monitoring of coast live oak communities to track the long-term habitat value of the systems.

Objective 6: Manage fire regimes in upland oak woodland and forests such that a natural diversity and balance of age-stands are maintained throughout the Habitat Reserve; *i.e.*, there is an appropriate mix of mature trees and recruitment of new trees.

Objective 7: Suppress wildfires in the coast live oak riparian community to the extent feasible.

Objective 8: Manage cattle such that adverse impacts to coast live oak communities are controlled to preserve habitat value through timed rotational grazing and the 25 percent residual dry matter standard (*i.e.*, light/moderate grazing levels) described in the Grazing Management Plan (*Appendix G*).

Objective 9: Control exotics invasions of coast live oak communities, especially along the Habitat Reserve-urban interface or other identified vulnerable areas (*e.g.*, along existing paved and dirt roads, utility easements).

Objective 10: Identify trees with high acorn productivity.

Objective 11: Maintain acorn production and protect seedlings and saplings to support establishment of new trees, such as by protecting seedlings and saplings in stands of coast live oak communities in the Habitat Reserve where predation by native

and non-native species is excessive, including by the use of protective structures where necessary.

Objective 12: Restore coast live oak communities in areas that currently support stands that are damaged or stressed by natural or human-induced factors, and where the adverse impact may not be naturally reversible. (Note that a specific *a priori* restoration objective for coast live oak communities has not been formulated, even though restoration of oak woodland is a stated goal of the AMP because at this time specific areas warranting restoration of coast live oak communities have not been identified. However, areas within the Habitat Reserve requiring restoration may be identified in the future, either as a result of more detailed field investigation of existing conditions or as triggered by natural or human-induced events.)

Conceptual Model

Yes – see figure below.

Regional and Subregional Management Information Needs

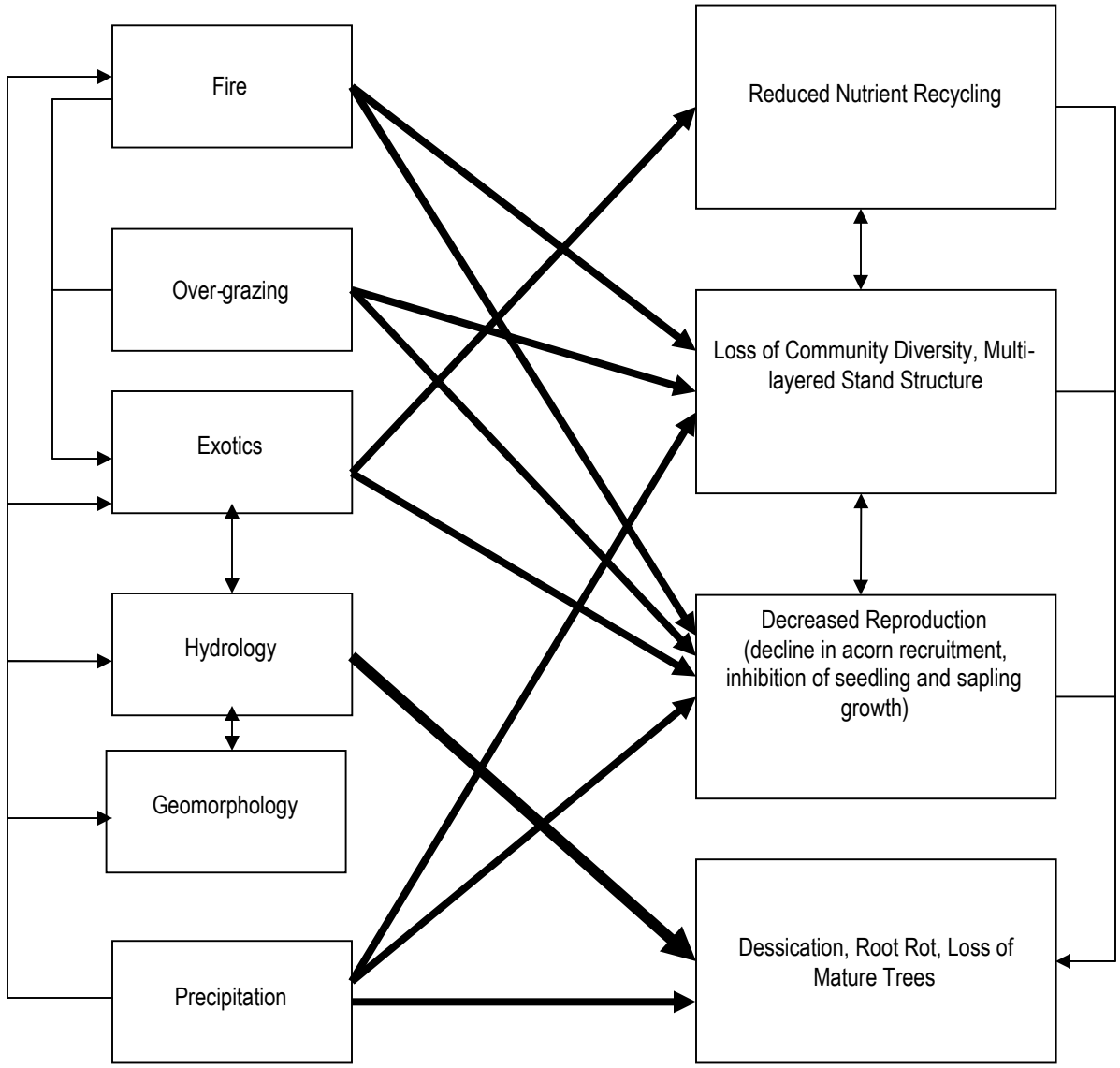
There is a substantial body of literature on oak communities in California in general, with most of the research being conducted in central California in relation to issues such as recruitment and regeneration, physiological ecology, competitive relationships (*e.g.,* with exotic species), grazing and disease (see CalPIF 2002 for a summary or oak woodland conservation and management issues). Based on general field observations of the conditions of individuals and recruitment of saplings, the live oak communities in the RMV portion of the Habitat Reserve generally are doing well and are healthy (T. Bomkamp, pers. comm. 2005).

Level of Management and Monitoring Priority - Medium

The overall priority for management and monitoring of coast live oak communities is medium. However, as discussed in *Part I, Chapter 7* (see *Tables 7-8a,b*), riparian and wetland communities, which include coast live oak riparian forest, have a high priority ranking for management and monitoring while coast live oak woodland and forest have a relatively low priority ranking. These rankings are based on a combination of "Importance Value" and "Index of Disturbance," as explained in *Part I, Chapter 7, Section 7.6.* In effect, therefore, coast live oak riparian will receive a higher priority for management and monitoring and upland oak woodland and forest a lower priority.

Coast Live Oak Stressor Model

Environmental Stressor **Community Response**



Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted primarily at a habitat landscape level.

Monitoring Variables

Listed below are suggested habitat-based monitoring variables. The detailed monitoring program for the California scrub oak will be developed by the Reserve Manager and Science Panel.

1. Relative cover of coast live oak
2. General health status of individual mature trees (*e.g.,* evidence of over-grazing or browsing, disease, new vegetative growth, etc.)
3. Seedlings and saplings
4. Acorn productivity
5. Cover and proportion of understory exotic plant species/native plant species
6. Soil conditions (*e.g.*, trampling, nutrients)
7. Hydrology (de-watering or over-watering)
8. Fire effects

Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Suggested Monitoring Methods

The following are suggested monitoring methods for coast live oak communities:

- Establish pseudo-randomized plots around stands. Sample plots should include the range of existing habitat conditions within the Habitat Reserve, including elevation, slope and aspect, proximity to roads and urban development, and uses within the Habitat Reserve (*e.g.*, recreation, grazing, fully protected areas, etc.). Generally exclude plots with less than 10 percent cover and less than at least three oak trees that meet or exceed 4 in dbh (diameter at breast height, or 4.5 ft from the ground) as such areas would not meet the definition of an oak woodland. However, at the Reserve Manager's discretion, areas that do not meet this standard may be selected for monitoring if there is evidence of incipient oak woodlands

- Tag trees and record species, tag number, dbh (in), height (ft) and dominance (*i.e.*, is the tree in the canopy of another tree or does it form the canopy?). Note slope and aspect of each tree, understory species (including proportion of natives to exotics), presence of debris and litter, soil type, depth, and parent material and elevation.
- Assess the status of trees as stressed or dead by examination of bark and small branches for dryness and brittleness. Trees would be classified as "healthy" if less than 50 percent brown and leafless, "partially dead" if at least 50 percent brown and leafless, and "dead" of entire tree appears brown and leafless (following Tietje *et al.*, UC Cooperative Extension, Integrated Hardwood Management Program).
- Assess acorn production.
- Create oak tree database through the use of software specially developed to track discrete resources (*e.g.*, TreePro software that links the database to GIS mapping capabilities).

Suggested Monitoring Locations

Selection of specific monitoring locations for oak woodlands would require additional field work, but would be selected to provide physiographic representation within the Habitat Reserve. Areas with substantial stands of oak woodlands that should be considered for monitoring include:

- Lower Gabino Canyon
- La Paz Canyon
- Upper Gobernadora Canyon
- Lower Cristianitos Canyon
- Blind Canyon
- Donna O'Neill Land Conservancy at Rancho Mission Viejo
- Wagon Wheel Canyon
- The "Narrows" area of Chiquita Canyon
- Lower Chiquita Canyon
- San Juan Creek within Caspers Wilderness Park
- Bell Canyon within Caspers Wilderness Park
- Live Oak Canyon within O'Neill Regional Park

Management Actions

Identified management actions for upland coast live oak woodland and forest are different in some ways from coast live oak riparian forest, because the latter community is part of the riparian/wetland systems and treated separately in the HRMP.

Coast Live Oak Woodland and Forest

Issues that likely would require active management at a habitat level for coast live oak woodland forest include:

- Control of invasive exotic plant species, especially annual grasses.
- Management of surface and subsurface hydrology to avoid both over- and under-watering.
- Cattle grazing, as provided for by the Grazing Management Plan.
- Fire management.
- Control of predation on seedlings and saplings.

The AMP element of the HRMP also provides for case-by-case restoration of coast live oak woodland and forest undertaken during the course of long-term adaptive management of the Habitat Reserve, with the overall goal of maintaining the existing diversity and habitat value of oak woodlands in the Habitat Reserve.

The two main objectives of the oak woodlands restoration program are:

Objective 1: To restore oak woodlands in areas that support existing mature trees, but where recruitment and regeneration are being inhibited by factors such as exotic weeds and annual grasses.

Objective 2: To restore oak woodlands in areas that are degraded or disturbed by future natural events and it is determined that they would not, or are unlikely to, recover naturally (*e.g.*, an area that has burned too frequently);

The first objective of restoring oak woodlands would be achieved by **(1)** identifying any degraded oak woodlands, and **(2)** focusing the restoration effort in degraded areas adjacent to healthy stands of oak woodland to the extent possible. A near-term management task would be to identify any such areas in the Habitat Reserve. Following management recommendations of CalPIF (2002), sites identified for restoration should then be prioritized on basis of their proximity to high quality sites and their likely success of regeneration and transplanted oak viability. Restoration of sites in close proximity to existing high quality sites have a better chance of being colonized by oak woodland species.

The second objective of restoring areas that are disturbed in the future is important for maintaining long-term net habitat value. For example, sites that currently support high quality oak woodlands but are damaged by a high intensity fire or several fires at short intervals may be identified for restoration.

As part of the management of the various lands in the Habitat Reserve supporting oak woodlands, the Reserve Manager would identify areas suitable or desirable for restoration, with oversight by the RMVLC to ensure that the proposed restoration is consistent with the goals and objectives of the AMP and that the restoration can be adequately funded. Generally it would be the decision of the Reserve Manager whether to undertake an enhancement or restoration project, but where the project may affect adjacent lands managed by the County or some other entity, or be affected by habitat conditions on the other ownership, a coordinated effort of the different entities may be desirable.

Restoration sites would be evaluated for their suitability including water table and soil conditions. Merrick *et al.* (1999) describe a knowledge-based model to evaluate sites for restoration suitability for valley oak (*Q. lobata*). If oaks currently are present or the site supported oaks in the recent past, it is considered to be suitable. If the site is not currently occupied by oaks, but has high soil water holding capacity, a high water table and loam soils, it is considered favorable for restoration.

Coast Live Oak Riparian Forest

The HRMP described in *Part I, Chapter 7, Section 7.10* provides a more detailed management approach (including restoration) for riparian/wetland communities, of which coast live oak riparian forest is a part. However, the large majority of coast live oak riparian forest subject to the AMP element of the HRMP is located in the San Mateo Creek Watershed in La Paz, Airplane, and middle Gabino Canyon, and on the Donna O'Neill Land Conservancy (*Figure 203-M*), which will not be subject to development impacts. Other substantial areas of coast live oak riparian forest in the Habitat Reserve are in Arroyo Trabuco in O'Neill Regional Park, in Bell Canyon in Caspers Wilderness Park, and in Wagon Wheel Canyon in the Riley Wilderness Park. The riparian/wetland management and restoration actions identified for San Juan Creek, lower Gobernadora Creek, and lower Arroyo Trabuco therefore will have little effect on coast live oak riparian forest.

With this in mind, the primary management actions relevant to the majority of coast live oak riparian forest in the Habitat Reserve are wildland fire management and the coordinated GMP in the San Mateo Creek Watershed. Also, any erosion stabilization in upper Gabino Canyon will benefit downstream coast live oak riparian forest in middle Gabino Canyon.

Potential Target Studies

No Habitat Reserve-specific potential target studies of coast live oak communities have been identified at this time. However, the Reserve Manager and Science Panel may recommend target studies in the future based on a demonstrated stressor.

SPECIES ACCOUNT

Rangewide and Regional Status

Coast live oak is the most common oak in coastal California and is widespread in valleys and slopes below about 4,900 feet (Hickman 1993; Holland and Keil 1995). According to Hickman (1993), it is known from the following California Floristic Provinces: Northwest California; Outer North Coast Ranges that extend north from Sonoma County to the northern California boundary and are characterized by redwood, mixed evergreen, and mixed hardwood forests and very high rainfall; Central Western California which extends south from Sonoma County to Santa Barbara County; Southwestern California which extends south from Ventura County to Baja California, Mexico; and Baja California to about the San Pedro Martir (Barbour and Minnich 2000).

Subregional Status

Coast live oaks may occur in four types of vegetation communities in the NCCP planning area, as defined by Gray and Bramlet (1992):

- oak savanna, which is annual or needlegrass grassland with widely scattered oaks (less than 10-20 percent canopy cover);
- oak woodland, which is a multi-layered vegetation community with 20-80 percent cover of oaks;
- oak forest, which is similar to oak woodlands, but with 80 percent or more canopy cover; and
- southern coast live oak riparian forest, which is a riparian community in drainages and streamcourses dominated by coast live oak, but mixed with other riparian species such as western sycamore and various willow species.

Oak woodlands and forest occur throughout the NCCP study area and comprise approximately 5,840 acres, of which 2,622 acres are in the planning area and 3,218 acres are in the CNF (*Figure 203-M*). The largest areas of coast live oak woodland are in the eastern portion of the study area in Caspers Wilderness Park and the hills west of Bell Canyon and in the northern portion of the planning area in Live Oak Canyon and upper Arroyo Trabuco. Live oak forest primarily occurs on the Donna O'Neill Land Conservancy, at the head of Cristianitos Creek, on the northern slopes of Blind Canyon, and in small patches in lower Chiquita Canyon and east of Cañada Gobernadora. The vast majority of woodlands and forest in the planning area are located in Subarea 1 (86 percent), followed by Subarea 2 (9 percent), Subarea 4 (3 percent) and Subarea 3

(2 percent). Except for Subarea 4, woodlands and forest are similarly represented in the Subareas. Proportionally, woodlands and forest account for 4 percent of the natural habitats in Subarea 1, 5 percent in Subarea 2, 3 percent in Subarea 3, but less than 1 percent in Subarea 4.

Southern coast live oak riparian forest is the most common riparian community in the study area (*Figure 203-M*). It comprises approximately 3,258 acres, with 2,106 acres (65 percent) in the planning area and 1,152 acres in the CNF. This vegetation type occurs throughout the study area, including Arroyo Trabuco, San Juan Creek, Cañada Gobernadora, Chiquita Canyon, Cristianitos Creek and its tributaries, Gabino Canyon, Airplane Canyon, Verdugo Canyon, Bell Canyon, Crow Canyon, Trampas Canyon, Live Oak Canyon, Lion Canyon, Hot Spring Canyon, Hickey Canyon and Rose Canyon (*Figure 203-M*). Within the Subareas, the large majority of coast live oak riparian forest in the planning area is in Subarea 1 (65 percent) followed by Subarea 2 (19 percent), Subarea 4 (10 percent), and Subarea 3 (5 percent) (*Part I, Chapter 3, Table 3-2*). Coast live oak riparian forest is the predominant riparian habitat type in all of the Subareas, accounting for 41 percent of Subarea 1, 99 percent in Subarea 2, 47 percent in Subarea 3 and 39 percent in Subarea 4.

Oak savanna is relatively uncommon with only 14 acres mapped in the study area; 11 acres in Caspers Wilderness Park, about 1 acre on Starr Ranch, about 1 acre in O'Neill Regional Park, less than 1 acre in Subarea 2 in the FTSP area, and less than 1 acre in Subarea 4 in Rancho Santa Margarita. There is no oak savanna in Subarea 1 in areas proposed for development.

Biological Considerations

Generally the upland oak communities (savanna, woodland and forest) are open where moisture is limited in drier, more exposed aspects, and densest in moist areas (Holland and Keil 1995). North-facing slope occurrences of oak woodlands and forests are also denser than south-facing slope occurrences (Holland and Keil 1995).

Oak woodlands consist of multilayered vegetation with a canopy that is 20 to 80 percent tree cover dominated by coast live oak (Gray and Bramlet 1992). Many understory shrubs in woodlands and forest are shade tolerant and include scrub oak (*Quercus berberidifolia*), California blackberry, snowberry (*Symphoricarpos mollis*), California walnut (*Juglans californica*), California-lilac (*Ceanothus* spp.), laurel sumac, gooseberry, toyon, California laurel, manzanita *(Arctostaphylos* spp.), poison-oak, Mexican elderberry, mountain-mahogany, sugarbush (*Rhus ovata*), big-leaf maple and white alder. Herbaceous understory species include California goldenrod (*Solidago californica*), western wild rye (*Elymus glaucus*), giant ryegrass, *Melica* spp., *Stellaria* spp., *Claytonia* spp., ripgut grass, wild cucumber, nightshade, *Phacelia* spp., and common eucrypta (*Eucrypta chrysanthemifolia*) (Gray and Bramlet 1992).

Soils that commonly support coast live oak include sandstone and shale-derived soils (Sawyer and Keeler-Wolf 1995). Coast live oak typically occupies slopes with deep soils, alluvial terraces, and the recent alluvium of canyon bottoms (Griffin 1977; Brown 1982). Open woodlands form when soils are shallow (Holland and Keil 1995).

Coast live oak riparian forest is dominated by coast live oak (*Quercus agrifolia*), with western sycamore (*Platanus racemosa*), Mexican elderberry (*Sambucus mexicana*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and Goodding's black willow (*Salix gooddingii*). Understory vegetation includes holly-leaf redberry (*Rhamnus ilicifolia*), California coffeeberry (*Rhamnus californica*), mule fat (*Baccharis salicifolia*), coastal goldenbush (*Isocoma menziesii* ssp. *veneta*), poison oak, toyon, laurel sumac, California mugwort (*Artemisia douglasiana*) and Douglas' nightshade (*Solanum douglasiana*).

Threats to coast live oak primarily stem from habitat destruction, reproductive depression, and disease. Holland and Keil (1995) state that in the vast majority of California oak woodland sites, oak reproduction ceased around 1900. The loss of acorn viability can be attributed to cattle and sheep in rangelands and an overabundance of deer in many northern California areas (Holland and Keil 1995). The oak woodland habitat also has been altered by the replacement of native bunch grasses with exotic annual grasses that produce many more seeds. Man's reduction in the number of predators of seed-eating animals which predate oak acorns also has been found to be a threat (Holland and Keil 1995). Introduced annual grasses, due to their rapid growth and uptake of available surface water, also contribute to the loss of native grasses historically present in oak woodlands and savannas as well as diminishing water supplies for oak seedlings (Stephenson and Calcarone 1999). In some areas, it appears that California laurel is replacing coast live oak, possibly due to grazing (Holland 1988). Wood-cutting, although not as prevalent in the southern portion of the State, has left areas of stumps because oaks were not able to reestablish (Holland 1988). Root rot, caused by overwatering during the summer in urban oaks, also has been known to cause mortality (Holland and Keil 1995). Since about 1995, a dieoff of oaks in Santa Cruz and Marin counties, termed Sudden Oak Death (SOD), has occurred, apparently indirectly from a water mold of the genus *Phytophthora* (EBCNPS 2001). This water mold breaks down the tree's circulatory system and makes it vulnerable to invasion by bark beetles, which normally cannot invade healthy trees. This water mold is infecting at least three species of oak: coast live oak, tanoak (*Lithocarpus densiflorus*), and black oak (*Quercus kelloggii*).

2.29 COULTER'S SALTBUSH

Species: Coulter's Saltbush (*Atriplex coulteri*)
Federal Status: None
State Status: None
CNDDB Rank: G2S2.2
CNPS Status: List 1B.2
Science Advisors Group: 3
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: Yes

CONSERVATION GOAL

1. Protect and manage *major* and *important populations* of Coulter's saltbush in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects approximately 90 percent of individuals and 88 percent of locations of the Coulter's saltbush.

2. Formulate a Habitat Reserve Management Program (HRMP) to provide for long-term protection and management of Coulter's saltbush.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for Coulter's saltbush is based both on overall conservation of locations and individuals and on the conservation of *major* and *important populations* in *key locations*. The impact and conservation analysis for plants in general is complicated by the fact that plant locations are mapped in the GIS as polygons and in many cases a polygon can be both "conserved" and "impacted" by a "blind" GIS analysis if the polygon is partially in development areas and partially in the Habitat Reserve. In these cases the proportion of the polygon conserved and impacted in terms of individuals needs to be analyzed in more detail to determine if the location should be considered permanently conserved or impacted. For example, the edge of a polygon of 100 individuals may be impacted such that 10 of the 100 individuals are impacted, resulting in 90 percent conservation of the location. In this case, even though 10 individuals are impacted, the location, as a whole, would be considered conserved. The conservation analysis for the Coulter's saltbush was conducted according to the following decision rules:

- Locations with fewer than 100 individuals must have at least 75 percent of the individuals in the Habitat Reserve or SOS to be considered conserved;
- If more than 25 percent of the individuals are impacted in locations supporting less than 100 individuals, the **entire location** and **all individuals** at the location are considered impacted (*i.e.*, the entire location is considered non-viable over the long term);
- For locations with more than 100 individuals, any location with at least 75 individuals in the Habitat Reserve would be considered conserved; and
- For the purpose of reporting all impacts to proposed Covered Species, for locations that are considered conserved, but for which some proportion of the location is impacted, the number of impacted individuals is still reported even though overall the location is considered conserved.

Because the GIS database includes polygon size and directly counted or estimated numbers of individuals in the polygon, the number of individuals impacted or conserved is estimated as a proportion of the polygon impacted (*i.e.*, the population density within the location is assumed to be uniform). For example, if a polygon is 1 acre in size and has 100 individuals, an impact to 0.1 acre of the polygon would impact 10 individuals.

A location is considered to be "impacted" if the entire location would no longer be viable as a result of the impact, even if some small number of individuals at the location remained in the Habitat Reserve. Locations that are partly impacted, but would remain viable according to the criteria described above are not considered "impacted" for the purpose of reporting impact and conservation statistics even if some proportion of the population is lost. The impacted individuals in these locations, however, are included in total number of individuals impacted. Individuals that are in the Habitat Reserve but part of the location considered impacted are also included in the total number of individuals impacted because it is assumed that the population at the location as a whole would not be viable over the long-term.

Subarea 1 Impacts

The proposed Covered Activities would permanently impact four of 33 locations (12 percent) and 277 of 2,752 individuals (10 percent) of Coulter's saltbush (*Figure 178-M*). (Note that one location totaling 25 individuals wholly mapped in existing orchards and two others that are partially in orchards totaling 28 and 283 individuals, respectively, were omitted from the analysis. Also note that Coulter's saltbush is only documented in Subarea 1.)

With regard to *major/important populations*, two of the three impacted locations *major/important populations* are in the Upper Cristianitos Creek *important population* (not a *key*

location), with populations of three and 12 individuals impacted. These locations are in the proposed orchards footprint in PA 6 and ultimately could be avoided. One location in the Middle Chiquita/Narrow Canyon *major population/key location* is considered impacted. The other impacted location totaling 10 individuals is located outside of mapped *major/important populations.* It is important to note that the Ranch Plan GPA/ZC EIR MM 4.9-3 states that "Prior to issuance of a grading permit for Planning Area 2, the Project Applicant shall demonstrate to the satisfaction of the County's Director of Planning Services Department or his/her designee that impacts to the key location and major population of Coulter's saltbush in the Chiquita sub-basin have been substantially avoided."

Of the 277 impacted individuals, 252 are in five locations in the Middle Chiquita/Narrow Canyon *major population/key location.* Based on the conservation criteria described above, four of the five locations with some impact to the population are considered conserved, as follows:

- 21 of 100 individuals impacted
- 3 of 21 individuals impacted
- 33 of 150 individuals impacted
- 185 of 600 individuals impacted

In the fifth location, 10 of 15 individuals are impacted and this location is considered permanently impacted.

The proposed Covered Activities also would result in temporary direct impacts to four locations and 111 individuals.

Subarea 1 Conservation

A total of 29 locations (88 percent) and 2,475 individuals (90 percent) would be conserved in the Habitat Reserve. With regard to *major/important populations* in *key locations*, 18 of 19 (95 percent) of the locations and 1,415 individuals (85 percent) in the Chiquita Canyon/Narrows *major population/key location* would be in the Habitat Reserve. All four locations and 350 individuals in the Middle Chiquita Canyon North of Treatment Plant *important population/key location*, both locations and 600 individuals in the Lower Chiquita Canyon *important population*, and all four locations and 100 individuals in the Upper Gabino *important population* would be conserved in the Habitat Reserve.

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Little is known about Coulter's saltbush, but several potential stressors on the species on RMV have been identified by T. Bomkamp (pers. comm. 2005), including:

- Non-native plants (wild radish, Italian ryegrass, Australian saltbush, and mustards)
- Alteration of soil/water relations
- Destruction of cryptogammic soils
- Cattle-related impacts

Goals and Objectives

The overall goal is to protect and manage Coulter's saltbush in the Habitat Reserve.

This goal will be met by the following objectives:

- Monitoring the population in all three locations annually for the first five (5) years following initiation of monitoring once occupied areas are dedicated to the Habitat Reserve.
- Soil sampling taken during surveys to measure pH and to maintain a range of acceptable soil alkalinity.
- Protection of populations and associated cryptogammic soils from cattle-related impacts if necessary.
- Control of non-native invasive species such as wild radish, Italian ryegrass, Australian saltbush and mustards in Coulter's saltbush areas to the extent necessary.
- Any populations and associated soils directly impact by development will be experimentally translocated to suitable receiver sites near where the impacts occur (see *Appendix I*).

Regional and Subregional Management Information Needs

Very little information is available for Coulter's saltbush from which to base a management program. General regional and subregional management information needs that should be addressed at the regional level include

- General life history of the species, including pollination, germination, dispersal, and soil/water relations; and

- The taxonomic relationship of different Coulter's saltbush populations and its relationship to *A. pacifica.*

Level of Management and Monitoring Priority – High

Because little is known about the variability of this species, the management and monitoring program for Coulter's saltbush focuses on monitoring the population in all three locations annually for the first five (5) years following initiation of monitoring. These initial monitoring surveys would document the annual status and annual variability of the population and note general habitat conditions such as species composition, native/non-native ratio, any observable disturbance conditions (*e.g.,* from cattle). Because of this species affinity for alkalinity, soil samples should be taken during surveys to measure pH. Maintaining an appropriate range of soil alkalinity may be crucial for managing this species. Protection of cryptogammic soils also may be a key element of long-term persistence.

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted at both a species-specific and habitat-based level.

Monitoring Variables

Listed below are suggested species-specific and habitat-based monitoring variables for Coulter's saltbush. The detailed monitoring program for Coulter's saltbush will be developed by the Reserve Manager and Science Panel.

1. Number, size, variability and health status (*e.g.,* new vegetative growth, flowering) of Coulter's saltbush.
2. Proportion of exotic plant species/native plant species in the vicinity Coulter's saltbush.
3. Soil pH at occupied sites.
4. Condition of cryptogammic soils and evidence of disturbance such as trampling by cattle.

Other Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

No specific management actions have been identified for the Coulter's saltbush at this time. The annual monitoring program will be directly toward identifying stressors that may need management actions in the future, such as invasive species controls, adjustments of soil alkalinities, and control of cattle-related impacts.

In addition to the adaptive management of Coulter's saltbush, if new populations in planned development areas are found, an experimental restoration program for the species would be undertaken, as described in the Translocation, Propagation and Management Plan for Special-status Plants (*Appendix I*). This plan describes the various methods for restoration, including seed collection, receptor site selection and preparation, greenhouse propagation, translocation of natural populations, introduction of cultivated plants, direct seeding at translocation sites, and long-term maintenance/repair and monitoring.

Potential Target Studies

The only potential target study identified at this time would be related to any experimentally translocated populations and associated soils. Because little is known about this species, annual monitoring will be conducted to determine what stressors may be operating and what management actions may be required in the future. The Reserve Manager and Science Panel will determine future necessary management actions based on the information collected through the annual monitoring.

SPECIES ACCOUNT

Regional and Rangewide Status

Coulter's saltbush occurs from Baja California, extending northward to Ventura County and also on the Channel Islands. Extant locations on the mainland include: RMV (approximately 3,000 plants); San Clemente State Park; San Onofre State Park; Whispering Hills in San Juan Capistrano; Dana Point Headlands; Bommer Canyon (two small populations of about 20 plants each); San Joaquin Freshwater Marsh (less than 25 plants observed); Laguna Beach; MacArthur Boulevard and Pacific Coast Highway; behind Newport Beach Public Library (observed by Dave Bramlet in 1998); Pelican Hill; and the east slope above Los Trancos Canyon, where it is common along the dirt road passing through coastal sage scrub on hill top in sandy clay soil. This species occurs on coastal bluffs and on alkali or saline flats in interior areas such as western Riverside County.

Coulter's saltbush is a CNPS List 1B species with a Threat Code of "2." List 1B indicates that Coulter's saltbush is rare, threatened or endangered throughout its range. Threat Code "2" indicates that the species is fairly endangered in California (20-80 percent of occurrences threatened). It is considered to be threatened by development and feral herbivores (CNPS 2001). Coulter's saltbush has no state or federal status.

Subregional Status

Coulter's saltbush is known from four general locations in the planning area: Chiquita Canyon, upper Cristianitos Canyon, and upper Gabino Canyon on RMV, and Whispering Hills to the west of RMV (*Figure 178-M*). Because this species is relatively rare within its range, all populations on RMV constitute *major* or *important populations*. The Chiquita Canyon group is further divided into one *major population* and two *important populations*. The Whispering Hills location has been dealt with as part of that development project. Thus, for the purposes of the conservation analysis, the planning area supports one *major population* and four *important populations.* Specific occurrences are described below.

- In upper Gabino Canyon a small population of about 100 individuals occurs west of and adjacent to the creek (No. 1 on *Figure 178-M*). This is an *important population* because of the rarity of this species in the region.
- Upper Cristianitos Creek supports two small locations numbering three and 12 individuals, respectively (No. 2 on *Figure 178-m*). This is an *important population* because of the rarity of this species in the region.
- Lower Chiquita Canyon west of the creek supports two locations numbering 200 and 400 individuals, respectively (No. 3 on *Figure 178-M*). This is an *important population* because of the rarity of this species in the region.
- Middle Chiquita just above and below the Narrows supports numerous locations ranging from the 10s to 600 individuals (No. 4 on *Figure 178-M*). The location with 600 individuals is east and adjacent to the creek about midway between the Narrows and Tesoro High School. Locations with 150, 150 and 200 individuals are west of the creek. This location overlaps substantially with the largest southern tarplant population. This group of locations east and west of the creek is a *major population* in a *key location.*
- Middle Chiquita just to the northwest of the treatment plant supports five locations, of which four are west of the creek (No. 5 on *Figure 178-M*). The locations west of the creek number 25, 50, 150 and 360 individuals, and the location east of the creek has 100 individuals. These five locations constitute an *important population*. The locations west of the creek constitute a *key location.*

- Two small locations are located in a major side canyon southeast of the Narrows. These locations number six and 10 individuals, respectively.
- One small population of less than 20 individuals occurs with southern tarplant (noted above) at a wetland seep between Gobernadora and Chiquita.

Biological Considerations

Coulter's saltbush is monoecious (male and female flowers on the same plant) with the inconspicuous female flowers subtended by bracts and the male flowers in panicles. The flowers are imperfect and bloom from March through October. The staminate flowers develop in short terminal spikes and glomerules in the upper leaf axils. The pistillate flowers develop below, also in the leaf axils. A pair of bracts (2 to 3 mm long) surrounds the fruit. The brown seeds are 1 to 1.5 mm long (Hickman 1993; Munz 1974). Coulter's saltbush is a decumbent to ascending perennial growing to 0.5 m in length. The leaves are subsessile, elliptic to lanceolate, somewhat greenish, sparsely fine-scaly and dentate. The blades are 7-20 mm in length. The seeds are found within a fruiting bract, which in this species is sharply dentate, 2-3 mm long, and with small tubercles (sometimes smooth) covering the surface of the bract. Information regarding pollination mechanisms was not found.

Protection Recommendations

- Protect the *key locations* of Coulter's saltbush in Middle and Lower Chiquita Canyon. Minimize impacts to *important populations* within the sub-basin and mitigate unavoidable impacts in the sub-basin.
- Protect the two known *important populations* of Coulter's saltbush in the Cristianitos sub-basin.
- Protect the *important population* of Coulter's saltbush in the Upper Gabino Canyon subunit.

Management Recommendations

- Implement a management program for Coulter's saltbush, including control of non-native invasive species, management of grazing and minimization of human access and disturbance as part of the adaptive management program**.**

Restoration Recommendations

- Translocate salvaged Coulter's saltbush to suitable restoration and enhancement areas in the same sub-basin as where impacts occur to the extent feasible. Receiver areas should support alkali soils suitable for the species and should be placed in locations that maximize connectivity and genetic exchange.

2.30 MANY-STEMMED DUDLEYA

Species: Many-stemmed Dudleya (*Dudleya multicaulis*)
Federal Status: None
State Status: None
CNDDB Rank: G2S2.1
CNPS Status: List 1B.2
Science Advisors Group: 3
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: Yes

CONSERVATION GOAL

1. Protect and manage *major* and *important populations* of many-stemmed dudleya in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects at 69 percent of individuals and 61 percent of locations of the many-stemmed dudleya.

2. Formulate a HRMP to provide for long-term protection and management of many-stemmed dudleya.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for many-stemmed dudleya focuses on overall conservation of locations and populations and conservation of *major* and *important populations* in *key locations.* A set of decision rules for determining whether a population is conserved or not is described below.

MM 4.9-35 of the Ranch Plan GPA/ZC EIR also was incorporated into the conservation analysis: "Prior to issuance of a grading permit for Planning Area 8, the Project Applicant shall demonstrate to the satisfaction of the County's Director of Planning Services Department or his/her designee that eight known locations of many-stemmed dudleya in the Talega sub-basin are protected."

The conservation analysis also includes avoidance measures within PA 6 in siting the orchards to avoid seven locations and 4,216 individuals that are within the Cristianitos Canyon *major population/key location* (see *Figure 179-M*).

The impact and conservation analysis for plants in general is complicated by the fact that plant locations are mapped in the GIS as polygons and in many cases a polygon can be both "conserved" and "impacted" by a "blind" GIS analysis if the polygon is partially in development areas and partially in the Habitat Reserve. In these cases the proportion of the polygon conserved and impacted in terms of individuals needs to be analyzed in more detail to determine if the location should be considered permanently conserved or impacted. For example, the edge of a polygon of 100 individuals may be impacted such that 10 of the 100 individuals are impacted, resulting in 90 percent conservation of the location. In this case, even though 10 individuals are impacted, the location, as a whole, would be considered conserved. The conservation analysis for the many-stemmed dudleya was conducted according to the following decision rules:

- Locations with fewer than 100 individuals must have at least 75 percent of the individuals in the Habitat Reserve or SOS to be considered conserved;
- If more than 25 percent of the individuals are impacted in locations supporting less than 100 individuals, the **entire location** and **all individuals** at the location are considered impacted (*i.e.*, the entire location is considered non-viable over the long term);
- For locations with more than 100 individuals, any location with at least 75 individuals in the Habitat Reserve would be considered conserved; and
- For the purpose of reporting all impacts to proposed Covered Species, for locations that are considered conserved, but for which some proportion of the location is impacted, the number of impacted individuals is still reported even though overall the location is considered conserved.

Because the GIS database includes polygon size and directly counted or estimated numbers of individuals in the polygon, the number of individuals impacted or conserved is estimated as a proportion of the polygon impacted (*i.e.*, the population density within the location is assumed to be uniform). For example, if a polygon is 1 acre in size and has 100 individuals, an impact to 0.1 acre of the polygon would impact 10 individuals.

A location is considered to be "impacted" if the entire location would no longer be viable as a result of the impact, even if some small number of individuals at the location remained in the Habitat Reserve. Locations that are partly impacted, but would remain viable according to the criteria described above are not considered "impacted" for the purpose of reporting impact and

conservation statistics even if some proportion of the population is lost. The impacted individuals in these locations, however, are included in total number of individuals impacted. Individuals that are in the Habitat Reserve but part of the location considered impacted are also included in the total number of individuals impacted because it is assumed that the population at the location as a whole would not be viable over the long-term.

Subarea 1 Impacts

As shown in *Table 2-41* and *Figure 179-M,* the proposed Covered Activities would result in direct permanent impacts to 149 of 386 locations (39 percent) and 19,642 of 63,666 individuals (31 percent) in Subarea 1. An additional impact to two locations totaling 395 individuals would occur in Subarea 4 SOS from road construction.

Table 2-41 also shows impacts to *major* and *important populations.* One *major population/key location* would be almost entirely impacted. Development in PA 3 would impact 58 of 61 locations (95 percent) and 5,441 of 5,678 individuals (96 percent) in the Gobernadora *major population/key location*. One *important population/key location* also would be virtually entirely impacted. Development in PA 2 would impact 40 of 41 locations and 6,635 of the 6,637 individuals in the Lower Chiquita *important population.* Relatively fewer impacts would occur to other *major* and *important populations,* ranging from no impacts to the East Talega *important population* to 25 percent of locations and 21 percent of individuals in the Chiquadora Ridge *major population/key location.* Overall for *major populations/key locations*, 25 percent of locations and 21 percent of individuals would be impacted. Overall for *important populations,* 52 percent of locations and 69 percent of individuals would be impacted.

For many-stemmed individuals in scattered locations outside of mapped *major/important populations,* 58 percent of locations and 65 percent of individuals would be impacted.

The proposed Covered Activities would result in temporary impacts to 29 location and 360 individuals.

Subarea 1 Conservation

A total of 236 locations (61 percent) and 44,204 individuals (69 percent) would be conserved in the Habitat Reserve (*Table 2-41*). For *major populations/key locations,* 67 percent of locations and 78 percent of individuals would be in the Habitat Reserve. For *important populations,* 48 percent of locations and 52 percent of individuals would be in the Habitat Reserve. One small dudleya population located in SOS on NAS Starr Ranch also would be conserved.

TABLE 2-41
CONSERVATION ANALYSIS FOR THE MANY-STEMMED DUDLEYA

Population	Total		Habitat Reserve				Impacts			
	Locations	Individuals	Locations	%	Individuals	%	Locations	%	Individuals	%
Cristianitos Canyon Major Population/Key Location	151	32,653	134	89%	28,849	88%	17	11%	3,804	12%
Upper & Middle Gabino/La Paz Canyon Major Population/Key Location	13	4,170	11	85%	4,124	99%	2	15%	46	1%
Gobernadora Major Population/Key Location	61	5,678	3	5%	237	4%	58	95%	5,441	96%
Chiquadora Ridge Major Population/Key Location	48	8,623	36	75%	6,844	79%	12	25%	1,779	21%
Subtotal for Major Populations/Key Locations	**273**	**51,124**	**184**	**67%**	**40,054**	**78%**	**89**	**33%**	**11,070**	**22%**
Lower Chiquita Canyon Important Population/Key Location	41	6,637	1	2%	2	0%	40	98%	6,635	100%
Chiquita Ridge Important Population/Key Location	18	1,349	17	94%	1,324	98%	1	6%	25	2%
Upper Gobernadora Important Population/Key Location	14	1,622	10	71%	1,423	88%	4	29%	199	12%
East Talega Important Population	14	292	14	100%	292	100%	0	0%	0	0%
Subtotal for Important Populations	**87**	**9,900**	**42**	**48%**	**3,041**	**31%**	**45**	**52%**	**6,859**	**69%**
Outside Population	26	2,642	10	38%	929	35%	15	58%	1,713	65%
Grand Total	**386**	**63,666**	**236**	**61%**	**44,024**	**69%**	**149**	**39%**	**19,642**	**31%**

[1] Of the estimated impacts to the dudleya in the Cristianitos Canyon major population/key locations, nine locations and 3,221 individuals are located in the 431 acres PAs 6 and 7 targeted for new orchards. RMV will avoid seven other locations and 4,216 individuals in PA 6. Given that only 50 of the 431 acres will be converted to agriculture, some additional conservation can be expected, but because the siting of the orchards has not been determined the impact estimate is overstated as it is for other biological resources in PAs 6 and 7.

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Relatively little is known about many-stemmed dudleya, but several potential stressors on the species on RMV have been identified by T. Bomkamp (pers. comm. 2005), including:

- Non-native plants (artichoke thistle, Italian ryegrass, bromes, wild oats, smooth cat's-ear, Crete hedypnois, and mustards)
- Cattle-related impacts
- Human activities (hiking, mountain bikes, equestrian).

The main stressors of these populations are non-native invasive species such as artichoke thistle, ryegrass, bromes, wild oats, smooth cat's-ear, Crete hedypnois, and mustards. Cattle impacts on the dudleya have not been observed on RMV (T. Bomkamp, pers. comm. 2005), Many-stemmed dudleya typically grows in areas where annual grasses are less prevalent and thus less attractive to cattle. However, cattle are identified as a potential stressor on the Cristianitos Canyon and Gabino Canyon dudleya populations because grazing in the southern pastures coincides with the dudleya growing season and monitoring for potential cattle impacts is thus warranted. Conserved areas also would need to be protected from human disturbance by hikers, mountains bikers and equestrians.

Goals and Objectives

The overall goal is to protect and manage *major* and *important populations* of many-stemmed dudleya in the Habitat Reserve.

This goal will be met by the following objectives:

- Monitoring of the *major* and *important populations* annually for the first five (5) years following initiation of monitoring once occupied areas are dedicated to the Habitat Reserve.
- Control of non-native invasive species such as artichoke thistle, Italian ryegrass, bromes, wild oats, smooth cat's-ear, Crete hedypnois, and mustards in many-stemmed dudleya areas to the extent necessary and feasible.
- Conduct timed rotational grazing on Chiquadora and Chiquita ridges per the GMP (*i.e.*, in late spring-summer) that is compatible growing and flowering season of the dudleya (generally April-June).

- Monitor *major populations* in Cristianitos and middle/upper Gabino Canyon for cattle-related impacts (cattle are present in these areas during the peak growing-flowering period).
- Populations and associated clay topsoils directly impacted by development will be translocated to the extent feasible and appropriate to suitable receiver sites such as the CSS/VGL restoration areas in Cristianitos and upper Gabino canyons (see *Appendix I*).

Regional and Subregional Management Information Needs

Relatively little information is available for many-stemmed dudleya from which to base a management program (see Species Account below). For example, translocation has been demonstrated to be at least moderately successful, albeit with mixed results (*e.g.*, the San Joaquin Hills Tollroad [SR-73]). General regional and subregional management information needs that should be addressed at the regional level include:

- General life history of the species, including habitat and microhabitat associations (*e.g.*, the potential role of shrubs in protecting plants from herbivores), pollination, dispersal, and, in particular, the year-to-year variability in germination (*e.g.*, does variability relate to genetic polymorphisms within populations that are sensitive to different environmental cues such as rainfall timing or amounts?).
- The taxonomic relationship among different many-stemmed dudleya populations.
- Competitive relationships with other native and non-native species.

Regional and subregional management information needs that can be addressed at the Habitat Reserve level include the relationship between cattle and many-stemmed dudleya and long-term management strategies. For example, dudleya tends to occur where annual grasses are less prevalent and less attractive to cattle. On the other hand, light/moderate grazing may benefit some populations of many-stemmed dudleya that are threatened by non-native annual grasses and weedy forbs. In particular, light/moderate grazing could be beneficial to dudleya populations on Chiquadora and Chiquita ridges where cattle are introduced in late spring following the peak dudleya flowering period. Another uncertainty is the long-term management of populations in ungrazed areas such as Donna O'Neill Conservancy. If these populations are threatened by invasive species, other management techniques such as prescribed burning, manual removal, mowing, or selective use of herbicides (such as currently used for artichoke thistle control) may be effective. It is also possible that some highly managed level of grazing in the currently ungrazed areas may be an effective management technique.

Level of Management and Monitoring Priority – High

Because little is known about the variability of this species, the management and monitoring program for many-stemmed dudleya focuses on monitoring the *major* and *important populations* annually for the first five (5) years following initiation of monitoring in a particular area. These initial monitoring surveys would document the annual status and annual variability of the population and note general habitat conditions such as species composition, native/non-native species ratio, any observable disturbance conditions such as trampling or individuals or soils from cattle, equestrian or other human recreation activities.

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted at both a species-specific and habitat-based level.

Monitoring Variables

Listed below are suggested species-specific and habitat-based monitoring variables for many-stemmed dudleya. The detailed monitoring program for many-stemmed dudleya will be developed by the Reserve Manager and Science Panel.

1. Number, size, variability and health status (*e.g.*, new vegetative growth, flowering) of many-stemmed dudleya.
2. Proportion of exotic plant species/native plant species in the vicinity many-stemmed dudleya.
3. Condition of soils and evidence of disturbance such as trampling/crushing by cattle, equestrian or other human activities.

Other Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

No specific management actions have been identified for the many-stemmed dudleya at this time. The annual monitoring program will be directly toward identifying stressors that may need management actions in the future, such as invasive species controls and control of cattle-related impacts or other human activities.

In addition to the adaptive management of many-stemmed dudleya, populations and associated clay top soils in development areas will be salvaged and translocated to suitable receiver sites to

the extent feasible and appropriate, as described in the Translocation, Propagation and Management Plan for Special-status Plants (*Appendix I*). This plan describes the various methods for restoration, including seed collection, receptor site selection and preparation, greenhouse propagation, translocation of natural populations, introduction of cultivated plants, direct seeding at translocation sites, and long-term maintenance/repair and monitoring.

Potential Target Studies

No target studies for the many-stemmed dudleya have been identified at this time. Because little is known about this species, annual monitoring will be conducted to determine what stressors may be operating and what management actions may be required in the future. The Reserve Manager and Science Panel will determine future necessary management actions based on the information collected through the annual monitoring.

SPECIES ACCOUNT

Rangewide and Regional Status

The many-stemmed dudleya is endemic to southwestern California, and is known only from southeast Los Angeles County, Orange County, western Riverside County, extreme southwestern San Bernardino County, and the northernmost portion of San Diego County. Modern records have not substantiated old collections from near Tehachapi in Kern County, and in Dehesa Valley in southern San Diego County.

Orange County supports the majority of the known populations of this species and was estimated by Roberts to support much as 80 percent of the total dudleya in the species' range (Roberts 1999). Roberts identified five areas of dudleya concentration in Orange County: **(1)** the San Joaquin Hills; **(2)** the northern Lomas de Santiago including the Santiago Hills north to Gypsum and Blind Canyons (1 and 2 combined generally comprise the Orange County Central/Coastal Subregion); **(3)** the Rancho Mission Viejo (Southern Subregion); and **(4)** the northern portion of San Diego County that comprises Camp Pendleton (Roberts 1999). A fifth concentration has been identified in the Gavilan Hills (Estelle Mountain) of western Riverside County (Roberts 1999). *Table 2-42* provides a region-wide summary of large and (potentially) important populations. Based on *Table 2-42*, it appears that Orange County (excluding the relatively small occurrences in the Cleveland National Forest) supports closer to 70 percent of the total dudleya.

TABLE 2-42
REGIONWIDE SUMMARY: 2002 STATUS OF MANY-STEMMED DUDLEYA WITHIN KNOWN RANGE IN SOUTHERN CALIFORNIA

Regional Large Population Areas	Dudleya Population: Number of Counted/Estimated Plants
Rancho Mission Viejo and San Clemente	65,250
Central/Coastal NCCP Reserve Lands	52,000
Camp Pendleton, San Diego County	32,000
Estelle Mountain, Riverside County	10,000
Subtotal:	***159,250***
Other Significant Smaller Population Areas	
Corona, Alberhill, Cleveland National Forest Riverside County	4,486
Cleveland National Forest Orange and San Diego counties	1,938
San Dimas/San Jose Hills (mostly Bonelli Regional Park) Los Angeles County	2,459
Chino Hills, Orange County	150
Subtotal:	***9,033***
APPROXIMATE TOTAL PLANTS	**168,300**

The smaller populations listed in *Table 2-42* do not necessarily include all potential *important populations* or *key locations* of the many-stemmed dudleya, because yet undiscovered plants may persist in small habitat fragments located outside of these areas. The preservation of these potential smaller *important populations* may also facilitate the survival and recovery of this rare species. Delineation and identification of other smaller populations is beyond the scope of this analysis.

Many-stemmed dudleya is a CNPS List 1B species with a Threat Code of "2." List 1B indicates that many-stemmed dudleya is rare, threatened or endangered throughout its range. Threat Code "2" indicates that the species is fairly endangered in California (20-80 percent of occurrences threatened). It is considered to be threatened by development, road construction, grazing and recreation (CNPS 2001). Many-stemmed dudleya has no state or federal status.

Subregional Status

Many-stemmed dudleya is known from five main areas in the planning area (*Figure 179-M*): Chiquita Ridge; Chiquadora Ridge; Gobernadora/Central San Juan east of Gobernadora Creek and north of Colorspot Nursery; Trampas Canyon/Cristianitos Canyon extending south to the

Talega development in the San Clemente Watershed; and upper Gabino and La Paz canyons. A smaller cluster occurs east of the Northrop Grumman facilities on the mesa. There also is a single record for the Bell Canyon area on Starr Ranch (F. Roberts 1997) and locations in Caspers Wilderness Park not in the data base, but these populations are considered to be small. The total counted individuals of many-stemmed dudleya in the planning area numbers about 65,250.

Within the planning area, this species occurs in open coastal sage scrub or sage scrub/grassland ecotones dominated by *Salvia apiana*, *Galium angustifolium*, *Bothriochloa barbinodis*, *Castilleja foliolosa*, *Aristida hamulosa*, and *Artemisia californica*. In some areas, such as ridges east of Gobernadora and north of Colorspot Nursery, this species is associated with Cieneba sandstone outcrops that support low densities of *Galium angustifolium*, *Bothriochloa barbinodis*, and *Castilleja foliolosa.* At other locations, such as portions of Chiquadora Ridge and Cristianitos, many-stemmed dudleya is often associated with purple needlegrass grassland and clay outcrops within the grassland complexes. In most of these areas, the dudleya typically grows in the shade of larger grasses or shrubs that appear to provide at least limited "nursery" effects.

The following describes the *major* and *important populations* and *key locations* of many-stemmed dudleya in the planning area:

Upper Gabino/Middle Gabino and upper La Paz Canyon support 12 locations ranging from about five individuals to about 1,500 individuals, cumulatively totaling more than 4,100 individuals (No. 1 on *Figure 179-M*). Eight of the 12 locations range from about 100-700 individuals, with one location at the boundary between middle and upper Gabino supporting about 1,500 individuals. Two locations near the county boundary with Riverside number about 500 and 700 individuals each, the latter of which overlaps the boundary with the La Paz Canyon sub-basin. These locations comprise a *major population* in a *key location.*

- A *major population* totaling approximately 34,137 individuals in 164 locations is located in the Cristianitos sub-basin and the southern portion of the Trampas Canyon sub-basin extending, south to the Talega development in the San Clemente Watershed and eastward into the western portion of the Lower Gabino and Blind canyon sub-basins (No. 2 on *Figure 179-M*). This population, which accounts for 52 percent of the documented many-stemmed dudleya in the planning area, occurs on both RMV land and the Donna O'Neill Conservancy at Rancho Mission Viejo and extends into Talega Open Space, as described below.
    - The portion of the Cristianitos Canyon *major population* on RMV outside the Donna O'Neill Conservancy supports about 72 locations ranging up to 1,800 individuals. Five of these locations number 1,100, 1,160, 1,500, 1,700 and 1,800 individuals each, respectively. These locations comprise five of the 11 largest counts known from the

planning area. An additional 11 locations range from about 400 to 976 individuals and 17 other locations support 100 to 355 individuals. The cumulative total of these locations is 18,796, individuals, or about 29 percent of the documented dudleya in the subregion. These locations comprise 55 percent of the individuals and 44 percent of the locations in the Cristianitos Canyon *major population* and *key location.*

- The Donna O'Neill Land Conservancy supports about 85 locations, with two of the locations supporting about 2,000 individuals each, and a third location of 1,175 individuals. The cumulative total of dudleya on the Conservancy is 14,250 individuals, accounting for 42 percent of the individuals in the Cristianitos *major population*.
- The Talega Open Space supports about seven locations totaling about 1,091 individuals, or 3 percent of the total in the Cristianitos *major population.*

- Fourteen locations totaling 292 individuals occur east of Northrop Grumman, but population estimates were not made (No. 3 on *Figure 179-M*). The 14 locations are considered an *important population* because they contribute to geographic diversity in the subregion and potentially provide a connection with nearby populations on Camp Pendleton.
- Chiquadora Ridge, including the area within the Gobernadora sub-basin, supports about 47 discrete locations totaling about 8,623 individuals (No. 4 on *Figure 179-M*). The locations range from 1 to 750 individuals, with eight locations numbering 540 to 750 individuals each. These locations comprise a *major population* and *key location* because the ridge is a major landscape feature in the planning area that provides important habitat connectivity functions.
- Chiquita Ridge west of the creek supports about 18 discrete locations ranging up to about 420 individuals, with four locations supporting more than 100 individuals (No. 5 on *Figure 179-M*). The cumulative total of these locations is about 1,349 individuals. These locations comprise an *important population* and *key location* because of their clustering on Chiquita Ridge, a major landscape feature in the planning area that provides important habitat connectivity function.
- Lower Chiquita Canyon east of the creek and south of the treatment plant supports about 41 locations totaling approximately 6,686 individuals (No. 6 on *Figure 179-M*). The locations range from 1 to 1,330 individuals, with four locations supporting at least 500 individuals. These locations comprise a *major population* in a *key location.*
- Central Gobernadora sub-basin east of the creek and the Central San Juan subunit north of the creek comprises a single population supporting about 61 scattered locations ranging from 1 to 2,000 individuals (No. 7 on *Figure 179-M*). Although there is one location with 2,000 individuals, the remaining 60 locations number 225 or fewer

individuals each. Combined, however, these locations total about 5,678 individuals and comprise a *major population.* Whether this population is in a *key location* should be considered in the context of the conservation status of the other *major* and *important populations* in the San Juan Creek Watershed, as discussed in the next section.

- Middle Chiquita Canyon (between the treatment plant and Oso Parkway) supports a few scattered locations in association with intermediate mariposa lily in the area between the Narrows and Tesoro High School. Because these locations are small and apparently do not serve a linkage function between other larger populations, they do not comprise an *important population.*

An additional *important population* in a *key location* was identified in the Gobernadora sub-basin based on Spring 2003 surveys.

- Upper Gobernadora sub-basin supports 13 locations ranging from 5 to 513 individuals, and totaling 1,622 individuals (No. 8 on *Figure 179-M*). This population is considered an *important population* in a *key location* because it contributes to the geographic diversity and potentially is connected to any populations in Caspers Wilderness Park.

Biological Considerations

Many-stemmed dudleya is a small geophyte that grows in open-habitat soils associated with coastal sage scrub and grassland plant communities in southern California. It usually grows in shallow weathered cobbly loam or clay soils, and open barrens associated with rock outcrops and ridgelines.

Many-stemmed dudleya, a member of the Crassulaceae, is one of about 45 species within the genus *Dudleya* (Moran 1960; Hickman 1993). It is a member of the subgenus *Hasseanthus,* which consists of four or five species of small, vernal perennials that originate from a subsurface corm (Hickman 1993; Dodero 1995). All members of *Hasseanthus* are from California and northwestern Baja California, Mexico. Moran (1960), Munz (1974), and Hickman (1993) provide descriptions for members of *Hasseanthus*. Many-stemmed dudleya is most closely related to *Dudleya variegata,* another yellow-flowered species with fewer, shorter, and more flattened leaves. Cytological studies indicate that many-stemmed dudleya is the closest member to subgenus *Dudleya* of all *Hasseanthus* (Clausen *et al.* 1045; Uhl and Moran 1953). The meiotic chromosome number of many-stemmed dudleya is n=17, which is typical of most members of the genus (Uhl and Moran 1953).

Few studies have been conducted regarding the reproductive biology of many-stemmed dudleya. Many-stemmed dudleya generally produces yellow flowers in May and June (Munz 1974),

although flowering can take place as early as March in coastal locations (Caesares and Koopowitz 1989). During the late spring withering flowers produce five follicles. The seeds are about 0.8 mm long. One study at the University of California, Irvine (Caesares and Koopowitz 1989) found that the average flower produced about 12 seeds and that about 52 percent of these were viable under nursery conditions. Field observations indicated a significantly lower viability in populations on the University of California, Irvine campus. Dodero (1995) noted that most members of the Hasseanthus produce 1-15 flowers per inflorescence branch and that flowers generate from 0 to 27 seeds.

Blochman's dudleya (*Dudleya blochmaniae* var. *blochmaniae*), a related coastal species, appears to set a large numbers of seeds and has high germination in favorable years (F. Roberts, pers. comm. 2000). Initial germination can number in the thousands but the number of seedlings rapidly decline as the season progresses because of predation, dry conditions, or a poor germination site. Dodero (1995) observed one population of *D. variegata* noting that about 1000 individuals had sprouted in January 1991. A seven-week dry period followed and by May, only 15 individuals developed inflorescence which produced fruit. The actual number of plants in a typical year to reach maturity and bloom is only a small fraction of individuals that either germinated or leafed out early in the growing season (Dodero 1995). Many-stemmed dudleya appears less prolific than Blochman's dudleya; however, it appears that, like Blochman's dudleya and others in the *Hasseanthus* subgenus, only a fraction of the plants at a site actually bloom during any given year (F. Roberts, pers. comm. 2000).

The insect pollinators of many-stemmed dudleya have not been studied. Dodero (1995) noted that coastal species of *Hasseanthus* appear to be pollinated by honey bees (*Apis mellifera*), bumble bees (*Bombus* spp.), digger bees (Family Anthophoridae), bembicine wasp *(Stenolia duplicata* and *Bembix occidentalis*), metallic swat bees (Family Halictidae), bee flies (Family Bombyliidae), bee mimic flower flies (Family Syrphidae), and soft-winged flower beetles (*Dasytes* sp.). Although the individual flowers are small, members of this group frequently flower in large masses and thus attract insects.

Many-stemmed dudleya seeds are dispersed by wind and water with the aid of gravity. In related species, seeds are sprinkled on the ground and occasionally blown along the surface in strong winds (Dodero 1995).

Many-stemmed dudleya appear only to thrive in relatively thinly vegetated habitat such as clay barrens, sparse grasslands, and openings in coastal sage scrub; thus, it likely that competition plays a significant part in species dispersal. Dense non-native grass and forb species likely limit dispersal. In Blochman's dudleya, small, open shrubs have been seen to aid dispersal by providing shelter from environmental conditions and herbivores (F. Roberts, pers. comm. 2000); this may be the case for many-stemmed dudleya as well.

Many-stemmed dudleya is a low, vernal succulent perennial originating from a corm. The corm is a specialized underground caudex (stem) that is adapted to dry conditions. The corm is filled with water and starch that allow the plant to survive extended dry periods (Dodero 1995). Dead outer layers form a protective coating that reduces water loss (Dodero 1995). Dormant plants of the similar *D. blochmaniae* have been known to survive at least three years without water (Dodero 1995). Observations indicate that early rains followed by prolonged dry periods during midwinter may cause individuals to become dormant while extended periods of rain throughout the rainy season encourage flowering (Dodero 1995).

Protection Recommendations

- Protect the Chiquita Ridge *important population* and *key location* totaling about 1,349 individuals in approximately 18 discrete locations. This population includes four locations totaling 100 to 420 individuals each.
- Protect the Chiquadora Ridge *major population* and *key location* totaling about 8,620 individuals in approximately 47 discrete locations. This population includes 24 locations totaling 100 to 750 individuals each, with eight of these locations numbering more than 500 individuals.
- Protect the Cristianitos Canyon *major population* and *key location* extending from the southern portion of the Trampas Canyon sub-basin in the north, through the Cristianitos Canyon sub-basin south to the Talega development open space located in the San Clemente Watershed. This area supports the largest *major population* and *key location* in the subregion with approximately 34,137 individuals in about 164 discrete locations, or about 52 percent of the documented dudleya in the planning area. Ninety-two of the 164 locations totaling 14,341 individuals are already conserved within the Donna O'Neill Conservancy at Rancho Mission Viejo and Talega open space (including two locations of 2,000 individuals and a third of 1,175 individuals). Five of the 72 RMV locations number 1,100, 1,160, 1,500, 1,700 and 1,800 individuals each. An additional 11 locations range from about 400 to 976 individuals and 17 other locations support 100 to 355 individuals.
- Protect the Gabino and Blind Canyon/La Paz Canyon *major population* totaling about 4,100 individuals in approximately 12 locations. This population includes eight locations of 100 to 1,500 individuals.
- Maintain direct habitat connectivity between the remaining major populations to convey pollinators and allow for dispersal.
- Salvage and translocate all individuals from development areas, as feasible and appropriate, where impacts cannot be avoided.

- Protect the lower Chiquita *major population* and *key location*, totaling about 6,686 individuals in 41 locations. The locations in this population range from 1 individual to 1,330 individuals, with four locations supporting at least 500 individuals.
- Protect the upper Gobernadora *important population* and *key location*, totaling 1,622 individuals in 13 locations.

Management Recommendations

As part of the Adaptive Management Program, the following management activities for many-stemmed dudleya will be conducted:

- Control non-native invasive species such as cardoon, ryegrass, bromes, smooth cat's-ear (*Hypocharis glabra*), Crete hedypnois (*Hedypnois cretica*), and mustards.
- Manage grazing as part of the Adaptive Management Program in a manner that optimizes the control of non-native grasses (*Lolium*, *Bromus*, *Avena*) while allowing for proliferation of the native grasses and forbs.
- Protect many-stemmed dudleya populations from human disturbance such as hiking, mountain bikes and equestrian activities.

Restoration Recommendations

Translocation of many-stemmed dudleya has been demonstrated to be successful (*e.g.*, the San Joaquin Hills Tollroad [SR-73]) and thus is recommended for as measure for mitigating impacts to dudleya, as described below:

- Translocate salvaged many-stemmed dudleya to CSS and VGL restoration and enhancement areas where feasible and appropriate. Potential restoration and enhancement areas include Chiquita Ridge, Chiquadora Ridge, upper Cristianitos Canyon, upper Gabino Canyon, Blind Canyon, and the Radio Tower Road area (although there are no documented locations along Radio Tower Road, the area supports clay soils that might be suitable for the dudleya). Receiver areas should support clay, cobbly loam, or sandy clay loam soils suitable for many-stemmed dudleya.

- Salvage suitable topsoils from development areas where feasible and appropriate and transport to restoration areas. Salvaged topsoils may be used to create suitable many-stemmed dudleya habitat and may contain seed bank.

2.31 SOUTHERN TARPLANT

Species: Southern Tarplant (*Centromadia parryi* var. *australis*)
Federal Status: None
State Status: None
CNDDB Rank: G4?T2S2.1
CNPS Status: List 1B.1
Science Advisors Group: 3
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: Yes

CONSERVATION GOAL

1. Protect and manage *major* and *important populations* of southern tarplant in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects approximately 91 percent of individuals and 81 percent of locations of the southern tarplant.

2. Formulate a HRMP to provide for long-term protection and management of southern tarplant.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for southern tarplant is based both on overall conservation of locations and individuals and on the conservation of *major* and *important populations* in *key locations*. (Note that three locations totaling 3,105 individuals are mapped in existing orchard in Chiquita Canyon and are not a part of this analysis.)

The impact and conservation analysis for plants in general is complicated by the fact that plant locations are mapped in the GIS as polygons and in many cases a polygon can be both "conserved" and "impacted" by a "blind" GIS analysis if the polygon is partially in development areas and partially in the Habitat Reserve. In these cases the proportion of the polygon conserved and impacted in terms of individuals needs to be analyzed in more detail to determine if the location should be considered permanently conserved or impacted. For example, the edge of a polygon of 100 individuals may be impacted such that 10 of the 100 individuals are impacted, resulting in 90 percent conservation of the location. In this case, even though 10

individuals are impacted, the location, as a whole, would be considered conserved. The conservation analysis for the southern tarplant was conducted according to the following decision rules:

- Locations with fewer than 100 individuals must have at least 75 percent of the individuals in the Habitat Reserve or SOS to be considered conserved;
- If more than 25 percent of the individuals are impacted in locations supporting less than 100 individuals, the **entire location** and **all individuals** at the location are considered impacted (*i.e.*, the entire location is considered non-viable over the long term);
- For locations with more than 100 individuals, any location with at least 75 individuals in the Habitat Reserve would be considered conserved; and
- For the purpose of reporting all impacts to proposed Covered Species, for locations that are considered conserved, but for which some proportion of the location is impacted, the number of impacted individuals is still reported even though overall the location is considered conserved.

Because the GIS database includes polygon size and directly counted or estimated numbers of individuals in the polygon, the number of individuals impacted or conserved is estimated as a proportion of the polygon impacted (*i.e.*, the population density within the location is assumed to be uniform). For example, if a polygon is 1 acre in size and has 100 individuals, an impact to 0.1 acre of the polygon would impact 10 individuals.

A location is considered to be "impacted" if the entire location would no longer be viable as a result of the impact, even if some small number of individuals at the location remained in the Habitat Reserve. Locations that are partly impacted, but would remain viable according to the criteria described above are not considered "impacted" for the purpose of reporting impact and conservation statistics even if some proportion of the population is lost. The impacted individuals in these locations, however, are included in total number of individuals impacted. Individuals that are in the Habitat Reserve but part of the location considered impacted are also included in the total number of individuals impacted because it is assumed that the population at the location as a whole would not be viable over the long-term.

Subarea 1 Impacts

The proposed Covered Activities would result in permanent direct impacts to seven locations (19 percent) and 12,587 individuals (9 percent) (*Table 2-43* and *Figure 180-M*). With regard to impacts to *major/important populations*, four locations (14 percent) and 11,405 individuals (10 percent) of the Middle Chiquita *major population/key* location would be impacted. Two

individuals in the Middle Chiquita Canyon North of the Treatment Plant *important population* would be impacted by maintenance of the existing RMV water line. Because only two of 635 individuals in this population would be impacted the location is not considered "impacted" although the two individuals are included in the impact totals. The remaining impacts to three locations and 1,180 individuals would occur outside mapped *major/important populations*. It is important to note that the Ranch Plan GPA/ZC EIR MM 4.9-2 states that "Prior to issuance of a grading permit for Planning Area 2, the Project Applicant shall demonstrate to the satisfaction of the County's Director of Planning Services Department or his/her designee that impacts to the key location and major population of southern tarplant in the Chiquita sub-basin have been substantially avoided."

Subarea 1 Conservation

A total of 30 locations (81 percent) and 129,984 individuals (91 percent) would be conserved in the Habitat Reserve (*Table 2-43* and *Figure 180-M*). Within regard to conservation of *major/important populations*, 25 locations (86 percent) and 107,601 individuals (90 percent) in the Middle Chiquita/Narrows *major population/key location* would be conserved. All locations and individuals in the Gobernadora Creek and Tesoro Mitigation Site *major populations/key locations* would be conserved in the Habitat Reserve. Virtually 100 percent of the locations and individuals in the Middle Chiquita Canyon North of the Treatment Plant *important population* would be conserved in the Habitat Reserve.

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Little is known about southern tarplant, but several potential stressors on the species on RMV have been identified by T. Bomkamp (pers. comm. 2005), including:

- Non-native plants (wild radish, Italian ryegrass, and mustards)
- Alteration of soil/water relations
- Population fragmentation

Goals & Objectives

The overall goal is to protect and manage *major* and *important population* southern tarplant in the Habitat Reserve.

TABLE 2-43
SOUTHERN TARPLANT CONSERVATION ANALYSIS

	Total		Habitat Reserve				Impacts			
Population	**Locations**	**Individuals**	**Locations**	**%**	**Individuals**	**%**	**Locations[1]**	**%**	**Individuals**	**%**
Middle Chiquita Canyon/Narrows Major Population/Key Location	29	119,006	25	86%	107,601	90%	4	14%	11,405	10%
Gobernadora Creek Major Population/Key Location	1	10,000	1	100%	10,000	100%	0	0%	0	0%
Tesoro Mitigation Site Major Population/Key Location	1	11,000	1	100%	11,000	100%	0	0%	0	0%
Middle Chiquita Canyon North of Treatment Plant Important Population/Key Location	2	635	2	100%	633	100%	0	0%	2	0%
Outside Population	4	1,930	1	25%	750	39%	3	75%	1,180	61%
Grand Total	**37**	**142,571**	**30**	**81%**	**129,984**	**91%**	**7**	**19%**	**12,587**	**9%**

[1] Impacted locations refer to the number of locations that would be considered impacted and not viable over the long-term.

This goal will be met by the following objectives:

- Monitoring the populations in the Chiquita and Gobernadora sub-basins annually for the first five (5) years following initiation of monitoring once occupied areas are dedicated to the Habitat Reserve.
- Soil sampling taken during surveys to measure pH and to maintain a range of acceptable soil alkalinity.
- Control of non-native invasive species such as wild radish, Italian ryegrass, and mustards in southern tarplant areas to the extent necessary.
- Any populations and associated soils directly impact by development will be translocated to suitable receiver sites near where the impacts occur (see *Appendix I*).

Regional and Subregional Management Information Needs

Very little information is available for southern tarplant from which to base a management program. General regional and subregional management information needs that should be addressed at the regional level include:

- General life history of the species, including pollination, germination, dispersal, and soil/water relations; and
- The taxonomic relationship of different southern tarplant populations.

Regional and subregional management information needs at the Habitat Reserve level that could be addressed through the HRMP include the effects of invasive species on the southern tarplant and the appropriate range of soil alkalinity for the species. Also, the relationship between soil disturbances such as discing and dispersal of the tarplant could be explored.

Level of Management and Monitoring Priority – High

Because little is known about the variability of this species, the management and monitoring program for southern tarplant focuses on monitoring the population in the Chiquita and Gobernadora sub-basins annually for the first five (5) years following initiation of monitoring. These initial monitoring surveys would document the annual status and annual variability of the population and note general habitat conditions such as species composition, native/non-native ratio, and any observable disturbance conditions (*e.g.*, from cattle or discing). Because of this species affinity for alkalinity, soil samples should be taken during surveys to measure pH. Maintaining an appropriate range of soil alkalinity may be crucial for managing this species.

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted at both a species-specific and habitat-based level.

Monitoring Variables

Listed below are suggested species-specific and habitat-based monitoring variables for southern tarplant. The detailed monitoring program for southern tarplant will be developed by the Reserve Manager and Science Panel.

1. Number, size, variability and health status (*e.g.*, new vegetative growth, flowering) of southern tarplant.
2. Proportion of exotic plant species/native plant species in the vicinity southern tarplant.
3. Soil pH at occupied sites.
4. Condition of soils and evidence of soil disturbance such as discing or trampling by cattle.

Other Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

No specific management actions have been identified for the southern tarplant at this time. The annual monitoring program will be directly toward identifying stressors that may need management actions in the future, such as invasive species controls, adjustments of soil alkalinities, and control of cattle-related impacts.

In addition to the adaptive management of southern tarplant, populations in planned development areas will be translocated to suitable nearby receiver sites, as described in the Translocation, Propagation and Management Plan for Special-status Plants (*Appendix I*). This plan describes the various methods for restoration, including seed collection, receptor site selection and preparation, greenhouse propagation, translocation of natural populations, introduction of cultivated plants, direct seeding at translocation sites, and long-term maintenance/repair and monitoring.

Potential Target Studies

No target studies are identified at this time for the southern tarplant. Because little is known about this species, annual monitoring will be conducted to determine what stressors may be operating and what management actions may be required in the future. The Reserve Manager and Science Panel will determine future necessary management actions based on the information collected through the annual monitoring.

SPECIES ACCOUNT

Rangewide and Regional Status

Historically southern tarplant was known from 47 locations in San Diego, Orange, Los Angeles, Ventura and Santa Barbara counties, with four populations reported from Mexico.[1] Of the approximately 47 populations in the U.S., between 35 and 40 percent have been extirpated. Currently, Orange County contains the majority of the remaining populations (*Table 2-44*). In his status report, Roberts divided the populations into: "major" – over 8,000; "moderate" – between 1,000 and 5,000; and "small" – fewer than 1,000. Nine populations are reported by Roberts as moderate (over 1,000) and two populations, Talbert Marsh and Canada Chiquita are reported as major.

Of the extant populations, many are on protected lands, including the populations at Newport Ecological Reserve (estimated at 160,000 individuals by DuBois in 2002, pers. comm. 2002), Hellman Ranch (now in permanent conservation) (3,307 individuals recorded in 1996), Bolsa Chica Mesa (estimated 2,000 individuals in conservation/preservation areas based on surveys by LSA in 2001), Talbert Park (8,000+), Madrona Marsh, Banning Ranch (2,000+ individuals in 1999 recorded by GLA). Also, not included by Roberts are 11,000+ individuals in the Chiquita Tesoro Mitigation Site and an estimated 10,000+ individuals in the Ladera portion of the GERA mitigation area, both of which would be considered as "major" populations based upon the Roberts' convention.

Southern tarplant is a CNPS List 1B species with a Threat Code of "1." List 1B indicates that southern tarplant is rare, threatened or endangered throughout its range. Threat Code "1" indicates that the species is seriously endangered in California (over 80 percent of occurrences threatened/high degree and immediacy of threat). It is considered to be threatened by habitat fragmentation, urbanization, vehicles and foot traffic (CNPS 2001). Southern tarplant has no state or federal status.

[1] Much of the information regarding status of the southern tarplant has been obtained from a report prepared by Fred Roberts for the Bolsa Chica Land Trust in 2000, entitled *Southern Tarplant (Hemizonia parryi ssp. australis) on the Bolsa Chica Mesa, Orange County, California.* This report was submitted to the Coastal Commission and is part of the public record for the Bolsa Chica project.

TABLE 2-44
REGIONWIDE SUMMARY: 2002 STATUS OF SOUTHERN TARPLANT WITHIN THE KNOWN RANGE IN SOUTHERN CALIFORNIA

Regional Major Population Area(s) in Orange County	Southern Tarplant Population: Number of Counted/Estimated Plants
Rancho Mission Viejo	145,600
Newport Backbay	Estimated 160,000*
Talbert Park	8,000
Banning Ranch	2,000+
Hellman Ranch	3,300
Bolsa Chica	2,000+
Subtotal:	***~320,900***
Other Important Populations	
Madrona Marsh, Los Angeles County	Estimated 1,000 to 5,000
APPROXIMATE TOTAL PLANTS	**325,900**

Note:* The Newport Backbay population is a preliminary rough estimate and is subject to field verification by T. Bomkamp.

Subregional Status

Southern tarplant is limited to two sub-basins in the planning area (*Figure 180-M*). The largest population is in Chiquita Canyon and, including the Tesoro mitigation site, has been estimated in recent years to number more than 120,000 individuals (there is substantial year-to-year variation in population sizes of this opportunistic species). A large population numbering 10,000+ individuals occurs on the GERA site in Gobernadora. The Chiquita locations comprise two *major populations* located in "The Narrows" area and the Tesoro site southwest of the wastewater treatment plant, respectively, and one *important population* located just north of the treatment plant. The GERA population also is a *major population.* All the populations are *key locations*.

Within the subregion, this species is typically associated with wet meadow areas that exhibit mildly alkaline/saline soils dominated by saltgrass (*Distichlis spicata*), Mexican rush (*Juncus mexicanus*), yerba mansa (*Anemopsis californica*), shining peppergrass (*Lepidium nitidum*), dwarf peppergrass (*Lepidium latipes*), and alkali plantain (*Plantago elongata*). In Chiquita Canyon this species is sometimes associated with or in close proximity to Coulter's saltbush. More than any of the other special-status plant species under consideration, this species is well

adapted to disturbance associated with flood events and appears to benefit from occasional disking or other soil-disturbing activities.

The following provides a more detailed description of the southern tarplant in the planning area and identifies *major* and *important populations*:

- Middle Chiquita north and south of the "Narrows" supports about 35 mapped locations ranging up to about 30,000 individuals in the largest (No. 1 on *Figure 180-M*). Estimated discrete locations numbering 7,000, 7,500, 10,000, 20,000, and 30,000 individuals, respectively, are located west of the creek. Locations east of the creek are more disparate and smaller, with the largest numbering about 750 individuals. This is a *major population* and the portion of the population west of the creek is a *key location*.
- Middle Chiquita northwest of the wastewater treatment facility supports three locations west of the creek numbering 3,000, 700 and 40 individuals, respectively (No. 2 on *Figure 180-M*). These locations comprise an *important population* in a *key location.*
- The Tesoro High School mitigation site in Lower Chiquita supported approximately 1,100 individual in 2000, 6,000 individuals in 2001 and 11,000 individuals in 2002 as determined during monitoring of the population (No. 3 on *Figure 180-M*). This population was introduced to the site in Fall of 1999 as mitigation for impacts to the tarplant at the High School site. This population appears to be self-sustaining and has increased for three consecutive years and should now be considered a *major population* in a *key location.*
- Further south in lower Chiquita Canyon there is one population numbering about 400 individuals. This population is relatively small for this species, but should be considered part of the Tesoro mitigation site *major population*.
- Portions of the Ladera Ranch Mitigation site in GERA, on the west side of the Gobernadora Creek "spur" that enters the mitigation area, supports an estimated 10,000+ individuals that have colonized the mitigation areas (No. 4 on *Figure 180-M*). This population should now be considered a *major population* in a *key location.*
- Finally, a wetland seep between Gobernadora and Chiquita supports a few hundred individuals during optimal years. While not large enough to be considered a major population, this population may potentially be an *important population* in a *key location.*

Biological Considerations

Southern tarplant is an annual member of the sunflower family (Asteraceae) that occurs in vernal pools, alkali playas, alkali grasslands, and disturbed areas. The stiff bristly stems are simple or

branched and can reach heights of up to 0.7 m. The lower leaves vary from 5 to 20 cm, and are linear-lanceolate and deeply divided. The upper leaves are linear and are spine-tipped. The infloresence can vary from open to dense. The ray flowers number from 9 to more than 30 and the ligule is 2 to 6 mm, 2 lobed, and yellow (sometimes becoming red). The species is characterized by many disk flowers with yellow corollas and brown or black anthers.

Southern tarplant typically flowers as early as June and sometimes into October, with peak flowering varying according to seasonal rainfall patterns.

Although little is known of the biology of the southern tarplant, it appears to respond well to translocation, as exhibited by the Tesoro mitigation site and it establishes well in highly disturbed areas, based on its abundance in cultivated and grazed areas of Chiquita Canyon.

Protection Recommendations

- Minimize impacts to the *key location* of southern tarplant west of Chiquita Creek in Middle Chiquita Canyon to the maximum extent feasible. Minimize impacts to the remainder of the *major population* in Middle Chiquita Canyon. Mitigate impacts to southern tarplant in a manner similar to the Tesoro mitigation project (ongoing mitigation projects in Chiquita Canyon have demonstrated over three successive years that this plant can be readily propagated from seed).
- Protect the *major population* of southern tarplant in a *key location* in Lower Chiquita Canyon.
- Protect the *major population* of southern tarplant totaling 10,000+ individuals located in GERA.

Management Recommendations

- Implement a management program for southern tarplant, including control of non-native invasive species, management of grazing and minimization of human access and disturbance as part of the Adaptive Management Program**.**

Restoration Recommendations

- Translocate salvaged southern tarplant to suitable restoration and enhancement areas in the Chiquita sub-basin. Receiver areas should support alkali soils suitable for the species and should be placed in locations that maximize connectivity and genetic exchange.

2.32 THREAD-LEAVED BRODIAEA

Species: Thread-leaved Brodiaea (*Brodiaea filifolia*)
Federal Status: Threatened
State Status: Endangered
CNDDB Rank: G2S2.1
CNPS Status: List 1B.1
Science Advisors Group: 3
Covered Species: Yes
Focal Monitoring Species: No
Planning Species: Yes

CONSERVATION GOAL

1. Protect and manage *major* and *important populations* of thread-leaved brodiaea in the Habitat Reserve.

CONSERVATION STRATEGY

1. Create a permanent subregional Habitat Reserve that protects approximately 98 percent of individuals and 61 percent of locations of the thread-leaved brodiaea.

2. Formulate a HRMP to provide for long-term protection and management of thread-leaved brodiaea.

HABITAT AND SPECIES CONSERVATION AND IMPACTS ANALYSIS

The conservation analysis for thread-leaved brodiaea is based both on overall conservation of locations and individuals and on the conservation of *major* and *important populations* in *key locations*. Habitat fragmentation and connectivity and the role of pollinators also are considered in the conservation analysis.

The conservation analysis also accounts for the following avoidance/mitigation measure required by the Ranch Plan GPA/ZC EIR and the SAMP USACE Permit Special Conditions for avoidance of thread-leaved brodiaea:

- MM 4.9-20. Prior to issuance of a grading permit for Planning Area 8, the Project Applicant shall demonstrate to the satisfaction of the County's Director of Planning Services Department or his/her designee that the four known locations of thread-leaved brodiaea that constitute an important population in the Talega sub-basin are protected.

- SAMP USACE Permit Special Condition I.A.3. The permittee shall avoid all impacts to the thread-leaved brodiaea (a threatened facultative wetland plan) in a major population in a key location (as described in the Southern Planning Guidelines) on Chiquadora Ridge as part of construction for Planning Area 2.

Subarea 1 Impacts

The proposed Covered Activities would result in impacts to 13 locations (39 percent) and 147 individuals (2 percent), of the thread-leaved brodiaea (see *Figure 173-M*).

With regard to *major population/important populations*, the following impacts would occur:

- four locations and 85 individuals in the Chiquadora Ridge *major population/key location*;
- six locations and 59 individuals in the Cristianitos Canyon *important population* in potential orchards in PA 6; and

Impacts to brodiaea mapped outside of the *major/important populations* include three locations supporting three individuals on the Prima Deshecha Landfill GDP site.

As noted above, the impact estimate provided above assumes avoidance of the large Chiquadora Ridge population of 2,000 individuals through project site design pursuant SAMP USACE Permit Special Condition I.A.3. Potential impacts in PA 8 are addressed by the GPA/ZC EIR MM 4.9-20 stated above. Some additional avoidance of impacts to the Cristianitos Canyon *important population* may occur in PAs 6 in siting of the orchards.

Subarea 1 Conservation

A total of 20 locations (61 percent) and 9,248 individuals (98 percent) of thread-leaved brodiaea would be conserved in the Habitat Reserve. Conservation of *major/important populations* would include:

- all six locations and all 6,105 individuals in the Cristianitos Canyon/Lower Gabino Canyon *major population;*
- seven locations (54 percent) and 341 individuals (85 percent) in the Cristianitos Canyon *important population;*
- all four locations and all 288 individuals in the East Talega *important population*;

- one location (100 percent) and 80 individuals (100 percent) in the Lower Arroyo Trabuco *important population*;
- one location (100 percent) and 183 individuals (100%) in the Middle Gabino *important population*; and
- one location (100 percent) and 250 individuals (100 percent) in the Trampas Canyon *important population.*

Protection of the vast majority of the brodiaea is important for conservation of the species, but maintaining adequate adjacent habitat to support pollinators of this species also is important. The Habitat Reserve would conserve adequate habitat in the vicinity of the conserved brodiaea populations and provide for habitat connectivity between populations (see *Figure 173-M*). Pollinator studies of the Arroyo Trabuco and Cristianitos Canyon brodiaea populations conducted by GLA have determined that burrowing bees (family Anthrophoridae), sweat bees (family Halictidae) and flower-loving flies (family Syrphidae) are the most common pollinators of thread-leaved brodiaea in these two areas (GLA, unpublished data). Their data also show that grading for the Arroyo Trabuco Golf Course, for example, has not had an adverse effect on pollination of brodiaea because adequate habitat to support the pollinators was conserved as part of the project open space. Sweat bees do not travel more than about 328 feet (100 m) from nest sites to forage (Roubik 1989) and burrowing bees are expected to have similar size home ranges. Therefore, as long as natural open space is maintained within about 328 feet of brodiaea populations, effects on pollinators should be minimal.[2] All three conserved populations in the Habitat Reserve easily achieve this threshold.

Habitat connectivity and contiguity allowing for potential genetic exchange between populations via pollinators in the Habitat Reserve and other localities will be maintained through intact habitat blocks and robust habitat linkages, including the Arroyo Trabuco and Chiquadora Ridge populations via habitat linkages B, D, and G and between the Chiquadora Ridge and Trampas Canyon populations via linkages G and J. However, the existing distances between populations are substantially larger than the apparent dispersal capability of the documented likely pollinators; movements of more than 1,000 feet by sweat bees or burrowing bees likely are rare if they occur at all. The existing minimum distance between the Arroyo Trabuco and Chiquadora Ridge populations is about 17,000 feet and between the Chiquadora Ridge population and the Trampas Canyon population, the nearest population to the south, is about 14,000 feet; both well beyond the dispersal distance of the likely pollinators. Thus, although the Habitat Reserve would maintain dispersal habitat for potential pollinators, under existing conditions the Arroyo Trabuco and Chiquadora Ridge populations may be effectively isolated.

[2] The reader is referred to Cane, J.H. 2001. Habitat fragmentation and native bees: a premature verdict? Conservation Ecology www.consecol.org/vol5/iss1/art3 for a discussion of native bee persistence in habitat fragments of "modest size." Cane concludes that networks of even small reserves can provide for "considerable pollinator diversity and the ecological services pollinators provide."

ADAPTIVE MANAGEMENT PROGRAM

Stressors

Management of thread-leaved brodiaea is an important part of the conservation strategy. Several known or potential environmental stressors of brodiaea were identified in *Part I, Chapter 7*:

- Non-native plants (artichoke thistle, Italian ryegrass, bromes, wild oats and mustards);
- Cattle-related impacts
- Human activities (hiking, mountain bikes, equestrian)

The main stressor on thread-leaved brodiaea in the Subregion likely is invasive, non-native species such as artichoke thistle and non-native grasses that compete with the brodiaea for space, nutrients and water. For example, the Arroyo Trabuco brodiaea population appears to have been particularly invaded by non-native species such as ryegrass since cattle have been taken off the area in conjunction with the dedication of Ladera Ranch Open Space. Cattle-related impacts and human activities may include trampling and crushing of soils and browsing of vegetation stalks by cattle during the brodiaea growing season.

Goals and Objectives

The overall goal is to protect and manage *major* and *important population* thread-leaved brodiaea in the Habitat Reserve.

This goal will be met by the following objectives:

Objective 1: Monitoring *major* and *important populations* annually for the first five (5) years following initiation of monitoring once occupied areas are dedicated to the Habitat Reserve.

Objective 2: Recording observations of pollinators, soil conditions (*e.g.*, surface disturbances, cracking, etc.) and other evidence of disturbance (*e.g.*, deep hoof prints, human activities).

Objective 3: Monitoring and control of non-native invasive species such as wild radish, Italian ryegrass, and mustards in thread-leaved brodiaea areas to the extent necessary.

Objective 4: Translocating any populations and associated clay topsoils directly impacted by development to suitable receiver sites where CSS/VGL restoration is underway (see *Appendix I*).

Regional and Subregional Management Information Needs

Some scientific information is available for thread-leaved brodiaea from which to base a management program, but more study of most aspects of this species' autecology are needed (see USFWS 2004d). General regional and subregional management information needs that should be addressed at the regional level include:

- General life history of the species, including pollination, dispersal, and particularly year-to-year variability in germination (*e.g.*, does variability relate to genetic polymorphisms within populations that are sensitive to different environmental cues such as rainfall timing or amounts?).

- The taxonomic relationship among different thread-leaved brodiaea populations and with other brodiaea species where hybridization is known to or may occur, such as with *B. orcuttii, B. terrestris* and *B. jolonensis* (see CNPS 2005; Recovery Workshop Seminar 2005; USFWS 1998d).

Regional and subregional management information needs at the Habitat Reserve level that could be addressed through the HRMP include the effects of invasive species on the thread-leaved brodiaea and the relationship between cattle, fire and brodiaea. *Part I, Chapter 7, Section 7.12.2* identifies three fundamental questions that could be tested through experimental treatments:

1. What are the cattle-relate impacts on brodiaea during the growing season?

2. What is the effect of prescribed burns on brodiaea during the growing season?

3. What is the effect of combined burning and grazing (*e.g.*, fall burn followed by winter/spring grazing)?

Level of Management and Monitoring Priority – High

Because little is known about the year-to-year variability of this species, the management and monitoring program for thread-leaved brodiaea focuses on monitoring the *major* and *important populations* annually for the first five (5) years following initiation of monitoring in areas upon their dedication to the Habitat Reserve. These initial monitoring surveys would document the annual status and annual variability of the population and note general habitat conditions such as species composition, native/non-native species ratio, and any observable disturbance conditions (*e.g.*, from cattle or recreational activities).

Level of Monitoring (*e.g.*, Species-specific, habitat, landscape, combination)

Monitoring will be conducted at both a species-specific and habitat-based level.

Monitoring Variables

Listed below are suggested species-specific and habitat-based monitoring variables for thread-leaved brodiaea. The detailed monitoring program for thread-leaved brodiaea will be developed by the Reserve Manager and Science Panel.

1. Number, size, variability and health status (*e.g.*, new vegetative growth, flowering) of thread-leaved brodiaea.
2. Proportion of exotic plant species/native plant species in the vicinity thread-leaved brodiaea.
3. Observed pollinators.
4. Condition of soils and evidence of soil disturbance such as cracking and trampling/crushing by cattle or humans.

Other Abiotic Monitoring Variables

1. Climate
2. Weather
3. Air quality
4. Water quality and runoff

Management Actions

Management actions for thread-leaved brodiaea would focus on controlling invasive species which compete with the brodiaea for space, nutrients and water, including, but not limited to, artichoke thistle, ryegrass, bromes, wild oats, and mustards. The invasive effects of non-native species can be exacerbated by over-grazing and frequent fire.

Timed-grazing and prescribed burns are the most efficient forms of exotics control, especially where non-native annual grasses such as bromes, wild oats and wild ryes are widespread and for which site-specific, selective manual treatments are not very effective. Herbicide treatment of artichoke thistle has been a successful control method on RMV. A potential limitation of timed-grazing as a management tool is that peak production of annual grasses on RMV coincides with the early growing season of thread-leaved brodiaea and the fleshy stalks are likely to be grazed before they have a chance to flower and set seed. Likewise, a prescribed burn in the spring would also burn stalks before they mature. Given that the locations being managed are by far the two largest populations in the Habitat Reserve, untested management actions that may depress

productivity in these locations even temporarily may not be desirable. The smaller populations may be more suitable for testing alternative management actions, but the Reserve Manager and Science Panel will need to weigh the risks and benefits of testing management actions on these populations.

The coordinated GMP is expected to have a net benefit on the brodiaea through controls on non-native species; however, the effects of grazing, positive or negative, need to be assessed through monitoring of the brodiaea populations.

The management recommendations for the two *major populations* are different because the practical long-term management opportunities are different.

1. For the Chiquadora Ridge population, timed-grazing is the recommended management approach and essentially would continue the existing grazing pattern. The "Chiquita Pastures" are grazed from late spring through September, with the focus of grazing on the cultivated barley fields and low levels of grazing in the adjacent natural vegetation. Grazing in this time period would allow the thread-leaved brodiaea on Chiquadora Ridge to bloom and set seed before cattle are introduced. Furthermore, because this location is within a few hundred feet of the eastern edge of planned development in lower Chiquita Canyon, it is unlikely that prescribed burns would be an acceptable management tool for exotic species (although occasional wildfires in the area may benefit the brodiaea over the long-term).

2. For the lower Cristianitos Canyon population, grazing has not been observed to be a problem for the brodiaea, but because cattle are in the area from October through May during the period of peak annual grass production and the period brodiaea are growing and flowering, populations will be monitored to ensure that grazing is not adversely affecting the brodiaea. Furthermore, given that the existing population appears to be healthy under the existing grazing regimen, the benefits of grazing under the present conditions and the future GMP may outweigh any negative impacts. Removal of grazing from the area may allow exotics to proliferate, with a consequent net loss of the brodiaea population. It is recommended that grazing continue in this area and that the population be monitored annually for at least the first five years of the program to determine if there are negative trends in the population and, at least anecdotally, if there is any evidence that cattle are causing harm to the population. If grazing appears to be having a negative impact on the brodiaea, protection of the area from grazing, such as exclosures, and using some alternative method of invasives control may be necessary. This area may be suitable for prescribed burns in the future because it is more remote from planned development. However, before any active alternative management actions are undertaken, it is recommended that an experimental grazing/burn study, as described

below, be carried out on smaller populations of brodiaea before being applied to this *major population.*

In addition to grazing, prescribed burns and selective herbicide treatments, various other methods to control invasive species may be implemented, such as mowing and manual removal (weed-whacking and hand-pulling).

Besides management of conserved populations, translocation and propagation of thread-leaved brodiaea would be conducted to the extent feasible and appropriate, as determined by the Reserve Manager and Science Panel, to expand the existing conserved locations. Potential restoration and enhancement areas would be focused in areas targeted for CSS and CSS/VGL restoration in Subarea 1, including Chiquita Ridge, and Chiquadora Ridge. The Translocation, Propagation and Management Plan for Special-status Plants (*Appendix I*) describes the various methods for restoration of thread-leaved brodiaea, including pre-translocation monitoring, seed collection, receptor site selection and preparation, translocation of natural populations, direct seeding at translocation sites, and long-term maintenance/repair and monitoring. The methods ultimately selected would depend on the extent of the impact, conditions associated with the affected populations, habitat conditions associated with individuals determined suitable for translocation, and site conditions associated with the receptor sites. Conserved and translocated brodiaea populations will be regularly monitored, as described in *Part I, Chapter 7, Section 7.12.2* and in the Translocation, Propagation and Management Plan for Special-status Plants.

Part I, Chapter 13, Section 13.2.3 and the HRMP described in *Part I, Chapter 7* also address edge effects, including potential effects from herbicides, pesticides and fertilizers. Application procedures for these substances in landscaped areas located adjacent to the Habitat Reserve will be managed using standard Integrated Pest Management protocols such as those developed for the Arroyo Trabuco Golf Course. IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural and mechanical practices, and use of resistant varieties. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment. With regard to pesticides and herbicides, for example, in selection and use of a chemical substance IPM considers the **(1)** efficacy of the material; **(2)** risk to the environmental in terms of toxicity and exposure; **(3)** factors influencing chemical fate and exposure, including solubility, soil affinity, soil type, evaporation loss, groundwater, depth to groundwater and distance to surface water, and degradation; **(4)** restriction on chemical in sensitive areas; and **(5)** use of windfoils to eliminate chemical drift during application. It should be noted that potential indirect effects on the Arroyo Trabuco population has already been addressed under the Section 7 consultation for the Arroyo Trabuco Golf Course, including a monitoring program and the study of pollinators described above.

Potential Target Studies

Two potential target studies are identified at this time for the thread-leaved brodiaea:

- An experimental adaptive management study of grazing and prescribed burning described in *Part I, Chapter 7, Section 7.12.2*; and

- Additional research on pollinators as an extension of the study conducted for the Arroyo Trabuco Golf Course.

SPECIES ACCOUNT

Rangewide and Regional Status

In the Transverse Ranges, the thread-leaved brodiaea is known to occur in the foothills of the San Gabriel Mountains, east to Arrowhead Hot Springs in the San Bernardino Mountains. Populations are also found in southern Orange, western Riverside, and northwestern San Diego counties. In 1998, the USFWS estimated that 50 extant populations occurred in southern California, with the majority consisting of sites supporting less than 2,000 plants (USFWS 1998d). Since 1998, some of these populations have been extirpated, while additional populations have been identified in Riverside, Los Angeles, San Diego and Orange counties. The exact number of extant populations is not known, but it is likely between 40 and 50. Most of these additional populations occur in northwest San Diego County. Similarly, in 1998 the USFWS estimated that 338 ha (835 ac) of occupied habitat occur within the range of this species; however, based upon extirpations and additional occurrences identified between 1998 and 2001, an estimate of somewhat less than 338 ha (835 ac) is more likely. As shown in *Table 2-45*, the largest locality is found in San Marcos in northern San Diego County with an estimated range of 201,200 to 342,000 flowering stalks, while the largest population in Riverside County is found on the Santa Rosa Plateau with over 30,000 flowering stalks estimated to occur on the ecological reserve. The largest extant populations in Orange County occur at Aliso-Woods Regional Park, consisting of several thousand plants and on Rancho Mission Viejo (see below). The largest population in Los Angeles County occurs in Glendora, containing an estimated 2,000 to 3,000 flowering stalks.

In western Riverside County this species is known to occur on the Santa Rosa Plateau; Upper Salt Creek, west of Hemet; the San Jacinto Wildlife Area (two localities); Perris, east of the Perris Valley Airport (approximately 5,000 flowering stalks); south of San Jacinto Road (<500 individuals); and in Railroad Canyon where approximately 3,000 plants are associated with *Sporobolus*-dominated alkali grassland.

TABLE 2-45
REGIONWIDE SUMMARY: 2002 STATUS OF THREAD-LEAVED BRODIAEA WITHIN KNOWN RANGE IN SOUTHERN CALIFORNIA

Regional Major Population Area(s)	Brodiaea Population: Number of Counted/Estimated Plants
San Marcos and Northern San Diego County Excluding Camp Pendleton	350,000 to 400,000 (estimated)[1] 201,200 (estimated)[2]
Camp Pendleton and San Onofre State Park	5,000 (estimated)
San Jacinto River and Hemet, Riverside County	10,000
Santa Rosa Plateau, Riverside County	30,000
Los Angeles County (Glendora and San Dimas)	2,000 to 3,000
Orange County	16,450-18,450
APPROXIMATE TOTAL PLANTS REGIONWIDE	**264,450 to 466,450**
Orange County Population Summary	
Rancho Mission Viejo	Approximately 9,300
Aliso-Woods Park	Approximately 2,000 to 3,000
Talega and Forster Ranch Developments	5,000 to 6,000
Arroyo Trabuco Golf Course	80
ORANGE COUNTY SUMMARY	**16,450 to 18,450+**

Notes:

[1] USFWS 1998d

[2] SANDAG GIS Database 2000. Locations of Sensitive Species Sitings (Sue Carnavale, pers. comm.)

In Orange County, populations are known from Aliso-Woods Canyon Regional Park (several thousand), Rancho Mission Viejo (4,500 to 5,500 flowering stalks), Forster Ranch (approximately 5,000 flowering stalks associated with a restoration/relocation program), Prima Deshecha Landfill, and the Talega Development where one small population will be preserved in open space and a second population is slated for translocation.

Thread-leaved brodiaea is state-listed endangered, federally-listed threatened and is a CNPS List 1B species with a Threat Code of "1." List 1B indicates that thread-leaved brodiaea is rare, threatened or endangered throughout its range. Threat Code "1" indicates that the species is seriously endangered in California (over 80 percent of occurrences threatened/high degree and immediacy of threat). It is considered to be seriously threatened by residential development, agriculture, mowing and discing for weed suppression and fire control, grazing, off-road vehicles, other recreational activities, military training and competition from non-native species (CNPS 2001; USFWS 2004d). At the time of the brodiaea's federal listing in 1998 the USFWS

(1998d) estimated that 50 extant populations occurred in southern California, with the majority consisting of sites supporting less than 2,000 plants. In 2004, in the proposed critical habitat designation, the USFWS (2004d) estimated 84 extant populations.

Subregional Status

Thread-leaved brodiaea is found in eight general locations in the planning area (*Figure 173-M*), excluding the translocated population at Forster Ranch: Chiquadora Ridge; Trampas Canyon sub-unit; Cristianitos Canyon; lower Cristianitos Canyon/lower Gabino Canyon; middle Gabino Canyon; Talega ridgeline east of Northrop Grumman; and just east of Trabuco Creek in the Arroyo Trabuco Golf Course project area. The approximately 9,540 flowering stalks known from the planning area, (excluding Forster Ranch) are a small percentage (about 2-3 percent) of the thread-leaved brodiaea range-wide, but represent an important geographic segment of the species. However, conservation of this species is most dependent on protection of the two largest concentrations in north San Diego County and western Riverside County (see *Table 2-45*).

Within the planning area, this species is associated with purple needlegrass grasslands and grassland/sage scrub ecotone areas. In many instances, the needlegrass grasslands exhibit low densities of native bunch grasses and support non-native English ryegrass (*Lolium multiflorum*) and cardoon (*Cynara cardunculus*). In all cases, the brodiaea is associated with clay soils; often times that occur as lenses in cobbly loams, clay loams or sandy clay loams. In such instances, the brodiaea is restricted to the clay lenses.

The following summarizes the size and distribution of thread-leaved brodiaea within RMV and identifies *major* and *important populations* and *key locations*:

- About 13 separate scattered locations occur in the Cristianitos sub-basin, ranging from one to 120 flowering stalks (No. 1 on *Figure 173-M*). These are *important populations* for conservation of the brodiaea in the subregion because they potentially provide connectivity between offsite locations to the south in San Onofre State Park and Camp Pendleton with planning area locations to the north (*e.g.,* Chiquadora Ridge). These locations could also potentially link planning area locations to occurrences to the west including the Donna O'Neill Conservancy lands, ultimately linking to the offsite Talega Development and Forester Ranch development occurrences to be preserved in open space. In addition, they occur in an area dominated by clay soils, and thus there is an opportunity to expand the population in this area through adaptive management. Some subset of these locations comprise *key locations*, but there is flexibility in which locations need to be protected to maintain population viability in the area.

- A large complex of six discrete locations totaling approximately 6,100 flowering stalks occurs on the hill outcrop adjacent to the mine pits in the southern portion of Cristianitos Canyon on the boundary between the Cristianitos and Gabino and Blind Canyons sub-basins (No. 2 on *Figure 173-M*). As one of the two largest populations on RMV, this is a *major population* in a *key location.*
- Four locations totaling 288 flowering stalks occur in the Talega sub-basin on the mesa east of Northrop Grumman near the boundary with the Gabino and Blind canyons sub-basins (No. 3 on *Figure 173-M*). Although not a large population, these locations may be considered an *important population* because they potentially contribute to connectivity and genetic exchange among the various nearby locations in the subregion.
- Five locations occur on Chiquadora Ridge southeast of the treatment plant, including the eastern portion of the Chiquita sub-basin and the western portion of the Gobernadora sub-basin (No. 4 on *Figure 173-M*). Four of the five locations are small (73, 2, 3 and 7 flowering stalks), but the easternmost location on the ridge has about 2,000 flowering stalks. These five locations together comprise a *major population* and one of the two largest on RMV.
- The largest location of this population also is in a *key location* for conservation of this species in the subregion because this location is on Chiquadora Ridge, a major landscape feature that serves an important habitat connection function, and it is the only *major population* in the San Juan Creek Watershed.
- One location of about 80 flowering stalks occurs on a slope east of Trabuco Creek in open space associated with the golf course project (No. 5 on *Figure 173-M*). This disjunct location is an *important population* because as the westernmost occurrence it contributes to the geographic diversity of the species in the subregion.
- One location of about 250 flowering stalks in the southeastern portion of the Trampas Canyon subunit of the Central San Juan and Trampas Canyon sub-basin (No. 6 on *Figure 173-M*). This location is an *important population* because it contributes to the geographic diversity of the species in the subregion.
- One location of about 183 flowering stalks occurs in the western portion of the middle Gabino subunit of the Gabino and Blind Canyons sub-basin (No. 7 on *Figure 173-M*). This location is an *important population* because it contributes to the geographic diversity of the species in the subregion.

Other locations of thread-leaved brodiaea in the planning area include:

- The Forster Ranch population, which is a translocated/restored population. This population numbered about 5,000 flowering stalks in 2001. Only a few brodiaea flowered in 2002, attributed to the poor rainfall.
- One location (no size estimate) occurs on the Donna O'Neill Conservancy at Rancho Mission Viejo.
- Two locations where 100 and 150 plants were detected, respectively, occur within the planned Talega Development (USFWS 2001e). These locations will be lost in association with the Talega Development, but corms excavated from these locations will be translocated to help offset this loss (USFWS 2001e). Another location of about 300 flowering stalks occurs in designated Talega Open Space.
- Three small populations with three flowering stalks in the Prima Deshecha Landfill GDP area (Bramlet 2004).

There is also a CNDDB record for a small to moderate size population in Caspers Wilderness Park (not shown in *Figure 173-M*) that has ranged in documented size of 24 flowering stalks in 1989 to 850 stalks in 1995.

Biological Considerations

Thread-leaved brodiaea is a perennial geophyte that has a corm with a dark brown, fibrous tunic. The flowering stalk is 20.3-40.6 cm (8-16 in) high and the narrow leaves are generally shorter than the flowering stem. The flowers are dark blue to violet and have six perianth segments. There are three stamens and three staminodia (sterile stamens), which are narrow and thread-like in each flower.

Thread-leaved brodiaea is one of 13 species of the genus *Brodiaea*, a genus largely restricted to California (Hickman 1993). *Brodiaea* is variously assigned to the family Liliaceae, or the segregate families Alliaceae or Themidaceae (Dahlgren *et al.* 1985; Hickman 1993; Fay and Chase 1996). Thread-leaved brodiaea belongs to the subgenus *Filifoliae*, a small group of three species (Niehaus 1971). The thread-like staminodia are the feature which distinguishes this species from other related brodiaea occurring in southern California. Its closest relative is Orcutt's brodiaea, a species thread-leaved brodiaea occurs sympatrically within several locations. Thread-leaved brodiaea reportedly hybridizes with *B. orcuttii* and *B. terrestris*, but these species have different chromosome numbers, so hybridization events should be rare (chromosome counts need to be confirmed, sources are inconsistent (CNPS 2001; Recovery Workshop Seminar 1995; USFWS 1994b).

Unlike many species of *Brodiaea*, members of the subgenus *Filifoliae* do not reproduce vegetatively and rely on seed germination (Niehaus 1971). Thread-leaved brodiaea blooms from March through June (CNPS 2001). The bell-shaped flowers are violet in color (Munz 1974). *Brodiaea* are self-incompatible and pollination between individuals must take place in order to produce seed (Niehaus 1971). Niehaus (1971) found that a broad spectrum of insects visit Brodiaea flowers but only tumbling flower beetles (Mordellidae) and sweat bees (Helictidae) were found to transport pollen between flowers. On the Santa Rosa Plateau, Gary Bell found that native bees were faithful to specific brodiaea species but the European honeybee was not (G. Bell, the Nature Conservancy, *pers. comm.* 1997, cited in U.S. Fish and Wildlife Service 1998; S. Moray, California Department of Fish and Game Endangered Plant Program, *in litt.* 1995). Pollinator studies of the Arroyo Trabuco and Cristianitos Canyon brodiaea populations conducted by GLA have determined that burrowing bees (family Anthrophoridae), sweat bees (family Halictidae) and flower-loving flies (family Syrphidae) are the most common pollinators of thread-leaved brodiaea in these two areas (GLA, unpublished data). Their data also show that grading for the Arroyo Trabuco Golf Course, for example, has not had an adverse effect on pollination of brodiaea because adequate habitat to support the pollinators was conserved as part of the project open space. Sweat bees do not travel more than about 328 feet (100 m) from nest sites to forage (Roubik 1989) and burrowing bees are expected to have similar size home ranges.

Sexual reproduction may occur in "pulses" when the dominant cover of European annuals is reduced as a result of fire suppression (S. Moray, *in litt*., 1995).

Upon maturity, the ovaries three lobes split, revealing many small (2 to 2.5 mm long) black seeds (Munz 1974). The seeds are then dispersed as wind rattles the capsules and releases the seeds (Smith 1997).

The annual growth cycle of this species begins with the above-ground appearance of a few grass-like leaves from each corm. The corms function similarly to bulbs in storing water and nutrients during the dormant season (Smith 1997). Individuals require several years to mature and frequently only a fraction of the mature individuals flower in a given year: a field study at the Santa Rosa Plateau Preserve revealed an 8:1 ratio of non-flowering corms to flowering plants and it is estimated that the number of flowering plants may vary up to tenfold from wet to dry years (Recovery Workshop Summary 1995). Another study found that only 20 plants bloomed where 8,000 corms were later located (Taylor and Burkhart 1992).

Thread-leaved brodiaea is declining throughout much of its range. This species and its habitat are threatened by habitat destruction and fragmentation from urban and agricultural development, pipeline construction, alteration of hydrology and floodplain dynamics, excessive flooding, channelization, off-road vehicle activity, trampling by cattle and sheep, weed

abatement, fire suppression practices (including discing and plowing), and competition from alien plant species (Peirce and Beauchamp 1979; CNPS 2001; USFWS 1998d).

Protection Recommendations

- Protect the large population of approximately 2,000 flowering stalks of brodiaea on Chiquadora Ridge and two of the four small populations in Chiquita Canyon south of the wastewater treatment plant. Protection of these locations would constitute protection of a *major population* in a *key location.*
- Protect the location supporting approximately 6,100 flowering stalks on the hill outcrop adjacent to the clay mine pits in the southern portion of Cristianitos Canyon. This location is the largest contiguous thread-leaved brodiaea population in the planning area and comprises a *major population* in a *key location.*
- Protect 10 of the 13 small, scattered locations in Cristianitos Canyon, totaling approximately 300 flowering stalks. Maintain a continuous habitat connection between these scattered populations to allow for interactions and genetic exchange between the populations. These locations meet the criteria of *important populations* in *key locations* because they provide a linkage between brodiaea locations in the area and because the area has good potential for enhancement and restoration.
- Protect the four locations totaling 288 individuals in the Talega sub-basin east of the Northrop Grumman facilities. The locations are considered *important populations* because they contribute to the geographic diversity and provide additional sources for genetic exchange and connectivity in this portion of the subregion.
- Protect the location of approximately 150 flowering stalks on the slope east of Trabuco Creek. This location is considered an *important population* because as the westmost occurrence in the subregion it contributes to the geographic diversity of the species in the subregion.
- Salvage and translocate individuals within development areas that cannot be avoided to areas with suitable soils. Where suitable soils are present, translocation sites should be located to the extent feasible and appropriate in key locations that maximize connectivity among locations within the subregion.
- Protect the location of approximately 250 flowering stalks in the southeastern portion of the Trampas Canyon subunit of the Central San Juan and Trampas Canyon sub-basin. This location is considered an *important population* because it contributes to the geographic diversity of the species in the subregion.
- Protect the location of approximately 183 flowering stalks in the western portion of the middle Gabino subunit of the Gabino and Blind Canyons sub-basin. This location is

considered an *important population* because it contributes to the geographic diversity of the species in the subregion.

Management Recommendations

As part of the Adaptive Management Program, the following management activities for thread-leaved brodiaea will be conducted:

- Control non-native invasive species such as cardoon, ryegrass, bromes and mustards.
- Manage grazing as part of the Adaptive Management Program in a manner that optimizes the control of non-native grasses (*Lolium, Bromus, Avena*) while allowing for proliferation of the native grasses and forbs.
- Protect thread-leaved brodiaea populations from human disturbance such as hiking, mountain bikes and equestrian activities.
- Collect data on pollinators to ensure that habitats (including soils) for native Halictid bees and other pollinators are preserved in the vicinity of preserved populations.

Restoration Recommendations

- Translocate salvaged thread-leaved brodiaea to CSS and VGL restoration and enhancement areas where feasible and appropriate. Potential restoration and enhancement areas include Chiquita Ridge, Chiquadora Ridge, upper Cristianitos Canyon, Ladera Ranch open space adjacent to the Arroyo Trabuco golf course, upper Gabino Canyon, and Blind Canyon. Receiver areas should support clay soils suitable for brodiaea and, as noted above, should be placed in locations that maximize connectivity and genetic exchange.

- Salvage clay topsoils from development areas where feasible and appropriate and transport to restoration areas. Salvaged topsoils may be used to create additional suitable brodiaea habitat.