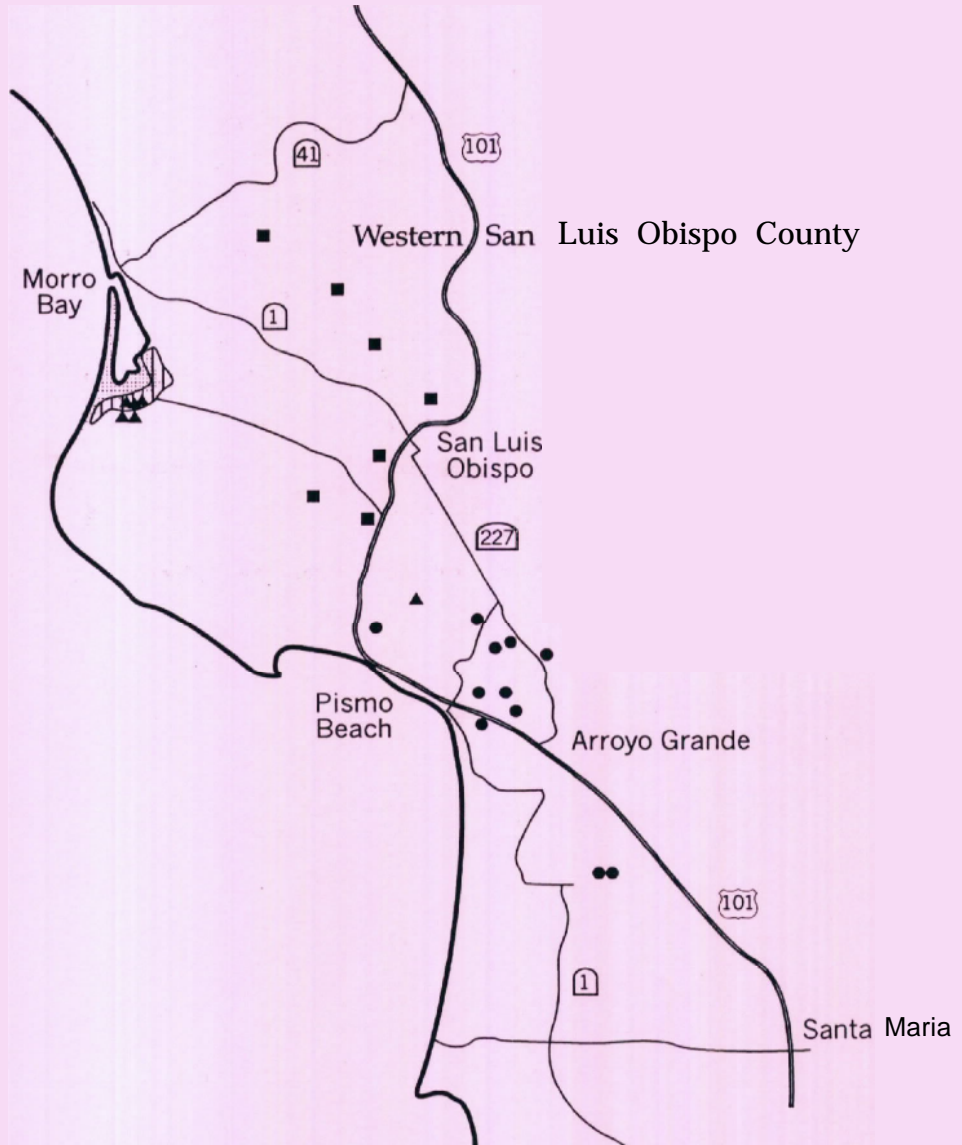


Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California



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Recovery Plan
for
the Morro Shoulderband Snail and Four Plants
from
Western San Luis Obispo County, California

Helminthoglypta walkeriana (Morro shoulderband snail)

Arctostaphylos morroensis (Morro manzanita)

Eriodictyon altissimum (Indian Knob mountainbalm)


Cirsium fontinale var. *obispoense* (Chorro Creek bog thistle)

Clarkia speciosa ssp. *immaculata* (Pismo clarkia)

prepared by
U.S. Fish and Wildlife Service
Ventura, California
for
U.S. Fish and Wildlife Service
Portland, Oregon

September 1998

Approved: _____


Manager, California-Nevada Operations Office,
Region 1, U.S. Fish and Wildlife Service

Date: _____

9/26/98

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Literature citation of this document should read as follows:

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EXECUTIVE SUMMARY

Current Species Status: This recovery plan includes four plants and one snail that occur only in western San Luis Obispo County, California.

- The current known range of the endangered Morro shoulderband snail (*Helminthoglypta walkeriana*) includes the Morro Spit and areas south of Morro Bay, west of Los Osos Creek and north of Hazard Canyon.
- The threatened Morro manzanita (*Arctostaphylos morroensis*) is restricted to fine sandy soils south of Morro Bay in stands of varying size scattered over an area of only 890 acres.
- Five of the six known sites with the endangered Indian Knob mountainbalm (*Eriodictyon altissimum*) are also south of Morro Bay, typically in a mix of chaparral and coastal scrub vegetation; the sixth site, at Indian Knob (the plant's namesake) is about 15 miles to the south.
- Inland, the endangered Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*) is known from eight locations between San Simeon and Pismo Beach, where it is restricted to seeps and springs in serpentine-derived soils.
- The endangered Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*) is known from fewer than 15 locations between Pismo Beach and Nipomo Mesa, in grassland openings in oak woodland and chaparral.

Habitat Requirements and Limiting Factors:

The Morro shoulderband snail occurs in coastal dune and scrub communities. The known threats are habitat destruction and degradation due to development, invasion by non-native plants such as veldt grass, structural changes in the vegetation due to plant senescence, and recreational use (e.g., off-highway vehicle activity). Additional threats may include competition with the brown garden snail (*Helix aspersa*), molluscicides, and the prospect of extirpation of those populations that are small and isolated.

Morro manzanita and Indian Knob mountainbalm partially overlap in range with the Morro shoulderband snail where coastal scrub and maritime chaparral communities intergrade, but occur primarily in maritime chaparral and coast live oak vegetation. The manzanita and mountainbalm are threatened with habitat destruction and degradation due to development, invasion by non-native plant species, and alteration of fire cycles. Like other chaparral species, establishment of new individuals is likely enhanced by fire, if conditions are appropriate and an adequate seedbank exists in the soil.

Chorro Creek bog thistle is restricted to seeps and bogs within grassland, and occasionally chaparral, on soils derived from serpentine rock. Threats to Chorro Creek bog thistle include water diversion, development, and excessive trampling by cattle.

Pismo clarkia occurs in grassland openings in chaparral and oak woodlands. The principal threats to the clarkia are habitat destruction and degradation due to development. Populations may also be negatively affected by road maintenance, heavy grazing, and competition with non-native invasive plants.

Recovery Objectives:

The recovery objective for Indian Knob mountainbalm, Chorro Creek bog thistle, and Pismo clarkia is reclassification from endangered to threatened status. In the future, depending on the success of recovery efforts and of gathering additional management and life history information, the Service may consider delisting these taxa. The recovery objective for the Morro shoulderband snail and Morro manzanita is delisting.

Recovery Criteria are summarized here. The full criteria are discussed in Part II of this recovery plan.

Criteria for reclassification to threatened status:

- Morro shoulderband snail: populations and their habitats are secured in all four Conservation Areas (Morro Spit, West Pecho, South Los Osos, and Northeast Los Osos), with populations large enough to minimize the short-term chance of extinction, as shown by life history studies. There must be adequate progress on control of exotic pest plants (including veldt grass) to assure that occupied habitat can remain intact and usable to the snail. Progress must have been made toward assessing possible threats, including competition from, or predation by non-native snails and pesticides. Potential habitat within the snail's historic range must have been surveyed to see whether undiscovered populations exist; if so, reclassification and delisting criteria will have to be reviewed.
- Indian Knob mountainbalm: Five occurrences from throughout its range must be on lands secured from human-induced threats. Management adequate to maintain the species must have been developed and implemented and populations must be projected (as shown by monitoring and research results) to be stable or increasing.
- Chorro Creek bog thistle: Populations and habitats from 6 sites (at least 3 of them in protected areas larger than 100 acres) must be secured from human-induced threats, with stable or increasing numbers of plants, and management that has been shown to promote the continued existence of the populations and their wetland habitat.
- Pismo clarkia: Eight populations, at least four of them large, must be secured from human-induced threats and must be stable or increasing in size. At least one protected population must be from the southern portion of its range.

Delisting Criteria:

- Morro shoulderband snail: Sufficient populations and suitable habitats (as shown by life history studies) from each of the four Conservation Planning Areas

(and, if necessary, any newly located populations) must be secured from the known threats, including exotic pest plants. Possible threats, including competition from non-native snails, predation by non-native snails, and use of pesticides, must have been assessed and effectively controlled or removed. The sites must be under permanent management to maintain the desired vegetation structure and control pests and human incursions.

•Morro manzanita: 90 percent of existing core acreage supporting high and medium cover of Morro manzanita and 80 to 90 percent of other acreage supporting low cover must be secured and shown to be in preserves of sufficient size, configuration, and placement to allow for successful management and the continued viability of the species.

Actions Needed:

1. Secure populations and habitat on unprotected land. To guide this process, the plan delineates “conservation planning areas” where the distributions of Morro manzanita, Morro shoulderband snail, and Indian Knob mountainbalm overlap. Land protection for the two other species is handled separately.
2. Manage secured lands to control or eliminate other known threats
3. Evaluate potential threats and conduct management-oriented research
4. Determine population dynamics and effects of recovery efforts
5. Develop and implement an education/information program
6. Reevaluate recovery criteria and revise recovery plan based on expanded knowledge.

Total Estimated Cost of Recovery: \$ 756,000, with costs yet to be determined for securing lands, prescribed burning, and protecting spring sources.

Date of Recovery Objectives: For the Indian Knob mountainbalm, Chorro Creek bog thistle, and Pismo clarkia, whose current objectives are downlisting to threatened status, meeting the objective depends on how soon habitat can be secured and monitoring programs begin. Ten years of monitoring would be needed to assure that site management benefits these plants.

For the Morro shoulderband snail and Morro manzanita the speed of meeting the objective of delisting depends on securing habitat, determining effective means of managing secured areas, and establishing monitoring programs. Ten years of monitoring may be needed to assure that site management is appropriate.

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I. INTRODUCTION

1. Background

The U.S. Fish and Wildlife Service listed one land snail and five plants that occur in western San Luis Obispo County, California, as threatened or endangered on December 15, 1994, pursuant to the Endangered Species Act of 1973 (Act), as amended. One plant, Morro manzanita (*Arctostaphylos morroensis*), was listed as threatened. Listed as endangered are the Morro shoulderband snail (*Helminthoglypta walkeriana*), Indian Knob mountainbalm (*Eriodictyon altissimum*), Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*), Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*), and California seablite (*Suaeda californica*). All of the taxa except California seablite are included in this recovery plan. Due to its greater historical range, California seablite is addressed in a revision of the Service's coastal saltmarsh recovery plan, which is being prepared at the Sacramento Fish and Wildlife Office.

Part I of this plan discusses threats and conservation efforts for the five taxa collectively and then addresses each taxon individually, with a summary for each taxon. In Part II, three of the species are addressed collectively—the Morro shoulderband snail, Morro manzanita and Indian Knob mountainbalm. These three species occur wholly (in the case of the snail and manzanita) or primarily (in the case of the mountainbalm) south of Morro Bay in the vicinity of the communities of Los Osos, Baywood Park, and Cuesta-by-the-sea (collectively called “Los Osos” in this plan). The Chorro Creek bog thistle and Pismo clarkia do not overlap in distribution or habitat type with the other taxa in this plan or with each other, so they are treated separately throughout most of Part II.

2. General Description of Habitats

The five taxa included in this rule are endemic to western San Luis Obispo County, California (Fig. 1). Two species, the Morro manzanita and the Morro shoulderband snail, have partially overlapping ranges and are restricted to a region within four miles of the ocean. They occur, for the most part, in the mouth of the

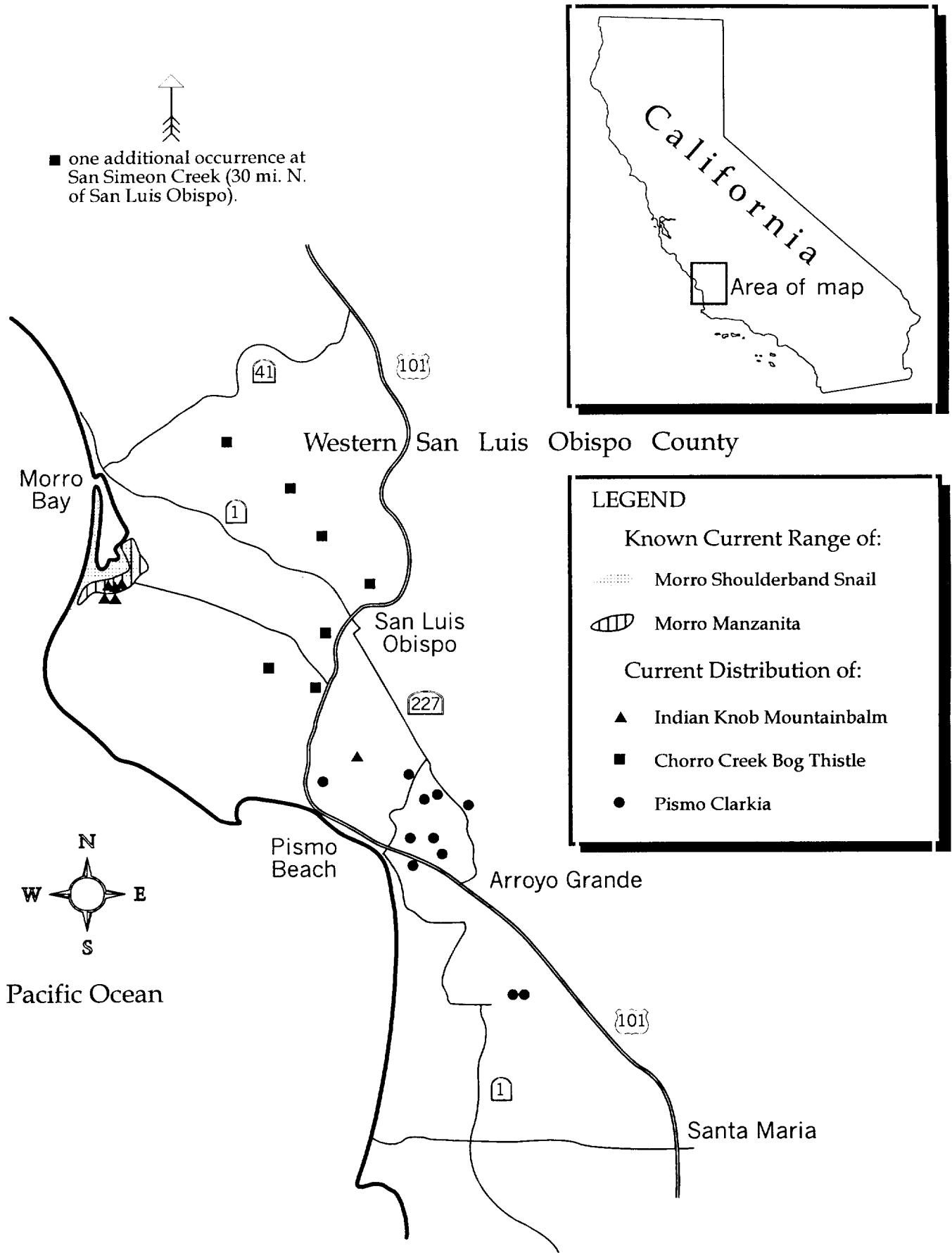


Figure 1. Distribution of the five taxa.

Los Osos Valley, bounded on the north by Morro Bay, on the east by Los Osos Creek, and on the south by the Irish Hills. The soils of this area are classified as Baywood fine sands. They developed from Pleistocene dune sands that once blanketed the flats and lower slopes south of Morro Bay.

The densest stands of Morro manzanita are on slopes on the northern edge of the Irish Hills where it is the dominant chaparral species. On the flats closer to Morro Bay, it occurs in patches or as scattered individuals within fragmented maritime chaparral, coastal scrub, and coast live oak communities. The Morro shoulderband snail occurs on the immediate coast in dune scrub vegetation and extends inland into the same coastal scrub community and variants of this community that provide appropriate, low-growing shrubs for shelter, food, and reproduction. Although the Indian Knob mountainbalm is not restricted to the Los Osos area, its distribution and that of Moro manzanita overlap at the margins of the coastal scrub and maritime chaparral communities on the slopes of the Irish Hills. Indian Knob mountainbalm occurs on Baywood fine sands and on leached, nutrient-poor tar sand formations about 15 miles to the south at Indian Knob.

The Chorro Creek bog thistle is found on sites farther inland, but still on the west side of the Santa Lucia range, in seeps or bogs associated with serpentine soils. These wetlands are often surrounded by grasslands and, occasionally, by chaparral.

Pismo clarkia grows on soils with a large component of fine sand, in grasslands interspersed with chaparral and oak woodlands south of San Luis Obispo to the Nipomo area.

General descriptions of central maritime chaparral, coastal scrub, dune scrub, coast live oak woodland, and annual grasslands are provided by Holland and Keil (1990), MacDonald (1988), Griffin (1988), Hanes (1988), Barbour and Johnson (1988), and Mooney (1988). Vegetation associations in regions of the Los Osos area have also been recently mapped by Jones and Stokes Associates (1997).

3. Overall Reasons for Decline and Current Threats

Habitat loss through development

All five taxa are threatened by habitat loss due to increasing urban development. Native habitats on Baywood fine sands, where the Morro manzanita, Morro shoulderband snail, and Indian Knob mountainbalm occur, are continuing to decline due to urban development. Growth of the human communities around Morro Bay, the San Luis Obispo area, Pismo Beach, and Arroyo Grande is reducing the already narrowly distributed habitats for these species. In addition to direct loss of habitat, habitat fragmentation by residences and roads is likely to (1) eliminate effective dispersal, especially by the Morro shoulderband snail, resulting in isolated populations, (2) diminish or eliminate gene flow between fragmented occurrences of sensitive plants, (3) alter surface hydrology and soil integrity, (4) facilitate invasion by nonnative species, and (5) diminish the processes which maintain these habitats and the opportunity to provide surrogate activities (e.g., the use of prescribed burns) to encourage species persistence.

Road maintenance activities

Plant populations adjacent to roads are vulnerable to maintenance activities, including mowing, grading, and herbicide application, and to road expansion. In addition to the direct removal of individual plants, these activities may create conditions favorable to the establishment and spread of invasive, non-native species. At least one occurrence of Chorro Creek bog thistle and several populations of Pismo clarkia have been affected by, or are vulnerable to, road maintenance activities or road expansion.

Off-highway vehicle activity

In addition to directly crushing or injuring sensitive species, unmanaged off-highway vehicle use can damage and destroy vegetation and soil structure, create disturbed sites where opportunistic non-native plants can establish, and increase soil erosion by wind or water.

Altered fire cycles

Maritime chaparral species have evolved with fire and are adapted to it. The Morro manzanita and the Indian Knob mountainbalm typically regenerate after a fire. Other endangered species in the Morro Bay area, such as the Morro

shoulderband snail and the Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*), are adapted to vegetation that has certain characteristics in structure and species composition—characteristics that may be lost as the vegetation community matures and senesces. Before European settlement, the Morro Bay region likely had sufficient native habitats, renewed by fire or other natural disturbance at sufficient intervals, to provide a mosaic of vegetation, in different stages of maturity, in which these species persisted.

Cattle grazing

Cattle graze habitat that supports Pismo clarkia and Chorro Creek bog thistle. Grazing can negatively affect plants in several ways: through direct consumption, damage by trampling, increased soil erosion, and by facilitating the spread of non-native plants and disturbance-tolerant species, which change the composition and structure of the vegetation. However, in communities where non-native grasses have already been introduced, grazing may reduce their biomass, thereby reducing their competition with native species. Studies on the effects of grazing on Chorro Creek bog thistle are being conducted at one location on Camp San Luis Obispo. The degree to which grazing affects Pismo clarkia still needs to be evaluated.

Non-native species

Several invasive non-native plants and one non-native mollusc are encroaching into native habitats in western San Luis Obispo County. Since European settlement of the Morro Bay area, substantial expanses of those native habitats have been lost to invasion of exotic plant species. Tyler and Odion (1996) and Jones and Stokes Associates (1997) provide recent summaries of the non-native plant species invading the native plant communities of Morro Bay. The information below is summarized from their reports.

Eucalyptus

Two species of eucalyptus (*Eucalyptus globulus* [blue gum] and *E. camaldulensis* [red gum]) invade native habitats in the Morro Bay area. After a fire, rapid establishment and growth of eucalyptus may lead to elimination of manzanita as the dominant chaparral species. Eucalyptus poses an additional threat during fire events, when its vigorous combustion produces firebrands that can cause spotfires several kilometers downwind, increasing fire hazard to surrounding areas.

Iceplants/fig-marigolds/sea-figs

Fig-marigold (*Carpobrotus edulis*), whose seeds are spread in the feces of deer and rabbits, forms dense mats in coastal dune scrub on Morro Spit and in openings in maritime chaparral on Baywood fine sands. Fig-marigold establishes itself abundantly in burned or mechanically disturbed areas if a seed source is in the vicinity. Although the seed of fig-marigold are destroyed by high temperatures, in recently burned chaparral new seeds can be carried in by deer or other animals. Mats of *Carpobrotus* establish quickly, crowding out slower growing manzanita seedlings. Established mats of *Carpobrotus*, with their fleshy leaves, will not completely burn in a fire. Therefore, with successive burns, iceplant can completely displace the maritime chaparral community.

Conocosia pugioniformis (no common name) is a more recent iceplant arrival in the Morro Bay area. It is also invading openings within maritime chaparral and coastal dune and sage scrub. Seeds are wind-dispersed and may also be dispersed by birds (V. Cicero, pers. comm. 1997).

Veldt grass

While veldt grass (*Ehrharta calycina*) is not currently a problem in mature Morro manzanita chaparral, it is an aggressive invader in coastal scrub and other sandy habitats where it fills openings between shrubs, outcompeting other species. Its seeds are wind-dispersed and it is becoming abundant in habitats upwind from Morro manzanita stands, so it is likely to become more prevalent in chaparral dominated by Morro manzanita in the future. Veldt grass has been recorded adjacent to habitat occupied by Pismo clarkia. It also occurs in habitat occupied by the Morro shoulderband snail; however, this perennial non-native grass does not offer a suitable microhabitat for the Morro shoulderband snail and invasively replaces the native vegetation that does provide suitable microhabitats for the snail. Established veldt grass is extremely difficult to remove.

Non-native annual grasses

Non-native annual grasses have become common in many California plant communities, especially those prone to disturbance, either natural or human-caused. Annual grasses are short-lived, but produce copious seed, dispersed by wind or animals. Livestock grazing and human activities such as road grading tend to cause habitat disturbance and disperse the seed, enhancing the

opportunities for invasion by these species. Non-native grasses, including bromes (*Bromus* sp.) and wild oats (*Avena* sp.), may threaten Pismo clarkia because it occurs in grassland habitats where these species are now often abundant. At certain sites, Chorro Creek bog thistle may be threatened by another non-native grass, annual ryegrass (*Lolium perenne*) when it occurs in high densities.

4. Overall Conservation Efforts

This section covers conservation measures for multiple taxa. Conservation efforts for individual taxa in this plan are discussed in the individual species accounts.

Federal and State

The final rule determining federal endangered or threatened status for these taxa was published on December 15, 1994. The listing of these taxa has afforded each the protection of the Endangered Species Act (Act). The Act prohibits the “take” of the Morro shoulderband snail on public or private lands. For non-Federal entities, take incidental to carrying out a project can be authorized under section 10 of the Act, which provides for permits and habitat conservation plans. Section 7 of the Act requires Federal agencies to consult with the Service with respect to any action they permit, fund, or carry out which may affect any listed species. Plants listed under the Act receive protection on Federal land; on other lands, the Act adds Federal sanctions only when knowing violations of State laws and violations of State criminal trespass laws occur [section 9(a)(2)]. The Act requires the Service to develop a recovery plan and to conserve fish, wildlife, and plants, including those that are listed [section 5]. To carry out the conservation program, the Department of the Interior is authorized to acquire land. Finally, the wetland habitat of Chorro Creek bog thistle may receive the limited protection afforded wetlands under the Clean Water Act of 1970.

State

The California Endangered Species Act (CESA) protects the Chorro Creek bog thistle and Indian Knob mountainbalm, which are listed by the State as endangered, and the Pismo Clarkia, listed as rare. The CESA prohibits the “take” of State listed threatened and endangered species without a permit. Permits authorizing “take” are issued by the California Department of Fish and Game.

The California Environmental Quality Act (CEQA) provides some level of protection for all of the species in this plan through the environmental review process. Initially, the public lead agency reviews a project to determine its impact on the species. If the impacts are not considered significant, a formal environmental impact report (EIR) is not required, and the project is granted a Negative Declaration with measures to reduce environmental impacts. If the project's impacts are considered significant, an EIR is required, which consists of a description of existing project site conditions, impact analysis, and detailed mitigation measures that would reduce project impacts to a less-than-significant level. Mitigation measures, such as avoidance, fencing, and landowner education programs, should be incorporated into the approved project, and may provide long-term species protection. However, if mitigation is not feasible, and if the lead agency believes the benefits of the project outweigh the environmental risks, the lead agency may approve a project having significant impacts by making a statement of overriding considerations.

California Department of Parks and Recreation has a General Plan for Montaña de Oro State Park (1988) which supports habitat for the Morro shoulderband snail, Morro manzanita, and Indian Knob mountainbalm. Policy in the plan states that habitat of the Morro shoulderband snail, Morro manzanita, and other sensitive species will be managed to benefit those species, that management actions shall be coordinated among the specific species, and that the Park will work cooperatively with the Fish and Wildlife Service and the California Department of Fish and Game to promote the conservation of these species.

County

County conservation efforts are shaped by coastal zone protection. Los Osos is within the coastal zone as defined in the California Coastal Act of 1976, which encourages the protection of coastal resources for the benefit of future generations. Proposed projects in the coastal zone must be consistent with the Local Coastal Plan which has been certified by the California Coastal Commission. The County of San Luis Obispo considers the Local Coastal Plan when reviewing planning projects in Los Osos. Much of the private land that supports Morro manzanita is identified in the Local Coastal Plan as sensitive resource areas. However, none of the private lands that support the Morro shoulderband snail are identified as sensitive resource areas. The County of San

Luis Obispo is also responsible for meeting the requirements of CEQA when reviewing proposed projects.

Private

The Land Conservancy of San Luis Obispo County, a nonprofit organization dedicated to preserving the land resources of San Luis Obispo County, proposed the Los Osos/Baywood Park Greenbelt Conservation Plan in 1993. The goal is to develop a program that will identify and conserve the unique biological and natural resources of the Los Osos and Baywood Park area in San Luis Obispo County. Plant communities and sensitive areas on the east side of Los Osos were surveyed and mapped. By working cooperatively with landowners, conservation easements can be created; streamlined approaches for building permits are offered in return. However, to date there has been minimal participation by affected landowners. The goal and efforts of the Service's recovery plan overlaps with the Greenbelt Plan in terms of conserving habitat. However, the plans differ in that the Service's recovery plan is species-specific, addressing the needs of each listed species throughout its range. The Greenbelt Conservation Plan addresses habitat within the urban reserve lines of Los Osos/Baywood Park and the conservation needs of various sensitive biological communities including those that do not support listed species.

Since the 1980s, the Los Osos/Morro Bay chapter of the nonprofit group Small Wilderness Area Preservation (SWAP), has focused its efforts on preserving, through acquisition, the El Moro Elfin Forest. This site, adjacent to Morro Bay and on the north side of Los Osos, supports several listed and sensitive species, including the Morro manzanita and Morro shoulderband snail. In 1995 acquisition of this site was successfully completed.

A local citizens group, the Morro Estuary Greenbelt Alliance (MEGA), has also recently formed in the Los Osos area to promote conservation of coastal dune habitats in the area and the sensitive species that occur there. Members of MEGA have worked with local citizens and staffs from local, state, and federal resource agencies to develop support for the conservation of the unique habitats in Los Osos.

5. Species Accounts

Each taxon is discussed individually. Descriptions are based on the *Federal Register* documents designating each species as endangered or threatened (USFWS 1994) and on information that has become available since listing.

Morro shoulderband snail (*Helminthoglypta walkeriana*)

Recovery Priority 8C

(See Appendix A for an explanation of the Recovery Priority System)

Taxonomy and Description

The Morro shoulderband snail was first described as *Helix walkeriana* by Hemphill (1911) based on collections made “near Morro, California.” He also described a subspecies of *Helix walkeriana*, *Helix* variety *morroensis*, from “near San Luis Obispo City” based on sculptural features of the shell (Roth 1985). Field (1930) transferred this species to the genus *Helminthoglypta*, and Roth (1985) considers “*morroensis*” to not warrant recognition as a subspecies. The Morro shoulderband snail, also commonly known as the banded dune snail, belongs to the Class Gastropoda and Family Helminthoglyptidae.

The shell of the Morro shoulderband snail is slightly translucent and has 5-6 whorls (Figure 2). Its dimensions are 18 - 29 millimeters (0.7 - 1.1 inches) in diameter and 14 - 25 millimeters (0.6 - 1.0 inch) in height. The Morro shoulderband snail can be distinguished from another native snail in the same area, the Big Sur shoulderband snail (*Helminthoglypta umbilicata*), by its more globose shell shape and presence of incised spiral grooves (Roth 1985). The shell of the Big Sur shoulderband snail tends to be flatter and shinier. The brown garden snail (*Helix aspersa*) also occurs in Los Osos with the Morro shoulderband snail and has a marbled pattern on its shell, whereas the Morro shoulderband snail has one narrow dark brown spiral band on the shoulder. The Morro shoulderband's spire is low-domed, and half or more of the umbilicus¹ is covered by the apertural lip (Roth 1985).

¹ Umbilicus: the cavity in the center of the base of a spiral shell that is surrounded by the whorls (Webster's Third New International Dictionary)

Figure 2. Morro shoulderband snail (*Helminthoglypta walkeriana*). Photo from U.S. Fish and Wildlife Service, Ventura.



Historical and Current Distribution

The Morro shoulderband snail is found only in western San Luis Obispo County. At the time of listing, the Morro shoulderband snail was known to be distributed near Morro Bay. Its currently known range includes areas south of Morro Bay, west of Los Osos Creek and north of Hazard Canyon (Figure 1). Historically, the species has also been reported near the city of San Luis Obispo (type locality for “*morroensis*”) and south of Cayucos (Roth 1985).

Habitat Description

The Morro shoulderband snail occurs in coastal dune and scrub communities. Through most of its range, the dominant shrub associated with the snail’s habitat is mock heather (*Ericameria ericoides*). Other prominent shrub and succulent species are buckwheat (*Eriogonum parvifolium*), eriastrum (*Eriastrum densifolium*), chamisso lupine (*Lupinus chamissonis*), dudleya (*Dudleya* sp.), and in more inland locations, California sagebrush (*Artemisia californica*) and black sage (*Salvia mellifera*) (Roth 1985). The Morro shoulderband snail has also been found under mats of non-native fig-marigold (iceplant) (*Carpobrotus* sp.).

Away from the immediate coast, immature scrub in earlier successional stages may offer more favorable shelter sites than mature senescent stands of coastal dune scrub. The immature shrubs provide canopy shelter for the snail, whereas the lower limbs of larger older shrubs may be too far off the ground to offer good shelter (Roth 1985). In addition, mature stands produce twiggy litter low in food value (Roth 1985).

Life History

No studies or documented observations exist on the feeding behaviors of the Morro shoulderband snail. Hill (1974) suggested that the snail probably feeds on the fungal mycelia² growing on decaying plant litter. The Morro shoulderband snail, belonging in the native snail fauna of California, is not a garden pest and is essentially harmless to gardens (Chambers 1997).

Sarcophagid flies have been observed to parasitize the Morro shoulderband snail. Empty puparia (“cases” left behind by adults emerging from pupae) were

² Mycelia: webs or mats of non-reproductive fungal strands (hyphae).

observed in empty snail shells by Hill (1974), Roth (1985), and Tounch (pers. obs., 1997). Hill (1974) and Roth (1985) suggested that mortality from infestations of larvae of this parasitoid fly often occurs before the snails reach reproductive maturity. The flies may have a significant impact on the population of the snail (Roth 1985). Seasonal drought and/or heat may contribute to the snail's egg mortality (Roth 1985). Based on shell examination, Roth (1985) also suggested that rodents may prey on the snail.

Reasons for Decline and Threats to Survival

The Morro shoulderband snail is threatened by destruction of its habitat due to increasing development and by degradation of its habitat due to invasion of non-native plant species (e.g., veldt grass), structural changes to its habitat due to senescence of dune vegetation, and recreational use (e.g., heavy off-highway activity).

In addition to the known threats, possible threats to the snail include:

- competition for resources with the non-native brown garden snail (although no assessment has been made of possible dietary overlap between the species);
- extinction due to populations being small and isolated;
- use of pesticides (including snail and slug baits);
- introduction of non-native predatory snails.

The use of snail baits and non-native predatory snails to control the brown garden snail could cause mortality to the Morro shoulderband snail. Non-native predatory snails have been observed preying on other native California snails (Roth, *in litt.* 1998). The importation and transportation of non-native snails are prohibited in San Luis Obispo County by the California Department of Fish and Game.

Conservation Efforts

The Morro shoulderband snail has been federally listed as endangered since December 1994. The Service anticipates that several habitat conservation plans (HCPs) will be developed to allow for the incidental take of the Morro shoulderband snail during the development of small subdivisions and single family residences. Such actions would result in the loss of habitat for the Morro shoulderband snail, but contiguous blocks of remaining habitat will likely be preserved and managed in perpetuity through the HCP process, as mitigation for

take of the Morro shoulderband snail and loss of its habitat on smaller isolated parcels. At the time of writing, three HCPs were being reviewed by the Service. The HCP process alone cannot achieve the protection of the larger parcels; thus, other methods of securing and protecting the larger parcels (e.g., in-fee purchase and permanent conservation easements) are being pursued.

A sewer treatment facility is currently proposed for Los Osos. Construction of this facility will destroy habitat for the Morro shoulderband snail, while operation of the facility will indirectly cause destruction of habitat by allowing the lifting of a moratorium on development. The County of San Luis Obispo will acquire habitat in one of the Service's Conservation Planning Areas to mitigate for the direct and indirect effects of the sewer treatment facility.

The Service is funding surveys and habitat research on the Morro shoulderband snail on State Park lands. A veldt grass control project for snail habitat on State Park lands began in 1998.

Morro manzanita (*Arctostaphylos morroensis*)

Recovery Priority 2C (See Appendix A)

Taxonomy and Description

Morro manzanita (*Arctostaphylos morroensis*) (Figure 3) was first described by Albert E. Wieslander and Beryl O. Schreiber in 1939 (Wieslander and Schreiber 1939) based on a specimen collected in Hazard Canyon, south of Morro Bay, which is now within the boundaries of Montaña de Oro State Park. The species has continued to be recognized by McMinn (1939), Abrams (1944), Munz (1959), Hoover (1970), and Wells (1993).

This handsome shrub of the heath family (Ericaceae) reaches a height of 1.5 to 4.0 meters (5 to 13 feet) and has crowded oblong to ovate grey-green to olive-green leaves, 2.5 to 4.0 centimeters (1 to 1.5 inches) long, with petioles 2 to 6 millimeters (0.08 to 0.20 inch) long. The white to pinkish flowers are 5 to 8 millimeters (0.2 to 0.3 inch) long, and form orange-brown fruits 8 to 13 millimeters (0.3 to 0.5 inch) in diameter with 8 to 10 stones per fruit

Figure 3. Morro manzanita (*Arctostaphylos morroensis*), Habit.
Photo from U.S. Fish and Wildlife Service, Ventura.



Figure 4. Morro manzanita (*Arctostaphylos morroensis*). Flowers.
Photo from U.S. Fish and Wildlife Service, Ventura.



(Wells 1993; Tyler and Odion 1996) that are fused but separable. Morro manzanita is distinguished from other manzanitas in the area by the following characters: the bark of the trunk is a shaggy grey to brown; the leaf blades range from wedge-shaped (cuneate) to rounded or nearly straight (truncate) at the base, with the lower surface paler and usually somewhat tomentose (short woolly hairs). Occasional specimens of Morro manzanita have small projecting lobes at bases of the leaf blades and a short leaf stalk or none at all—characters more representative of the rare La Cruz manzanita (*A. cruzensis*), which occurs in the same area. Recent work by Holland et al. (1990) and Mullany (1990) has clarified the distinctness of the taxon, and its relation to La Cruz manzanita.

Historical and Current Distribution

The historic distribution of Morro manzanita was estimated to cover between 2,000 and 2,700 acres (McGuire and Morey 1992), based on the distribution of Baywood fine sands soil in the Los Osos area. The flat areas covered by Baywood fine sands have largely been developed, primarily in the communities of Los Osos, Baywood Park, and Cuesta-by-the-Sea on the south and east sides of Morro Bay. Some development has also occurred on the steeper north-facing slopes of the Irish Hills. The current range of Morro manzanita is approximately 840 to 890 acres (LSA Associates, Inc. 1992); half of the range consists of small or low-density patches of manzanita plants that remain in and around developed areas of Los Osos and Baywood Park, and half consists of more continuous and more dense (at least 50 percent cover by this species) stands of manzanita. An analysis of mapped distributions by cover classes suggests that the area actually covered by Morro manzanita shrubs may currently be less than 162 hectares (400 acres) (Tyler and Odion 1996). Population estimates from 1992 range from 86,000 to 153,000 individuals, depending on the method used (McGuire and Morey 1992, LSA Associates 1992).

Approximately 65 per cent of the remaining Morro manzanita habitat is in private ownership; the bulk of this is habitat with high densities of manzanita.

Approximately 35 per cent of the plant's habitat is on publicly owned lands within Montaña de Oro State Park, and two small preserves managed by California Department of Fish and Game; most of the habitat on public lands supports low or moderate densities of Morro manzanita (McGuire and Morey 1992).

Habitat Description

The distribution of Morro manzanita is correlated with that of soils, classified in soil surveys as Baywood fine sands, developed on ancient sand dunes that were deposited during the Pleistocene epoch, when sea levels 90 meters (300 feet) lower than current levels allowed large volumes of sand to blow inland into the Los Osos Valley. Morro manzanita is found in association with coastal scrub, maritime chaparral, and coast live oak woodland communities in sites with no or low to moderate slopes. On steeper slopes, particularly on the north-facing slopes of the Irish Hills, Morro manzanita occurs in almost pure stands.

Where Morro manzanita occurs in dense stands, few understory species are present (Tyler and Odion 1996). Morro manzanita is not known to inhibit the growth or seed germination of other plants (i.e., to be allelopathic), but allelopathy is known in at least one other species of manzanita (Chou and Muller 1972). Older individuals of Morro manzanita may have canopies 10 meters (33 feet) in diameter.

Life History

Morro manzanita is a long-lived shrub that flowers in winter, with fruit maturing and seed dispersing in summer and fall. Seeding is its only means of reproduction. Unlike some other manzanitas, Morro manzanita lacks a woody burl from which it can resprout following a fire (Tyler and Odion 1996). Typically, when obligate-seeding manzanita individuals are consumed by fire, stand regeneration depends on relatively long-lived seeds that remain viable in a soil seedbank. Dormancy mechanisms inhibit seed germination until the proper environmental conditions, such as a fire, occur that scarify the seeds and provide open sites in which seedlings can establish. Recent studies found that Morro manzanita seeds were typically very common under the canopies of adult individuals, but not beyond the canopy. Under canopies seed densities were estimated at 12,000 to 37,000 seeds per square meter, although viability of the seeds was less than 5 percent. About 80 per cent of the seeds were found in the top 2.5 centimeters (1 inch) of the soil samples (Tyler and Odion 1996).

Morro manzanita is expected to be relatively long-lived. Studies of stand age based on trunk ring counts and aerial photos of previous disturbance events, including fire and possibly clearing, indicate that the youngest intact stands are

some of those south of Highland Drive, which are about 37 years old. Stands west of Pecho Drive are about 47 years old. The remainder are older than 47 years, with stands in the Elfin forest estimated to be the oldest (Tyler and Odion 1996).

The germination response of Morro manzanita to fire has not been studied in depth. However studies of other species suggest that fire intensity and depth of the buried soil seedbank influence the number of seeds that survive the fire and are able to germinate (Tyler and Odion 1996). Studies of post-fire establishment in other chaparral species suggest that the highest mortality occurs in seedlings during the first year following a fire. At this stage, the seedlings are young and are particularly susceptible to herbivory and to competition for water (Tyler and Odion 1996).

Some seedling establishment in Morro manzanita has also occurred following mechanical clearing (LSA Associates, *in litt.* 1993). While the process of clearing likely causes some seed scarification, other environmental conditions that may encourage regeneration after a fire, such as heat and leachate from ash, are missing. Aerial photo analysis suggests that mechanical clearing and burning for ordnance removal in the 1940s and 1950s converted maritime chaparral containing Morro manzanita into weedy coastal sage scrub on what is now State Park land west of Pecho Road (Tyler and Odion 1996).

Reasons for Decline and Threats to Survival

The greatest threat to Morro manzanita is loss and fragmentation of its habitat from development. About 75 percent of its historical habitat has been altered by development, primarily in the communities of the Los Osos area. Over half the remaining habitat is in private ownership; proposals are pending to develop several large parcels.

Although approximately a third of the habitat for Morro manzanita is owned and managed by the California Department of Parks and Recreation (Montaña de Oro State Park), it is still subject to alteration. Groves of non-native *Eucalyptus* trees planted in the early 1900's have encroached on nearby stands of Morro manzanita (Holland et al. 1990). The Department initiated a stand containment project in 1989, which removed seedling trees that were established beyond the perimeter of

the original groves. Current efforts are focused upon removal within the Hazard Canyon riparian corridor. However, if the containment project is not maintained, new expansion of the *Eucalyptus* into manzanita habitat can be anticipated. Also within Montaña de Oro State Park, installation of a trans-Pacific telephone cable resulted in the removal of approximately 300 plants in Hazard Canyon in the early 1990s. Planning averted greater destruction.

Except for two parcels owned by California Department of Fish and Game, the remaining habitat for Morro manzanita is in private ownership on lands that surround the communities of Baywood Park and Los Osos. Expansion of these communities has already destroyed Morro manzanita habitat, and much of what remains is slated for residential development (Keil 1990; Holland 1990; San Luis Obispo County 1991).

Conservation Efforts

In response to a petition to the State of California to list Morro manzanita as a threatened species, the California Coastal Conservancy funded the Land Conservancy of San Luis Obispo to develop conservation strategies for the State and federally endangered Morro Bay kangaroo rat as well as for sensitive species, including the Morro manzanita. The Conservancy has been developing strategies in conjunction with the Service, California Department of Fish and Game, the California Department of Parks and Recreation, local and county planning agencies, and local landowners (Land Conservancy of San Luis Obispo 1993). To date, such efforts have been hampered by conflicting goals among the participating entities and lack of participation by key landowners. Legally binding conservation measures that would afford protection to the Morro manzanita have not been developed, while proposed real estate developments located in high density manzanita stands are being approved by elected County officials.

Indian Knob mountainbalm (*Eriodictyon altissimum*)

Recovery Priority 8C (See Appendix A)

Taxonomy and Description

Indian Knob mountainbalm (*Eriodictyon altissimum*) (Figure 5) was first collected on Indian Knob by Philip V. Wells in 1960, and was described by him two years later (Wells 1962). This diffusely branched evergreen shrub of the waterleaf family (Hydrophyllaceae) reaches a height of 2 to 4 meters (6.6 to 13 feet). The sticky leaves are long (6 to 9 centimeters [2.4 to 3.5 inches]) and narrow (2 to 4 millimeters [0.08 to 0.20 inch]); the lavender flowers (1.1 to 1.5 centimeters [0.4 to 0.6 inch] long) are arranged in coiled clusters and produce tiny (0.4 millimeter [0.02 inch] long) seeds. As with other fire-adapted chaparral plants, Indian Knob mountainbalm produces new growth primarily from rhizomatous suckers. Only two other narrow-leaved *Eriodictyon* species occur in southern California; narrow-leaved yerba santa (*E. angustifolium*) occurs in the New York Mountains in the eastern Mojave Desert and has much smaller flowers. The other, Lompoc yerba santa (*E. capitatum*), is restricted to a few locations in coastal Santa Barbara County and has a distinctly capitate (headlike) inflorescence.

Historical and Current Distribution

Only six stands of Indian Knob mountainbalm are known (Figure 1). Five of six extant stands occur within a few square miles of each other, from the south side of the community of Los Osos to the north end of Montaña de Oro State Park. Each of these stands has fewer than 50 plants. A sixth stand is found 15 miles to the southeast on Indian Knob, between San Luis Obispo and Arroyo Grande; with more than 500 plants, it comprises the largest stand (Lynn Dee Oyler, Botanical Consultant, *in litt.* 1991). Estimates of population sizes are imprecise because Indian Knob mountainbalm sprouts from the root, making identification of a genetic or physiological “individual” difficult. Two of the Morro Bay stands are on lands owned and managed by Montaña de Oro State Park, and co-occur with Morro manzanita in Hazard Canyon. The remaining stands are on private property. Because rugged terrain in the Irish Hills (between Morro Bay and Indian Knob) has precluded extensive botanical surveying, it is not known whether other stands of Indian Knob mountainbalm occur in this area.

Figure 5. Indian Knob mountainbalm (*Eriodictyon altissimum*).
Photo from U.S. Fish and Wildlife Service, Ventura.



Habitat Description

Indian Knob mountainbalm occurs in soils derived from marine sandstones containing tar deposits referred to as “tar sands” and, in the northern part of its range, on Baywood fine sands and weathered ancient dune soils. This species co-occurs with Morro manzanita in several locations in maritime chaparral.

Vanderwier (1987) did a detailed study of the chaparral and oak woodland communities at the type locality for Indian Knob mountainbalm.

As with other members of this genus, Indian Knob mountainbalm is thought to be adapted to ecologic disturbance, specifically to periodic fire within the chaparral community. Field botanists have noted that most stands of Indian Knob mountainbalm are mature or senescent, and that prescribed fire may be needed to revitalize the stands (Bittman 1985; John Chesnut, biological consultant, pers. comm. 1997; Keil pers. comm. 1997).

Life History

This perennial shrub is believed to be relatively long-lived; slow-growing lichens can be found attached to its woody stems. Indian Knob mountainbalm flowers in June and July. A variety of nonspecialist potentially pollinating insects have been recorded visiting the flowers of this species. Fruits contain a single ovule and seed set is low in those plants in which it has been recorded (John Chesnut, pers. comm. 1997). A related species, Lompoc yerba santa, is self-incompatible and reproductive and genetic studies suggest that small colonies may consist of only a single genotype (clone) (Elam 1994). It is not known if Indian Knob mountainbalm is self-compatible; however, it is possible that some colonies are also composed of a single clone. In addition to sexual reproduction, this species regenerates by root sprouts.

Reasons for Decline and Threats to Survival

The potential for development is the greatest threat to Indian Knob mountainbalm on private lands. In the early 1990's, a water storage tank was installed within a hundred feet of one occurrence north of Highland Drive on private property. Surface mining of tar sands was proposed several years ago for the Indian Knob area (Vanderwier 1987); however, part of this stand now receives protection through a conservation easement that restricts mining activities (N. Havlik, pers. comm. 1997). At Montaña de Oro State Park, a communications line installed in

Hazard Canyon in the early 1990s would have affected scattered individuals, but efforts were made to avoid them.

Conservation Efforts

This species was listed by the State of California Fish and Game Commission as endangered in 1979. The City of San Luis Obispo has purchased a conservation easement that provides protection to a large portion of the known population at Indian Knob. The easement covers almost 1500 acres and restricts mining and development where the known population of the mountainbalm occurs.

Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*)

Recovery Priority 8 (See Appendix A)

Taxonomy and Description

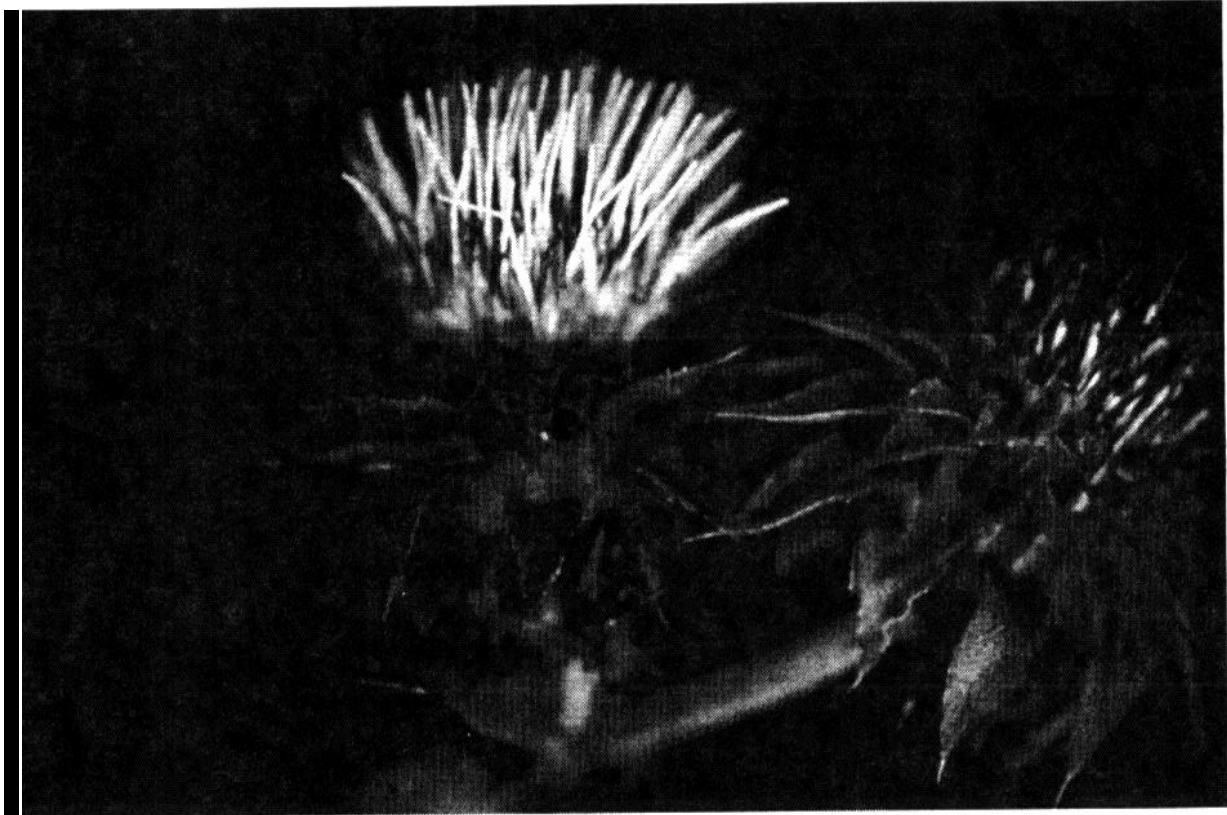
Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*) (Figure 6) is in the composite family (Asteraceae) and is one of two rare varieties of *Cirsium fontinale*. The species first was described by Edward L. Greene in 1886 as *Cnicus fontinalis*. Six years later, he transferred the plant to the genus *Carduus*, and in 1901 Jepson transferred the plant to the genus *Cirsium*. In 1938, J. T. Howell described the variety *obispoense*, based on plants collected at Chorro Creek two years earlier (Abrams and Ferris 1960).

First-year plants form a rosette of spiny leaves that can reach up to one meter (3 feet) in diameter. In the second year, the plant produces an inflorescence (flowering stalk) up to 2 meters (7 feet) in height bearing numerous heads of whitish to pinkish-lavender tinged flowers. Chorro Creek bog thistle is distinguished from other thistles in its range by its nodding flower heads and the glandular hairs on its leaves.

Life History

Chorro Creek bog thistle is a biennial or short-lived perennial herb that typically lives two or three years. It forms a rosette of leaves the first year and usually flowers its second year. If sufficient reserves remain after flowering, some plants may persist into a third year (Chipping 1994, Harding Lawson Associates 1996). The blooming period generally occurs from May through July, occasionally

Figure 6. Chorro Creek bog thistle (*Cirsium fontinale* var. *obispoense*).
Photo from US. Fish and Wildlife Service, Ventura.



extending into September or October. Seedlings have been observed establishing on small patches of recently-disturbed, hummocky, and open soil (Harding Lawson Associates 1996).

Habitat Description

Chorro Creek bog thistle is restricted to saturated areas formed by seeps, springs, and slow streams on serpentine soils. Such soils have very low calcium/magnesium ratios compared to other soils, and frequently have high levels of metals, such as chromium and nickel. Chorro Creek bog thistle tolerates these conditions, which are toxic to many plants.

Historical and Current Distribution

Chorro Creek bog thistle is known from multiple colonies at eight to ten separate sites, depending on how the sites are defined (Figure 1, Table 1). Since the listing of this species in 1994, an additional occurrence has been identified near Miossi Creek (Hendricksen, *in litt.* 1997). Seven sites are near San Luis Obispo, and one outlying site is near San Simeon, about 50 kilometers (30 miles) to the north.

Population size of Chorro Creek bog thistle may vary substantially from one year to the next due to its short lifespan and habitat conditions that may fluctuate with seasonal rainfall (Chipping 1994, Harding Lawson Associates 1995, 1996). Five of the eight sites support 1,000 to 2,000 individuals, while the remaining three sites have from 50 to several hundred individuals each. A summary of the populations is provided in Table 1. Previous reports and records on the species may refer to the sites by different names, and may identify a different number of sites. In this plan, colonies in the same drainage are discussed as a single location.

Reasons for Decline and Current Threats

Due to its narrow habitat requirements, Chorro Creek bog thistle probably has never been abundant. Extant colonies are threatened by proposed water diversions, development, road right-of-way maintenance, and excessive trampling by cattle. Colonies also may decline, temporarily or permanently, because of drought conditions.

Table 1. Recorded populations of Chorro Creek bog thistle, San Luis Obispo County, California.

NDDDB = Natural Diversity Data Base of California Department of Fish and Game

NDDB Number	Location	Estimated number of Individuals (date)	Ownership	Comments
1	San Simeon Creek	~1,100 (1993), 7 colonies	Private	one site voluntarily protected by landowners
2	Laguna Lake	~1,000 (1993), 3 colonies	City of San Luis Obispo	grazing exclosures
3	Chorro Creek / Camp San Luis Obispo	2,900 (1995) 1,800 (1996) 1,100 (1997)	California Army National Guard	annual monitoring
4, 5	Perfumo Canyon	~600 (1993), 4 colonies	City of San Luis Obispo, Private, County (road right of way)	some colonies along road. The City of San Luis Obispo has recently acquired lands supporting three of the four occurrences at this location.
6	Pennington Creek	~2,200 (1993), 2+ colonies	Calif. Polytechnic State U., San Luis Obispo	natural reserve
7, 8	Froom Ranch & Froom Creek	200 - 300 (1988, 1993), 4+ colonies	Private	
9	San Bernardo Creek	500+ (1993)	Private	
un-numbered	Mioosi Creek	~1000 (1997)	Private	

Chorro Creek bog thistle is not usually eaten by cattle, probably due to its spiny leaves. Broken inflorescences and damaged plants have been noted in colonies accessible to cattle, suggesting negative effects on thistle populations (Chipping 1994). Cattle may also introduce additional non-native plants to the wetland environments through their presence and feces. In other instances, however, thistle seedlings have been observed colonizing patches of saturated soil made bare by cattle hoof prints (Chipping 1994). If non-native species, such as annual ryegrass (*Lolium* sp.), or dense stands of native bulrush and spikerush occur in a seep area, light or periodic cattle use may be creating germination sites that would otherwise not be available to the thistle. Cattle use occurs at the Miossi Creek, Pennington Creek, and San Simeon sites, on some or all colonies (Chipping 1994, Chipping, pers. comm. 1996, Hendricksen, *in litt.* 1997). At the Laguna Lake site, two of the three colonies are inside a grazing exclosure constructed to protect the plants (Tina Hall, The Nature Conservancy, pers. comm. 1991). Reopening the thistle's wetland habitat to cattle use at the Chorro Creek site was recently suggested to reduce competition from non-native grasses (E. Begley, pers. comm. 1997). On properties adjacent to those supporting colonies at San Simeon Creek, land development proposals include well installation (San Luis Obispo County, *in litt.* 1991). Because Chorro Creek bog thistle depends on moisture from seeps, it could be negatively affected by diversions of water from above the seeps.

At the Perfumo Canyon site, the population adjacent to the southern edge of Perfumo Canyon Road has been mowed where it extends into the road right-of-way (Chipping 1994).

At the Froom Ranch site, a residential development project was proposed for the site's relatively flat terraces (Morro Group 1988), but has not proceeded. Additional colonies may occur in the seeps above the terraces, but direct adverse effects from residential development are less likely there because of the steeper slopes (Chipping, pers. comm. 1997).

To control alien species of thistle, the San Luis Obispo County Department of Agriculture introduced the seedhead weevil (Coleoptera: Curculionidae: *Rhinocyllus conicus*) to several sites in San Luis Obispo County in the early 1980's. The seedhead weevil had been introduced for this purpose throughout

California since the early 1970's. Initial reports from field botanists indicate that the seedhead weevils are feeding on Chorro Creek bog thistle (e.g., Harding Lawson Associates 1996), although population-level effects are not known. Biologists have suggested that, because the length of the flowering season of the thistle far exceeds the egg-laying period of the weevil, predation by the weevil may account for only a small reduction in seed availability (Charles Turner, Research Botanist, USDA Agricultural Research Service, pers. comm. 1991). Oviposition (egg laying) by the weevil has been recorded at the Camp San Luis Obispo (Harding Lawson Associates 1995), and San Simeon colonies (Turner in Chipping 1994). However, inadequate information exists to determine the population-level effects of the weevil and whether control is needed (Chipping 1994, Harding Lawson Associates 1996). The weevil has affected other native thistles around the United States (Loude et al. 1997, Strong 1997).

Conservation Efforts

The situation for Chorro Creek bog thistle has improved since its listing in 1994. Currently, multiple colonies at four locations (Laguna Lake, Chorro Creek, Perfumo Canyon, Pennington Creek) are secured from development. At one site on San Simeon Creek the landowners have entered into a voluntary protection agreement with The Nature Conservancy and participate in a monitoring program for the thistle. The Department of Fish and Game funded field investigations in 1993 to identify extant colonies, search for additional sites, and describe potential introduction sites at more than 50 specific localities around San Luis Obispo (Chipping 1994).

Grazing exclosures have been installed around some or all colonies at Pennington Creek, Laguna Lake, and Chorro Creek. The California Military Department has fenced, restored, and monitored the Chorro Creek bog thistle at Camp San Luis Obispo since 1994 (Harding Lawson Associates 1995, 1996). Currently the Military Department is studying the effects on the Chorro Creek bog thistle of experimental short-term use of the site by cattle.

Most recently, in 1997, an agreement was reached as part of a development approval process, whereby the City of San Luis Obispo will receive over 350 acres in the Perfumo and Froom Creek drainages. These lands support at least

three previously recorded colonies of Chorro Creek bog thistle from the Perfumo Canyon location and at least one colony on upper Froom Creek that had not been recorded. This is the southernmost protected site in this taxon's range.

Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*)

Recovery Priority 2C (See Appendix A)

Taxonomy and Description

Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*) (Figure 7), a member of the four o'clock family (Onagraceae), was first collected in Carpenter Canyon by Frank Harlan Lewis and Margaret Ensign Lewis in 1947. Their monograph on the genus *Clarkia* (Lewis and Lewis 1955) described the plant for the first time. The plant is an erect annual herb, with wiry, branched stems up to 5 decimeters (20 inches) long; the petals are white or cream-colored at the base, shading into pink or red-lavender in the upper part and are 1.5 to 2.5 centimeters (0.6 to 1.0 inch) long. It is distinguished from the subspecies *speciosa* by its larger flowers and the pattern of petal color. In his flora of San Luis Obispo County, Hoover (1970) notes the geographical separation between Pismo clarkia and the subspecies *speciosa*. The latter subspecies occurs north of San Luis Obispo from the Santa Lucia range to the Salinas River drainage.

Historical and Current Distribution

This plant is very narrowly distributed on coastal marine terraces in a 10 to 15 mile stretch of coast, from south of San Luis Obispo to Nipomo Mesa in western San Luis Obispo County (Fig. 1). About sixteen occurrences have been recorded (Table 2). Three of these are believed to be completely extirpated, five others have been partially destroyed by residential and golf course development. The four largest sites have been estimated to support 1,000 to 3,000 plants each and the smallest fewer than 50 plants.

Habitat Description

Pismo clarkia typically occurs in fine, dry, sandy soils, derived from ancient marine terraces, in grasslands or openings in chaparral and oak woodlands at elevations below 600 feet.

Figure 7. Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*)
Photo from U.S. Fish and Wildlife Service, Ventura.



Table 2. Recorded populations of Pismo clarkia, San Luis Obispo County, California.

NDDB Number	Location	No. of Individuals	Ownership	Comments
2	Ormonde Road	1,000 – 2,000 (NDDB 1987 & 1997)	Private (most), County (ROW)	Roadside mowing on right-of-way (ROW).
3	Price Canyon	—	—	Historic, not relocated.
4	Carpenter Canyon	~30 (NDDB 1987)	Caltrans (?), Private	At road edge with minimal habitat available.
5	Price Canyon	1,000 – 2,000 (NDDB 1985 & 1987)	Private (most), County (ROW)	Grazed and in road right-of-way. Bisected by Price Canyon Road.
6	Grover City	?	Private	Portion lost to development by 1987. Status of remainder unknown.
7	AG Cemetery	EXTIRPATED	—	—
8	James Way	< 200 (Steeck, pers. obs. 1997)	Private	Several colonies preserved in open space, fenced; others destroyed, with reseeding as mitigation.
9	Oak Park School	EXTIRPATED	—	—
10	Black Lake Canyon area	600 (Oyler in litt. 1992)	Private	Development pending. Mitigation includes reseeding.
11	Highway 227	100 – 1,000 in 1992 (Keil, <i>in litt.</i> 1997)	Private	Considered for development in 1992. Not developed.
12	Pismo Creek	>20 (O’Neil, in litt. 1997)	Private	Proposed for development. Early planning stages (1997).
13	Gragg Cyn	several thousand (NDDB 1998)	Private	Initially proposed for development; no proposal currently pending.
14	Oak Park Road	> 3,000, over 50-60 acres (Interface 1996)	Private	Proposed for development.
15	Black Lake Canyon South Willow Road	15+ (McLeod 1989, 1992)	Private	Development pending. Site to remain as undeveloped, in undeveloped open space.
16, 17	Black Lake Canyon North Willow Road	?	Private	Original site scraped during golf course development. Soil and seed moved as mitigation.

Life History

Pismo clarkia is an annual herb that typically flowers from May through July, occasionally extending into September. It has been noted that plants do not necessarily appear in the same locations in consecutive years (Dunn, *in litt.* 1987; Oyler, pers. comm. 1997), suggesting that a soil seedbank may exist. Seeds are not known to have any specialized dispersal mechanism. No further information on life history is currently available.

Reasons for Decline and Threats to Survival

At least three historical populations are believed to have been extirpated and at least five others have been partially destroyed by housing or golf course developments or are located where developments have been approved. Extant populations are on private lands and are threatened by continuing residential and commercial development, road maintenance activities, and possibly grazing and competition with non-native grasses, including veldt grass. Mitigation efforts have frequently involved experimental attempts to establish populations in dedicated open space areas. To the Service's knowledge, none of these attempts have successfully created viable, self-sustaining populations.

Conservation Efforts

This species was listed by the State of California Fish and Game Commission as Rare in 1978. A small amount of seed from two populations is being maintained for conservation purposes in the long-term seedbanking program at Rancho Santa Ana Botanic Garden (RSABG *in litt.* 1997). No other species-specific conservation efforts have been undertaken. Mitigation efforts for populations altered or destroyed by development have often involved attempts to establish new populations rather than avoidance or on-site preservation of existing populations. Attempts to re-establish populations on undeveloped portions of sites that will remain in open space are experimental, however, and should not be considered adequate mitigation under CEQA. Although several of the population creation efforts are too recent to evaluate success, similar activities with other rare annual species have most often failed (Fiedler 1991).

6. Recovery Strategy

This plan addresses recovery of three of the species collectively: Morro shoulderband snail, Morro manzanita, and Indian Knob mountainbalm. The snail and the manzanita have narrow distributions primarily south of Morro Bay on Baywood fine sands soils. Five of the six known occurrences of the mountainbalm also occur in this region on Baywood fine sands and adjacent soils. Recovery of the remaining two species (Chorro Creek bog thistle and the Pismo clarkia) is addressed individually because their distributions and habitats differ from those of the Morro Bay species, and from one another.

Morro Bay species (Morro manzanita, Indian Knob mountainbalm, and Morro shoulderband snail)

A coordinated approach to maintaining the mosaic of dune, coastal scrub, coast live oak, and maritime chaparral vegetation where the listed Morro Bay species occur is essential to their recovery. These plant communities support several other listed and sensitive species in the area south of Morro Bay including:

- Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*) (endangered)
- Morro blue butterfly (*Icaricia icarioides morroensis*) (sensitive)
- beach spectaclepod (*Dithyrea maritima*) (sensitive)
- splitting yarn lichen (*Sulcaria isidiifera*) (sensitive)

Listed and sensitive species that occur within the boundaries of the Conservation Planning Areas identified in this plan, but in plant communities or habitats adjacent to the ones with the plan's species, include:

- western snowy plover (*Charadrius alexandrinus nivosus*) (threatened)
- Mimic tryonia snail (*Tryonia imitator*) (sensitive)
- California seablite (*Suaeda californica*) (endangered)
- salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*) (endangered)

Several other listed and sensitive species (e.g., California red-legged frog [*Rana aurora draytonii*] and southern sea otter [*Enhydra lutris nereis*]) occur in the Morro Bay area, but do not typically co-occur with the listed taxa for which this plan was developed and do not occur in the Conservation Planning Areas.

This recovery plan emphasizes conservation of the largest remaining tracts of intact natural habitat throughout the range of the three listed Morro Bay species included in this plan. An approach that integrates the recovery of these three species with the endangered, threatened and sensitive species with which they co-exist offers the best opportunity for success. Should habitat conservation efforts for these listed species fail, it is possible that new listings could become necessary and the Morro manzanita may be reclassified as endangered.

To coordinate recovery, this plan roughly delineates “Conservation Planning Areas” where:

(1) the distributions of the Morro manzanita, Morro shoulderband snail, and Indian Knob mountainbalm overlap or are contiguous with one another, with historic or occupied habitat for the Morro Bay kangaroo rat, and with the distributions of other sensitive species. These areas offer the best opportunity to focus recovery and management efforts on biologically rich natural communities. The occurrence of multiple species of concern emphasizes the need to manage for healthy, unfragmented biological communities, rather than focusing on a species-by-species approach.

(2) natural habitats are relatively large and unfragmented by development. Although growth of the human community of Los Osos has caused substantial habitat loss and alteration, relatively unfragmented natural areas still exist. Typically, larger habitats will have lost fewer of their biological components and are more likely than small areas to maintain community and ecosystem processes (e.g., food webs, pollination and seed dispersal mechanisms, nutrient cycling, and fire/flood regimes).

(3) natural habitats are in public ownership or are adjacent to areas that are already secured and are to be managed for their biological diversity. Two of these Conservation Planning Areas—the Morro Spit and West Pecho—are located primarily on State Park lands. Ownership at two others—South Los Osos and Northeast Los Osos—is split among State Parks, the County, and private individuals and companies.

Conservation Planning Areas are delineated to focus conservation activities on lands that support numerous listed and sensitive species and where recovery

potential is high. Substantial protection of land within the Conservation Planning Area boundaries is essential to the recovery of the three species, and this recovery plan places a higher priority on securing unprotected lands inside the four Conservation Planning Areas than outside of them. Implementing this recovery plan will require cooperation among the various landowners.

One limitation of this plan is the lack of information available on habitat use by the Morro shoulderband snail. Most of the distributional information available on the Morro shoulderband snail is presence/absence data, from which the size or viability of populations cannot be inferred. Therefore, all sites occupied by the Morro shoulderband snail are considered important for its recovery and their relative merits for protection will be assessed on a site by site basis.

The Conservation Planning Areas are discussed below. Their boundaries have been roughly delineated using 1995 aerial photos, and are shown in Figure 8.

- **Morro Spit Conservation Planning Area** includes the length of the spit and the foredune areas extending south toward Hazard Canyon. The spit's windward side and its north end are non-vegetated; patches of vegetation occur along its leeward side on Morro Bay. This Conservation Planning Area provides habitat for the Morro shoulderband snail in dune scrub vegetation, and supports breeding habitat for western snowy plovers, also federally listed as threatened. Populations of sensitive species such as beach spectaclepod and California seablite also occur in this area. This Conservation Planning Area is in public ownership; most of its lands are managed as the Morro Dunes Natural Preserve in Montaña de Oro State Park. The City of Morro Bay manages the north end of the spit.
- **West Pecho Conservation Planning Area** lies to the east of the Morro Spit Conservation Planning Area and is bounded on the east by Pecho Road and the community of Los Osos; it extends north to the Bay and south to Hazard Canyon. Elevations range from sea level on the Bay to about 75 meters (250 feet) along its southeastern edge. Vegetation associations include coastal dune scrub, with coastal sage scrub closer to Hazard Canyon. This Conservation Planning Area supports the Morro shoulderband snail, low-density Morro manzanita stands along its southeastern edge, and California seablite—all

federally listed species. It also supports several sensitive species, including the Morro blue butterfly, as well as habitat for the Morro Bay kangaroo rat. Most of this Conservation Planning Area is within Montaña de Oro State Park. The California Department of Fish and Game owns an ecological reserve in this Conservation Planning Area which is managed cooperatively with adjoining State Park's property. Privately owned lands occur along its northeastern border within the community of Los Osos.

- **South Los Osos Conservation Planning Area** is bounded on the west by Pecho Road, on the north and east by residential development in the community of Los Osos and agricultural fields; it extends into Montaña de Oro State Park to encompass the distribution of Morro manzanita and Indian Knob mountainbalm. This Conservation Planning Area is on the slopes of the Irish Hills from about 60 to 300 meters (200 to 1000 feet) elevation. It contains most of the remaining Morro manzanita, and five of the six known occurrences of the Indian Knob mountainbalm on its upper slopes in Morro manzanita chaparral, and maritime chaparral communities. On its lower slopes, south of Highland Drive, it supports the Morro shoulderband snail and perhaps the last known population of the Morro Bay kangaroo rat. Much of this Conservation Planning Area is in private ownership; the southern portion is within Montaña de Oro State Park.
- **Northeast Los Osos Conservation Planning Area** includes undeveloped areas between Los Osos Creek and Baywood Park and is divided by South Bay Boulevard. Its elevation range is from sea level to about 30 meters (100 feet). Vegetation is dominated by variants of coastal sage and dune scrub, with scattered stands of manzanita and coast live oak. It supports the Morro shoulderband snail, Morro manzanita, mimic tryonia snail, Morro blue butterfly, splitting yarn lichen, dune almond, historical habitat for the Morro Bay kangaroo rat, and an unusual community of dwarfed coast live oaks. This Conservation Planning Area includes the State- and County- owned Elfin Forest Preserve, portions of Morro Bay State Park, and privately owned lands.

Once lands are secured, management will be required to ensure that the ecosystem processes and community interactions to which these species are adapted still function. The encroachment of non-native species into the coastal and inland

habitats around Morro Bay already presents a significant management challenge. Methods must be developed to control them while avoiding substantial negative effects to associated native organisms. Because the native habitats south of Morro Bay have been reduced in extent and fragmented, the opportunities for dispersal and recolonization by the Morro Bay species are substantially diminished. Active management is needed to maintain and sufficiently restore the mosaic of biological communities to permit the recovery of the listed Morro Bay species and halt the decline of other species of concern.

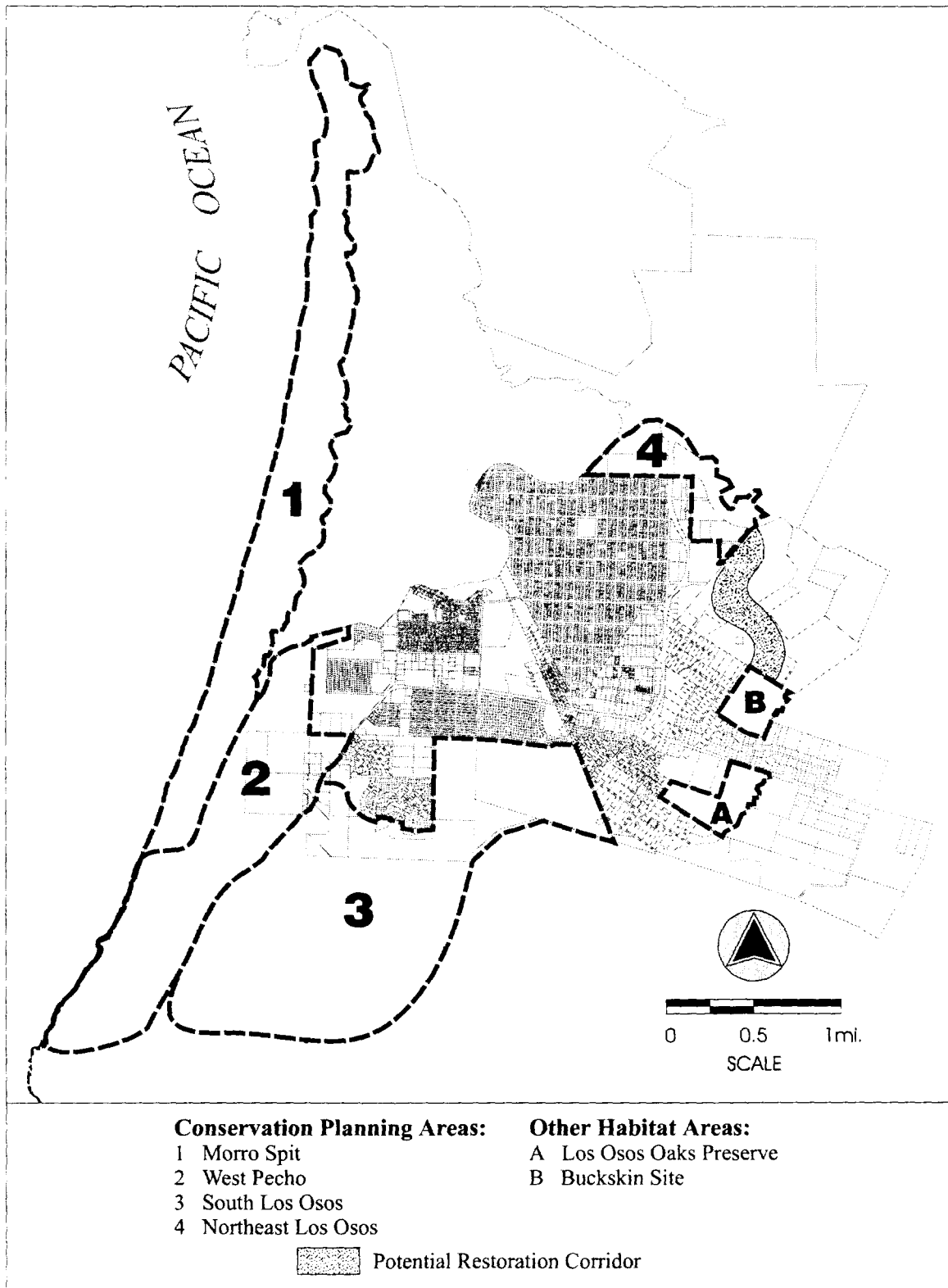
Chorro Creek bog thistle

The focus of recovery for the Chorro Creek bog thistle is to secure populations from development and protect springs and spring sources from modifications that would be detrimental to the thistle or its wetland habitat. Secured sites should include adequate surrounding habitat to allow for population expansion and to support pollinators and other key ecological interactions. It is also of high priority to evaluate the effects of land management practices, particularly livestock grazing, on this species, as several populations are currently subjected to cattle use. The intensity and timing of cattle use at a site may determine the thistle's response.

Pismo clarkia

Securing protection for large, self-sustaining populations is the primary recovery need for Pismo clarkia. Only one naturally occurring population is currently protected. Secured sites should include adequate surrounding habitat to allow for population expansion and movement and to support pollinators. Habitat may be secured through fee purchase, conservation easements, and set-asides as mitigation under CEQA. All local lead agencies must be informed of the importance of conserving naturally occurring populations of this species in open space, rather than allowing experimental translocation of populations into unoccupied habitat. Habitat management for secured sites should focus on controlling non-native species that might compete with the clarkia and controlling the secondary effects of adjacent land uses on the clarkia, particularly when protected areas are small. The combined effects of grazing and competition with non-native grasses on this species should also be evaluated to determine how current grazing practices affect the status of the clarkia.

Figure 8. Conservation Planning Areas for Morro Bay Species



Source: US Fish and Wildlife Service; SLO County Planning Department; Crawford Multari & Clark Associates

II. RECOVERY

Objectives and Criteria

Morro Shoulderband Snail

The recovery objective for the Morro shoulderband snail is delisting.

Downlisting for the Morro shoulderband snail can be considered when sufficient populations and suitable occupied habitats from all four Conservation Planning Areas (Morro Spit, West Pecho, South Los Osos, and Northeast Los Osos) are secured and protected. These areas should be intact and relatively unfragmented by urban development. Snail populations must be large enough to minimize the short-term (next 50 years) risk of extinction on any of the four Conservation Planning Areas, based on results of tasks 3.2.1.1, 3.2.1.2, and 3.2.1.3 and on at least preliminary results from task 4.1. Downlisting also requires that potential habitat within the snail's historic range will have been identified and surveyed to see if undiscovered populations exist. Should surveys locate additional populations, especially north of Morro Bay, recovery criteria will have to be evaluated and revised.

Delisting can be considered for the Morro shoulderband snail when habitats from all Conservation Planning Areas (and, if necessary, any newly located populations) are successfully managed to maintain the desired community structure and secured from threats of development, invasion of non-native plants, structural changes due to senescence of dune vegetation, recreational use, pesticides (including slug and snail baits), parasites, and competition or predation from non-native snail species. Results of recovery tasks must continue to a low medium-to-long term risk of extinction from any of the four Conservation Planning Areas.

Morro Manzanita

The recovery objective for Morro manzanita is delisting.

Morro manzanita can be considered for delisting when all three of the following have been achieved: (1) 90 percent of existing acreage supporting high (75-100 percent) and medium (25-75 percent) cover of Morro manzanita and 85-90 percent of low (1-24 percent) cover supporting Morro manzanita are secured from human-induced threats in preserves in the Northeast Los Osos, South Los Osos and West Pecho Conservation Planning Areas with no greater fragmentation by roads, residences, or other areas of human use than currently exists, (2) evidence that the acreage and approximate cover classes of Morro manzanita in preserves can be maintained over time and that preserves are not made unmanageable by small size, proximity to urban development, or fragmentation, and (3) site-specific management plans have been successfully implemented for the preserves.

Because habitat in the Conservation Planning Areas must remain unfragmented to recover this species, habitat attrition must be restricted to isolated or remnant patches of Morro manzanita that are unlikely to be viable over the long term.

Highest priority for securing sites should be given to stands where Morro manzanita is the dominant in terms of cover, where large blocks of occupied habitat are still present, and where Morro manzanita habitat can be secured that abuts other protected lands, as in the South Los Osos Conservation Planning Area.

Indian Knob Mountainbalm

The current recovery objective for Indian Knob mountainbalm is reclassification to threatened status. The Service is providing only downlisting criteria at this time, because so little information is available on this species' reproductive biology, demography, and response to fire, and whether existing occurrences are composed of one or multiple genetic individuals. As management and life history information become available, recovery criteria will be revised and delisting criteria will be developed.

Indian Knob mountainbalm can be considered for downlisting when all three of the following have been achieved: (1) at least five occurrences from throughout

its range are on lands secure from human-induced threats, (2) surrounding habitat is protected in amounts adequate to permit management of the vegetation community using prescribed fire, if it is deemed beneficial for the species, and (3) populations are projected to be self-sustaining and either stable or increasing as determined from long-term monitoring and research results.

Chorro Creek Bog Thistle

The current recovery objective for Chorro Creek bog thistle is reclassification to threatened status. The Service is providing only downlisting criteria at this time, because so little information is available on this species' hydrologic needs, pollination biology, requirements for seedling establishment, and demographic fluctuations in response to environmental variation. As information on life history and management become available, recovery criteria will be revised and delisting criteria will be developed.

Chorro Creek bog thistle may be considered for downlisting when (1) populations from throughout the range of this species, each made up of multiple colonies, and their habitat at six sites are secure from human-induced threats, including water diversions or drawdowns, (2) at least three of these sites are in protected areas of greater than 100 acres and populations are deemed viable and stable or increasing as determined by monitoring over a precipitation cycle that includes multiple years of below average rainfall, (3) protected sites are being managed in a way that will support the continued existence of Chorro Creek bog thistle populations and their wetland habitats, and (4) management is effective, as shown by at least ten years of monitoring.

Pismo Clarkia

The current recovery objective for Pismo clarkia is reclassification to threatened status. The Service is providing only downlisting criteria at this time, because so little information is available on this plant's reproductive biology, soil seedbank dynamics, response to livestock grazing and population dynamics within its grassland habitat. As information on life history and response to management

activities becomes available, recovery criteria will be revised and delisting criteria will be developed.

Pismo clarkia can be considered for downlisting when (1) eight populations are on lands secured from human-induced threats with adequate surrounding habitat to permit natural population expansion and movement as suitable microhabitats shift in the landscape, (2) the eight protected populations represent the plant's entire range, (3) these populations must be large, stable or increasing (a minimum of ten years of monitoring is needed because population sizes fluctuate due to precipitation), and (4) management of these populations and associated lands in the future must be reasonably assured for the long term, and must be effective, as demonstrated by stable or increasing populations.

Narrative Outline

1. Secure populations and habitat on unprotected lands.

Methods for securing lands include in-fee purchase, gifts of easement or fee interest by the property owner, deed restrictions (provided restrictions cannot be changed privately without the knowledge of Federal, State and County agencies), acquisition of property rights (e.g., development rights) or permanent conservation easements.

1.1 Morro Bay Species:

A substantial amount of the land within the South Los Osos Conservation Planning Area is proposed or being considered for development and should be secured. Unprotected lands also occur in the Northeast Los Osos Conservation Planning Area. The West Pecho Conservation Planning Areas is primarily in public ownership, managed by State Parks and the Department of Fish and Game, although important snail habitat remains in private ownership. The Morro Spit is in public ownership, managed by State Parks and the City of Morro Bay.

1.1.1 Secure primary sites:

The South Los Osos Conservation Planning Area supports the greatest density of Morro manzanita, three of the six populations of the mountainbalm, habitat for the Morro shoulderband snail, and perhaps the last extant population of the Morro Bay kangaroo rat, and is adjacent to State Parks lands along part of its border.

The Northeast Los Osos Conservation Planning Area supports the most northern intact population of Morro manzanita, the Morro shoulderband snail, habitat for the Morro kangaroo rat, and several other sensitive species.

To promote the recovery of these species, lands secured within the conservation planning areas should be contiguous and they should be configured with low perimeter-to-area ratios to minimize the effects of surrounding land uses on protected areas (e.g., invasion by non-native landscaping plants, incursion by pets, pesticide drift, excessive irrigation). When new residential areas will border protected areas, buffer zones for fire control should be included as part of the community receiving the fire protection, rather than part of the conservation lands. Buffer zones should not be counted as part of the habitat considered essential for the recovery of the species.

1.1.2 Conduct surveys to evaluate the relative importance of secondary sites, dispersal corridors, and other areas of potential habitat (example areas are shown in Figure 8 as “other habitat areas”) and secure as necessary

The current distribution of the Morro shoulderband snail should be clarified through surveys of potential habitat (e.g., Los Osos Oaks Preserve). Aerial photos from the 1940s show large amounts of coastal scrub in what is now the developed community of Los Osos. Surveys of both the fragmented in the interior of Los Osos, and the habitats on the community’s perimeter will clarify recovery options for this species. Surveys of historical locations north of Morro Bay have not relocated

Morro shoulderband snails; however, the location of historical collections south of Cayucos, in particular, should be resurveyed over a number of years, in case a small population still exists there. Depending on the period of isolation, there could be substantial genetic differences between populations of snails from the north and south of the mouth of Morro Bay due to genetic drift or local selection. If found, populations north of Morro Bay should be secured.

The Fish and Wildlife Service is currently funding surveys for this species at the Elfin Forest of Morro Bay State Park, the Morro Dunes State Reserve, Montaña de Oro State Park, and Morro Strand State Beach.

1.2 Secure Chorro Creek Bog Thistle currently on unprotected lands

Four of the eight sites currently have land-use designations that provide protection from development; colonies at one additional site have voluntary protection by the land owner. The site with voluntary protection is especially important as it represents the only protected colony in the northern range of the bog thistle. In securing lands from development, it is essential to include the spring sources, adequate habitat for pollinators, and adequate lands to buffer the populations from surrounding land uses and allow for population expansion and movement.

1.3 Secure Pismo Clarkia currently on unprotected lands

Currently only one naturally occurring population, in a small open space area within a residential development, is secured from development. In securing sites, priority should be given to large populations with adequate surrounding lands to prevent site degradation by the secondary effects of adjacent land use (e.g., irrigation, herbicide drift, landscape waste dumping, encroachment by non-native species, vegetation management for fire protection activities). Configuring open space areas to maximize area while minimizing perimeter will typically help reduce these effects. Sites should be large enough to allow population expansion and movement (as suitable microhabitats shift in the landscape) and should include adequate habitat for pollinators.

1.4 Survey potential habitat to identify additional populations of Pismo clarkia and secure as necessary

A property at Indian Knob, on which the City of San Luis Obispo holds a conservation easement, is within the range of this species, has some protection, and may support potential habitat for this species. This site should be surveyed for Pismo clarkia as should other unsurveyed habitat within its range.

2. Manage secured lands to control or eliminate other known threats

Although habitat alteration through development is currently the most substantial and irreversible threat facing all of the species in this plan, the management of lands secured from development will remain a formidable task, made more so in those cases where the secured habitats are adjacent to high density residential and urban development.

2.1 Manage secured lands for Morro Bay species

Threats identified to date are discussed below. Additional threats may become apparent as focused research is completed and if new populations are discovered. As new threats arise, management actions to reduce or eliminate their effects on the Morro Bay species should be implemented.

2.1.1 Collaborate with landowners and responsible entities to control threats on secured lands

For Conservation Planning Areas that contain secured lands under multiple ownerships, a working group or other method will be needed to coordinate management actions between parcels and to share information on effective methods of controlling threats (e.g., eradication or control of non-native species, eliminating illegal off highway vehicle [OHV] trespass).

2.1.1.1 Develop and implement strategies to control or eliminate illegal OHV use on secured lands

Currently, OHV use degrades habitat in the South Los Osos and West Pecho Conservation Planning Areas. Once lands are secured, OHV traffic in these areas should be managed to prevent further habitat disturbance and degradation. Management programs (i.e., education, posted restrictions, and/or physically restricting access) for controlling or eliminating OHV use should be developed and implemented in cooperation with the California Department of Parks and Recreation.

2.1.1.2 Develop and implement strategies to control non-native plant species

Veldt grass, eucalyptus, and the iceplants (*Conocosia* and *Carpobrotus*) are the non-native weedy species currently of greatest concern in the habitats of the Morro Bay species. These species have the potential to compete aggressively with native species, particularly after fires or soil disturbance. *Conocosia* has seeds that are wind- and bird-dispersed (Tyler and Odion 1996; V. Cicero, pers. comm. 1998), so elimination from the boundaries of a burn or preserve site may not adequately reduce its establishment in an area. *Carpobrotus* seeds are dispersed through the feces of herbivores, which may be particularly attracted to recently burned sites due to the new growth of native shrubs (Tyler and Odion 1996).

Control efforts should be prioritized, with consideration given to the aggressiveness of the invader, its potential to alter the functioning and composition of the native community, the effectiveness of the control method, the future plans for the site, and the potential for reinvasion from surrounding sources.

Methods to remove these species include hand pulling or other manual removal, localized herbicide applications, or biocontrol. Eucalyptus is often removed manually, followed by herbicide treatment of the cut trunk and resprouts. Due to the chemical components of eucalyptus leaf litter, restoration activities may be needed before the site will again support a native plant community (Jones and Stokes Associates 1997). Hand removal of veldt grass is difficult because of its pervasive root system and tendency to break at the nodes (Tyler and Odion 1996). The regeneration of the iceplants via stem pieces make hand removal of those species extremely difficult. The Service is not aware of any effective biocontrol agents currently in use for these species.

The effectiveness of methods to control non-native species must be assessed with respect to collateral damage inflicted on native organisms in the surrounding community. Control of fig-marigold has been attempted on the Morro Spit using herbicide applications. This was halted in 1996 after the Park noted Morro shoulderband snails under iceplant mats (V. Cicero, pers. comm. 1996).

2.1.1.3 Develop and implement fire management programs

2.1.1.3.1 Develop and implement prescribed burn plan to maintain a mosaic of vegetation types necessary for recovery of Morro Bay species

Prescribed burn guidelines should be developed. For example, burns should be conducted in a mosaic pattern to ensure that species in adjoining areas will have the opportunity to colonize the burned areas. Adjoining plots should not be burned until several years of monitoring suggests that the previously burned areas have been recolonized by the target species. To increase the target species' opportunity to colonize the

burned areas, the shape of the areas to be burned should be chosen to maximize the periphery (i.e., allowing more entrance area for immigration). Burned areas should be monitored for any invasions of non-native plant species. Pre-burn control of non-native plants, both to reduce the risks of fire escape (as in the removal of *Eucalyptus* sp.) and the likelihood or extent of invasion by non-natives after the fire, should be conducted. Burn prescriptions should follow the guidelines.

2.1.1.3.2 Develop and implement strategy for wildfire suppression in areas with high fuel loads

Agencies with trust responsibilities for the sensitive biological resources south of Morro Bay should work with the California Department of Forestry, local agencies and concerned parties to assure that their strategies for wildfire prevention and suppression protect the area's sensitive biological resources while minimizing the risk to human life and property on the wildland/urban interface. Defining appropriate and inappropriate post-fire activities is particularly important, such as seeding or revegetating for erosion control.

2.1.2 Prevent potential introduction of non-native predatory snails on secured and adjacent lands

Any introduction of non-native snails into San Luis Obispo County should be prevented to avoid the potential threats of predation and competition with the native Morro shoulderband snail. California Department of Fish and Game and the County Department of Agriculture should continue current prohibitions, programs and

activities that prevent or discourage any future introduction of non-native predatory snails into San Luis Obispo and adjacent counties.

2.1.3 Discourage pesticide (e.g., molluscicide) applications on areas adjacent to habitat

Any pesticide applications on areas adjacent to habitat must be designed to avoid harming populations of Morro shoulderband snails. Some habitat areas of the Morro shoulderband snail are adjacent to residential, agricultural, and public development. Public awareness and appropriate limitations should be established to limit the potential for adverse effects on the snail's populations. Public awareness and appropriate limitations should be developed in coordination with the County Department of Agriculture and in keeping with the protection provided to the Morro shoulderband snail by the Endangered Species Act.

2.2 Manage secured land for Chorro Creek bog thistle

Once sites are secured, management efforts should focus on protecting spring sources and evaluating appropriate land management strategies. Other threats may become apparent as monitoring and focused research is completed and if new populations are discovered. As new threats arise, management actions to reduce or eliminate their effects on the Chorro Creek bog thistle should be implemented.

2.2.1 Modify roadside maintenance activities for the bog thistle, as needed

The County should designate regions of County road right-of-ways where the thistle grows as environmentally sensitive areas; roadside maintenance has been identified as a potential problem along Perfumo Canyon Road. Road maintenance workers should be informed of the occurrence of thistle in these areas and directed to avoid them.

2.2.2 Protect spring sources for the bog thistle

The maintenance of springs is very important in protecting the habitat of the bog thistle. The indirect effects of altering spring flow or quality on the thistle should be considered under the HCP (should there be any that include this plant's habitat) and CEQA processes.

2.3 Manage secured lands for Pismo Clarkia

Once sites are secured, management efforts should focus on controlling non-native species and assessing, and reducing the negative effects of, surrounding land use practices on this species. Other threats may become apparent as monitoring and focused research is completed and if new populations are discovered. As new threats arise, management actions to reduce or eliminate their effects on the Pismo clarkia should be implemented.

2.3.1 Control non-native species, including veldt grass and fig-marigold

Fig-marigold or iceplant (*Carpobrotus edulis*) and veldt grass should be eliminated from the habitat of the only known protected site for this species (EO 8, in part) while these species are still very limited in extent. At other sites, non-native species should also be controlled or removed if they threaten Pismo clarkia.

2.3.2 Modify roadside maintenance activities for Pismo clarkia

Of the currently known sites, only one very small colony of Pismo clarkia (Natural Diversity Data Base [NDDDB] occurrence # 4) exists within (or adjacent to) a State highway right-of-way under the jurisdiction of the California Department of Transportation (Caltrans). Caltrans has designated the strip of highway along which it occurs as "environmentally sensitive."

Several known sites for this species occur along County roads (NDDDB occurrences 2 & 5) and at least one of these is occasionally mowed,

probably for fire prevention purposes. The extent of these sites should be carefully mapped and the County should modify its mowing regime and other road maintenance activities to avoid the flowering and fruiting seasons for clarkia.

2.3.3 Expand conservation seed collection for Pismo clarkia

Currently, Rancho Santa Ana Botanic Garden houses conservation seed collections of this species from two populations. As an emergency backup measure against extinction, seeds from several additional populations, preferably from the southern portion of this species range, should be added to the collection.

3. Evaluate potential threats and conduct management-oriented research

3.1 Conduct habitat-oriented research for Morro Bay species

Because of the need to manage large habitat areas for the benefit of multiple listed, candidate, and sensitive species, habitat-oriented research is especially important for the Morro Bay species.

3.1.1 Develop methods to control non-native plant species that will not threaten populations of listed, candidate, and sensitive species

Control of iceplants using herbicide applications has been attempted on dunes at Morro Dunes State Preserve. This was halted in 1996 after the Park noted the presence of live Morro shoulderband snails under mats of iceplant (Cicero, pers. comm. 1996). Methods should be evaluated and implemented to control invasive non-native plant species without threatening populations of the Morro shoulderband snails or other listed, candidate, or sensitive species.

3.1.2 Determine methods to maintain a mosaic of vegetation communities appropriate for all listed and sensitive species

Habitats need to be managed at the community level, rather than for specific species, to ensure that management methods do not further endanger organisms that are already endangered by habitat loss. The effectiveness of prescribed burns to maintain the mosaic of vegetation must be assessed with respect to collateral damage inflicted on native organisms in the surrounding community. For example, individual Morro shoulderband snails in the Montaña de Oro State Park have been unintentionally killed as a result of prescribed burning of coastal scrub conducted during habitat restoration for the endangered Morro Bay kangaroo rat. Prescribed burns for restoration should consider the community level and result in a net benefit for the target species. This will require many steps, of which only two are discussed below:

3.1.2.1 Determine recolonization abilities of the Morro shoulderband snail following burning or other habitat restoration techniques

Use of fire as a tool to restore Morro manzanita chaparral to previously disturbed habitats in the West Pecho CPA has been suggested. These areas, although they once probably supported high cover of Morro manzanita, now support coastal sage scrub communities that may be inhabited by the Morro shoulderband snail. Before burning prescriptions or restoration activities are developed, the presence of other listed and sensitive species and their recolonization abilities should be considered.

3.1.2.2 Determine recolonization abilities of the Morro manzanita and Indian Knob mountainbalm following burning or other habitat restoration techniques.

Where Morro manzanita individuals are old, as in the Elfin forest, the soil seedbank may be sparse and viability low (Tyler

and Odion 1996). Indian Knob mountainbalm also occurs in very small populations of less than 50 ramets and these small populations may be producing little seed. Regeneration abilities under a variety of potential fire intensities should be determined before prescribed burns are conducted in areas where they have the potential to substantially affect these species.

3.2 Conduct species-specific research

Although many basic characteristics of the life history of these species are known, other critical aspects need to be investigated to allow refinement of management actions.

3.2.1 Conduct species specific research on Morro Bay species

3.2.1.1 Determine if brown garden snail is a competitive threat to Morro shoulderband and control as necessary

Competition for food, estivation sites, and especially shelter sites between Morro shoulderband and the non-native brown garden snail (*Helix aspersa*) should be investigated. Preferred food, estivation, and shelter sites should be determined for both species. If the research results show that both snails use similar resources and *Helix* is a competitive threat, a detailed control strategy for *Helix* should be developed and implemented. The best available method of control for exotic snail species that will not also affect the Morro shoulderband snail is hand-picking. This process is very time-consuming and would probably not completely eradicate *Helix*.

3.2.1.2 Study habitat use and life history needs of the Morro shoulderband snail

Studies should be performed to determine if immature stands in earlier successional stages offer more favorable shelter and litter

higher in food value compared to mature senescent stands of coastal dune scrub. Documented observations and research on the feeding behaviors of the snail should be gathered to determine the required vegetation needed for food resources. Information on the snail's reproduction, growth, and dispersal capabilities should also be obtained. This information is needed to understand the ecological, management, and recovery requirements of the snail.

3.2.1.3 Identify Morro shoulderband parasites and determine if parasitism rates are threatening populations.

The sarcophagid fly parasitoid of the Morro shoulderband should be identified to determine whether it is native or introduced. Since vacant fly puparia were found inside many empty subadult shells, the mortality from the parasitoid flies probably occurs before the snail's reproductive maturity (Roth 1985). Research results should determine how this parasitic infestation during pre-reproductive maturity affects the population dynamics of the snails. If research results conclude that the parasite is detrimental to the snail's recovery, a control strategy for the parasite might be considered.

3.2.1.4 Study the reproductive biology of the mountainbalm and the response of the species to fire

Research is needed to determine if the Indian Knob mountainbalm is self-compatible and is producing seed in adequate amounts to sustain existing populations. Results will be used in combination with Task 3.215, below, to determine if human-mediated population expansion is needed in small populations. Understanding the response of this species to fire will be needed to ensure appropriate management of preserve areas.

3.2.1.5 Determine if the small populations of the mountainbalm are multiclonal

If the small populations are composed of only single clones, and if the species is self-incompatible or exhibits substantial inbreeding depression, then introduction of additional genotypes may be needed to expand the populations.

3.2.2 Chorro Creek bog thistle

3.2.2.1 Evaluate the effects of livestock use on this species and its wetland habitat and modify grazing regimes, if necessary

In late 1997, the California Military Department began experiments to investigate the effects of cattle and reduction of competing vegetation on reproduction, seedling establishment, and survival of the bog thistle in its wetland habitat.

3.2.2.2 Study the reproductive biology of the Chorro Creek bog thistle and evaluate the effects of the non-native seedhead weevil on bog thistle reproduction. Initiate control methods, if needed.

The seedhead weevil has been found on Chorro Creek bog thistle at Camp San Luis Obispo and at San Simeon Creek and feeds on the other subspecies of this thistle in San Mateo County. Information is needed on whether the weevil has an effect on reproduction to the extent that control of the weevil is necessary. Since the introduction of the weevil is recent (20 to 30 years ago) periodic monitoring will be needed to assess whether weevil herbivory rates vary substantially over time.

3.2.3 Conduct species-specific research on Pismo clarkia

3.2.3.1 Determine control methods for non-native grasses that threaten Pismo clarkia populations

Non-native annual grasses occur with the clarkia in many populations as does the more recently arrived non-native perennial veldt grass. The influence of these non-natives and effective methods of controlling them in clarkia habitat should be investigated. Experimental control of veldt grass should be given priority as its dense root system, perennial nature, and preference for sandy soils increase the likelihood that it will substantially compete with the clarkia.

3.2.3.2 Evaluate the effects of livestock grazing regimes on populations

Livestock currently graze in at least one substantial population of Pismo clarkia (NDDDB occurrence 5) on private land. Light grazing may be beneficial to the clarkia if it reduces competition from non-native grasses or provides seedling establishment sites. Grazing during the reproductive period of the clarkia or overgrazing could cause rapid population declines if it reduces the reproductive output or survival of plants, however. Investigations are needed that compare ungrazed situations with several different grazing regimes.

3.2.3.3 Study the reproductive biology and soil seedbank dynamics of the Pismo clarkia.

Research is needed to determine the pollinators of Pismo clarkia to ensure that pollinators are addressed in preserve design, if necessary. Research on soil seedbank dynamics will be used to manage secured areas and will help clarify this species ability to withstand environmental variation and its response to other land uses, such as cattle grazing.

3.3 Evaluate research results and use in future management

Based on findings, review and incorporate research results into management strategies for these species. Implement control methods for those potential threats determined to be actual threats.

4. Determine population dynamics and effects of recovery efforts

Studies should be conducted to learn the number and size of successful self-sustaining populations for each species to establish criteria for their re-classification.

4.1 Document population dynamics and cycles to ascertain trends

Wide population fluctuations, both spatially and temporally, have been observed within populations of Pismo clarkia. Monitoring of Pismo clarkia, Chorro Creek bog thistle, Indian Knob mountainbalm, and the Morro shoulderband snail should be conducted to document population dynamics and cycles to determine population trends. Standardized survey methodology should be used to track populations from one year to the next.

4.2 Evaluate effectiveness of methods used to reduce threats

Regular monitoring is needed to evaluate the success of reducing threats to these species. This is necessary to determine if recovery goals are being met and if downlisting or delisting are appropriate.

5. Develop and implement an education/information program

The benefits of protecting native species and their habitats and maintaining native biological communities should be explained clearly to all concerned parties.

5.1 Inform and coordinate with local lead agencies

Because city and county governments are the primary agencies that determine future land uses for unprotected occurrences and habitats, their participation is critical for recovery. In some cases, lead agencies will need to revise existing land use plans to accurately address the current status of listed species. For instance, the Local Coastal Plan for the Los Osos area does not currently identify areas where the Morro shoulderband snail occurs as environmentally sensitive.

For Pismo clarkia, local lead agencies that currently have jurisdiction over projects that may affect the clarkia include the County of San Luis Obispo, and the cities of Pismo Beach, Grover Beach, and Arroyo Grande. These lead agencies should be informed or reminded of the repeated failure of translocation in general as a mitigation measure for rare plant species. The potential for Pismo Clarkia to occur in the Nipomo area, and the need to conduct surveys during June and July when most other annual grassland species are dead, should be well publicized.

5.2 Inform and educate the public

The Service should strive to encourage appreciation for the unique and sensitive species of western San Luis Obispo County.

5.2.1 Hold public meetings

The U.S. Fish and Wildlife Service, California Department of Fish and Game, California Department of Parks and Recreation, and San Luis Obispo County should hold at least one informal public meeting to explain recovery activities for the listed species and to encourage local appreciation of the unique species found in the County.

5.2.2 Discourage plantings of other species of manzanitas in Los Osos

Because manzanitas are known to hybridize, landscape plantings of manzanita in and around the community of Los Osos should be limited to the Morro manzanita, the only species native to the specific area. The La Cruz manzanita occurs to the east of Los Osos Creek and the brittle leaf manzanita (*Arctostaphylos crustacea*) occurs to the south, in the Irish Hills.

5.2.3 Encourage landscaping with local native maritime chaparral, coastal dune and scrub vegetation in the Los Osos area

Encourage preservation of native vegetation in residential areas and landscaping with native maritime chaparral, coastal dune, and coastal scrub vegetation from local sources. Listed and sensitive species could benefit from small areas of native vegetation if they are contiguous with larger blocks of habitat already secured. Landscaping or restoration of native vegetation could also provide an effective buffer between secured areas and intensely used residential or recreational areas. These landscaping or restoration sites could also serve as demonstration gardens to increase the public's knowledge and appreciation for the unique habitat of Los Osos.

6. Reevaluate recovery criteria and revise recovery plan based on expanded knowledge from research, monitoring, and management

The scientific validity of the recovery criteria and recovery plan should be reviewed and revised as more information becomes available. The criterion of maintaining sufficient numbers of populations or conservation areas should be assessed, and the success or failure of management actions should be evaluated.

6.1 Reevaluate and refine recovery criteria

Based on the future information gathered from life history studies, monitoring, and management actions, the criteria for delisting and downlisting the taxa for this plan should be evaluated and, if necessary, refined.

6.2 Revise recovery plan based on expanded knowledge from research, monitoring, and management

Based on the expanded knowledge from research and monitoring results and the evaluation of the relative success and failure of the management programs in attaining recovery goals, the recovery plan should be revised to improve future management. When *potential* threats are found to be *actual* threats, management responses should be incorporated into the revised recovery program.

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PART III. IMPLEMENTATION SCHEDULE

The schedule that follows summarizes actions and estimated costs for the recovery plan for the Morro shoulderband snail and four plants from San Luis Obispo County, California. It is a guide to meet the plan's objectives as explained in Part II, Narrative Section. This schedule shows task priorities, task numbers, task descriptions, task durations, responsible agencies, and lastly, estimated costs. These actions, when accomplished, should recover the taxa and protect their habitats. It should be noted that the estimated monetary needs for some tasks remain to be determined, and therefore the schedule reflects an incomplete estimate of funds needed for recovery of the taxa.

Definitions and Acronyms Used:

Priorities in column one of the implementation schedule are assigned as follows:

- 1 An action that *must* be taken to prevent extinction or to prevent the species from declining irreversibly in the *foreseeable* future.
- 2 An action that must be taken to prevent a significant decline in species' population/habitat quality, or some other significant negative impact short of extinction.
- 3 All other actions necessary to provide for full recovery of the species.

Task durations are the number of years estimated to accomplish the task.

"Continuous" indicates that the task will be implemented on an annual basis once it is begun. "Ongoing" indicates that the task has been implemented and will continue until no longer necessary for recovery.

Key to Acronyms for Responsible Parties:

CALTRANS	— California Department of Transportation
CAARNG	— California Army Reserve National Guard
CDFG	— California Department of Fish and Game
CDPR	— California Department of Parks and Recreation
CITY	— City of San Luis Obispo
CPSU	— California Polytechnic State University, San Luis Obispo
NGOs	— Non-government organizations (e.g., Land Conservancy of San Luis Obispo, California Native Plant Society, Audubon Society)
PVT	— Private parties
RSABG	— Rancho Santa Ana Botanic Garden
SLOCO	— San Luis Obispo County
TBD	— To be determined
USFWS	— U.S. Fish and Wildlife Service

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task description	Task Duration (years)	Responsible Party	Cost Estimates (in thousands of dollars)					
					Total thru 2017	FY 1	FY 2	FY 3	FY 4	FY 5
Need 1: Secure populations and habitat on unprotected lands										
1	1.1.1	Secure primary sites for Morro Bay species	Ongoing	USFWS SLOCO CDPR CDFG	TBD	TBD	TBD	TBD	TBD	TBD
1	1.1.2	Conduct surveys to evaluate the relative importance of secondary sites, dispersal corridors, and other areas of potential habitat and secure as necessary	7	USFWS CDFG CDPR TBD	TBD	TBD	TBD	TBD	TBD	TBD
1	1.2	Secure Chorro Creek bog thistle sites	Ongoing	CDFG USFWS	TBD	TBD	TBD	TBD	TBD	TBD
1	1.3	Secure Pismo clarkia sites	5	CDFG USFWS	TBD	TBD	TBD	TBD	TBD	TBD
1	1.4	Survey potential habitat to identify additional populations of Pismo clarkia	Ongoing	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Need 1 Subtotal Cost:					TBD	TBD	TBD	TBD	TBD	TBD
Need 2: Manage secured lands to control or eliminate other known threats										
2	2.1.1.1	Develop and implement strategies to control or eliminate illegal OHV use	Continuous	CDFG CDPR USFWS	16	2	1	1	1	1
2	2.1.1.2	Develop and implement strategies to control non-native plant species	Continuous	CDFG CDPR USFWS NGOs	80	10	5	5	5	5
2	2.1.1.3.1	Develop and implement prescribed burn plan	Continuous	CDFG CDPR CDFG	TBD	TBD	TBD	TBD	TBD	TBD

Priority #	Task #	Task description	Task Duration (years)	Responsible Party	Cost Estimates (in thousands of dollars)					
					Total thru 2017	FY 1	FY 2	FY 3	FY 4	FY 5
3	2.1.1.3.2	Develop and implement strategy for wildfire suppression	Continuous	CDPR CDFG CDFG TBD	32	4	2	2	2	2
2	2.1.2	Prevent potential introduction of non-native predatory snails	Continuous	CDFG SLOCO	2	0.5	0	0	0.5	0
3	2.1.3	Discourage pesticide applications	Continuous	CDFG SLOCO	5	0.5	0.5	0.5	0.5	0.5
3	2.2.1	Modify roadside maintenance activities for Chorro Creek bog thistle	Continuous	CDFG SLOCO TBD	16	2	1	1	1	1
1	2.2.2	Protect spring sources for Chorro Creek bog thistle	Continuous	CDFG SLOCO CAARNG CITY PVT CPSU	TBD	TBD	TBD	TBD	TBD	TBD
1	2.3.1	Control non-native species, including veldt grass and sea fig at Pismo clarkia sites	Continuous	CDFG CDPR NGOs	30	2	2	2	2	2
2	2.3.2	Modify roadside maintenance activities for Pismo clarkia	Continuous	CDFG SLOCO CALTRANS	6	2	0	0	1	0
1	2.3.3	Expand and maintain conservation seed collection for Pismo clarkia	Ongoing	RSABG	5	1	0.3	0.3	0.3	0.3
Need 2 Subtotal Cost (with Tasks 2.1.1.3.1 and 2.2.2 TBD):					192	24	11.8	11.8	13.3	11.8

Priority #	Task #	Task description	Task Duration (years)	Responsible Party	Cost Estimates (in thousands of dollars)					
					Total thru 2017	FY 1	FY 2	FY 3	FY 4	FY 5
Need 3: Evaluate potential threats and conduct management-oriented research, and incorporate research results into future management										
2	3.1.1	Determine methods to control non-native plant species	5	CDFG CDPR USFWS SLOCO NGOs	35	10	5	5	5	10
2	3.1.2	Determine methods to maintain a mosaic of vegetation communities	5	CDFG CDPR USFWS SLOCO	120	40	20	20	20	20
2	3.2.1.1	Determine if brown garden snail is a competitive threat to Morro shoulderband	3	CDFG CDPR USFWS	12	4	4	4	0	0
2	3.2.1.2	Study habitat use and life history needs of the Morro shoulderband snail	3	CDFG CDPR USFWS	45	15	15	15	0	0
2	3.2.1.3	Identify Morro shoulderband parasites and determine if parasitism rates are threatening populations	3	CDFG CDPR USFWS	12	4	4	4	0	0
2	3.2.1.4	Study the reproductive biology and the response to fire of the mountainbalm	3	CDFG USFWS	8	2	2	4	0	0
2	3.2.1.5	Determine if small populations of the mountainbalm are multiclonal	1	CDFG USFWS	5	5	0	0	0	0
2	3.2.2.1	Evaluate the effects of livestock use on Chorro Creek bog thistle	Ongoing	CDFG USFWS	24	6	4	4	4	6
2	3.2.2.2	Study the reproductive biology and evaluate the effects of the non-native seedhead weevil on Chorro Creek bog thistle	Continuous	CDFG USFWS	16	4	4	0	0	0
2	3.2.3.1	Determine if non-native grasses threaten Pismo clarkia populations	3	CDFG USFWS	20	6	6	8	0	0
2	3.2.3.2	Evaluate the effects of livestock grazing regimes on Pismo clarkia populations	3	CDFG USFWS	15	5	5	5	0	0
2	3.2.3.3	<u>Study the reproductive biology of Pismo clarkia</u>	3	CDFG	20	8	6	6	0	0

Priority #	Task #	Task description	Task Duration (years)	Responsible Party	Cost Estimates (in thousands of dollars)					
					Total thru 2017	FY 1	FY 2	FY 3	FY 4	FY 5
Need 3 Subtotal Cost:					332	109	75	75	29	36
Need 4: Determine population dynamics and effects of recovery efforts										
2	4.1	Monitor populations to ascertain trends	Ongoing	CDFG CDPR USFWS CAARNG	150	10	10	10	10	10
2	4.2	Evaluate effectiveness of methods used to reduce threats	Continuous	USFWS	60	4	4	4	4	4
Need 4 Subtotal Cost:					210	14	14	14	14	14
Need 5: Develop and implement an education/information program										
3	5.1	Inform and consult with local lead agencies	Ongoing	CDFG CDPR USFWS	11	2	1	1	1	1
3	5.2.1	Hold public meetings	1	USFWS CDFG CDPR SLOCO	1	1	0	0	0	0
3	5.2.2	Discourage plantings of other sp. of manzanitas in Los Osos	Continuous	CDFG SLOCO CDPR	1	0.5	0	0	0	0.5
3	5.2.3	Encourage landscaping with local native vegetation	Continuous	NGOs USFWS CDFG	1	0.5	0	0	0	0.5
Need 5 Subtotal Cost:					14	4	1	1	1	2
Need 6: Reevaluate recovery criteria and revise recovery plan based on expanded knowledge from research, monitoring, and management										
2	6.1	Reevaluate recovery criteria	1	USFWS CDFG CDPR	2	0	0	0	0	2

Priority #	Task #	Task description	Task Duration (years)	Responsible Party	Cost Estimates (in thousands of dollars)					
					Total thru 2017	FY 1	FY 2	FY 3	FY 4	FY 5
2	6.2	Revise recovery plan	2	USFWS CDFG CDPR	6	0	0	0	3	3
Need 6 Subtotal Cost:					8	0	0	0	3	5
TOTAL COST:					756	151	101.8	101.8	60.3	68.3

APPENDIX A. Explanation of Recovery Priority System

The Recovery Priority System uses the criteria of degree of threat, recovery potential, and taxonomy (level of genetic distinctiveness) to assign all listed species a number (1-18). A fourth factor, conflict, is a supplementary element in determining what actions are to be implemented for species recovery. This factor gives priority, within each category, in preparation of recovery plans to species that are, or may be in conflict with construction or development projects. Thus, the species retains its numerical rank and acquires the letter designation of "C", indicating conflict (1C-18C). A detailed discussion of the Recovery Priority System can be found in 48 FR 51985.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic genus	1	1C
	High	Species	2	1 2C
	High	Subspecies	3	2 3C
	Low	Monotypic genus	4	3 4C
	Low	Species	5	4 5C
	Low	Subspecies	6	5 6C
Moderate	High	Monotypic genus	7	6 7C
	High	Species	8	7 8C
	High	Subspecies	9	8 C
	Low	Monotypic genus	10	9 10C
	Low	Species	11	10 11C
	Low	Subspecies	12	11 12C
Low	High	Monotypic genus	13	12 13C
	High	Species	14	13 14C
	High	Subspecies	15	14 15C
	Low	Monotypic genus	16	15 16C
	Low	Species	17	16 17C
	Low	Subspecies	18	17 18C

APPENDIX B. Summary of Agency and Public Comments on the Draft Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California

On September 30, 1997, the Service released the Draft Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California for a 90-day public comment period that ended on December 29, 1997 (62 Federal Register 51126).

Copies of the draft recovery plan were sent to more than 100 interested parties. Seven comment letters were received. Local jurisdictions that responded included the County of San Luis Obispo and the City of San Luis Obispo. Five individuals were asked to peer review the document; one peer reviewer responded. Peer reviewers were selected based on their familiarity with either a taxonomic group, a geographic area, and/or jurisdictional issues.

The number of letters received, by affiliation:

Local governments	2
State agencies	1
Federal governments	1
Environmental/conservation organizations	1
Academia/professionals	2

Summary of Significant Comments and Service Responses

The Service has reviewed all written comments received on the draft plan. Comments that were either technical in nature, or were updating the information in the draft recovery plan have been incorporated into the appropriate section of the recovery plan. Summarized below are comments that were substantive in nature, along with the Service's response to each, and an indication as to what modifications were made to the plan, if any:

Comment 1: With respect to Task 2.1.1.3.1 ("develop and implement prescribed burn plan for maintaining a mosaic of vegetation types necessary for recovery of Morro Bay species"), planning the shape of the burned area should be considered in the prescribed burn plan. Because immigration by Morro shoulderband snails into any burned area would take place across the perimeters of that area, planning the shape of the burned area to maximize the periphery would tend to increase the rate of immigration.

Response: The Service agrees with this management suggestion and has added it to Task 2.1.1.3.1.

Comment 2: Landscaping on public property in the Los Osos area should be done with locally native coastal dune and scrub vegetation for the benefit of

locally listed and sensitive species. These areas could provide habitat and be used for public education.

Response: The Service agrees that this task would further the recovery of the species covered in this plan. Task 5.2.3 has been added to address this comment.

Comment 3: The Northeast Los Osos Conservation Planning Area (CPA) does not extend far enough south to encompass existing contiguous coastal dune and scrub communities along the eastern boundaries of Los Osos.

Response: The Service agrees that the natural habitats south of the Northeast Los Osos CPA may be important for recovery. The CPAs identified in this plan encompass those locations the Service believes are of greatest importance to secure for the recovery of the three listed Morro Bay species. One of the criteria for the general delineation of the CPAs was that they contain native habitats that support one or more of the listed species. The region between the Northeast Los Osos CPA and “Other Habitat Area B” appears to be primarily farmed agricultural land and is therefore not included in the roughly delineated CPAs. However, reducing isolation of populations by securing “corridors” to connect larger areas of intact habitat is often important for species conservation. Therefore, in this final plan the Service has identified a potential corridor that could connect the Northeast Los Osos CPA and “Other Habitat Area B”, if opportunities for acquisition and restoration become available.

Comment 4: The area identified in the draft plan as “Other Habitat Area C” is being considered for urban-level development due to its central location and existing surrounding development. The Service should consider surrounding development and planning-related issues prior to including it in the final plan.

Response: The Service has taken this into consideration. “Other Habitat Areas” are those locations that support one or more of the listed species and are either protected (as in Los Osos Oaks Preserve) or that are likely to contain important unfragmented habitat for only one (rather than multiple) listed species. In this final plan, the Service has removed “Other Habitat Area C.” While this location likely contains Morro shoulderband snails, it is of lower priority for protection than the Conservation Planning Areas and “Other Habitat Areas A and B”, due to the high density residential development that surrounds it and its isolation from the Conservation Planning Areas.

APPENDIX C. Individuals and Agencies that provided comments on the Draft Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California.

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September 1998