

## **Appendix B. Environmental Assessment**

<b>CHAPTER 1. PURPOSE AND NEED FOR ACTION .....</b>	<b>1</b>
<b>Introduction .....</b>	<b>1</b>
<b>Plan Area .....</b>	<b>1</b>
<b>Refuge Management Alternatives .....</b>	<b>1</b>
<b>Purpose and Need for the Proposed Action.....</b>	<b>4</b>
<b>NEPA and this Document .....</b>	<b>4</b>
<b>Decisions to be Made .....</b>	<b>5</b>
<b>Comprehensive Conservation Planning Process.....</b>	<b>5</b>
Issues Identification .....	6
Public Involvement .....	6
<b>U.S. Fish and Wildlife Service and National Wildlife Refuge System.....</b>	<b>6</b>
<b>Purposes of the Guadalupe-Nipomo Dunes National Wildlife Refuge.....</b>	<b>7</b>
Vision Statement.....	7
Goals of the Refuge .....	8
<b>CHAPTER 2. ALTERNATIVES.....</b>	<b>9</b>
<b>Current Management.....</b>	<b>9</b>
<b>Alternatives Development Process .....</b>	<b>9</b>
<b>Alternatives Considered but Eliminated from Detailed Analysis.....</b>	<b>9</b>
<b>Features Common to All Alternatives .....</b>	<b>10</b>
<b>Description of Management Alternatives .....</b>	<b>11</b>
Alternative A: No Action (Continue Current Management).....	11
Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education. ....	12
Alternative C: Minimal wildlife and habitat management, and the Refuge is closed to public. ....	16
<b>CHAPTER 3. AFFECTED ENVIRONMENT .....</b>	<b>28</b>
<b>CHAPTER 4. ENVIRONMENTAL CONSEQUENCES.....</b>	<b>29</b>
<b>Physical Resources.....</b>	<b>29</b>
Water .....	29
Air Quality .....	35
Noise.....	36
Wilderness .....	37
<b>Biological Resources .....</b>	<b>37</b>
Vegetation and Habitat .....	37
Wildlife.....	41

Listed and other Special Status Species .....	46
<b>Social and Economic Environment .....</b>	<b>53</b>
Public Use .....	54
Economy .....	54
Cultural Resources .....	55
<b>Environmental Justice.....</b>	<b>58</b>
<b>Cumulative Effects .....</b>	<b>59</b>
Cumulative Effects on the Physical Environment .....	59
Cumulative Effects on Biological Resources.....	60
Cumulative Effects on Cultural Resources .....	61
Cumulative Effects on the Social and Economic Environment .....	61
 <b>CHAPTER 5. PLANNING TEAM MEMBERS RESPONSIBLE FOR PREPARING THIS DOCUMENT.....</b>	 <b>66</b>
 <b>CHAPTER 6. COORDINATION, CONSULTATION, AND COMPLIANCE.....</b>	 <b>67</b>
Agency Coordination and Public Involvement .....	67
Notice of Intent.....	67
Environmental Review and Consultation.....	67
Other Federal Laws, Regulations, and Executive Orders.....	67
Distribution and Availability .....	67
References Cited .....	68
 <b>TABLES</b>	
Table 1. Summary of Alternatives .....	18
Table 2. Summary Impacts of Alternatives. ....	62
 <b>FIGURES</b>	
Figure 1. Guadalupe-Nipomo Dunes National Wildlife Refuge Vicinity Map .....	2
Figure 2. Guadalupe-Nipomo Dunes National Wildlife Refuge Location Map. ....	3
Figure 3. Guadalupe-Nipomo Dunes Refuge Priority Management Areas .....	13

## **Glossary of Terms and Acronyms**

CCP	Comprehensive Conservation Plan
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
GIS	Geographic Information System
IPM	Integrated Pest Management
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
Refuge System	National Wildlife Refuge System
PUP	Pesticide Use Proposal
Refuge	Guadalupe-Nipomo Dunes National Wildlife Refuge
SLAMM	Sea-Level Affecting Marshes Model
USFWS/Service	U.S. Fish and Wildlife Service
1997 Improvement Act	The National Wildlife Refuge System Improvement Act of 1997

## ***Chapter 1. Purpose and Need for Action***

### **Introduction**

The U.S. Fish and Wildlife Service (Service or USFWS) has prepared this environmental assessment (EA) in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190, 42 U.S.C. 4321-43470), as amended, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR §1500 et seq.), and the Department of the Interior's NEPA procedures (43 CFR Part 46). To comply with CEQ NEPA regulations and ensure the NEPA process is integrated into the CCP process at the earliest possible time, this EA has been prepared concurrent with the draft CCP for the Guadalupe-Nipomo Dunes National Wildlife Refuge (NWR or Refuge). The EA evaluates the environmental effects of three alternatives for managing the Guadalupe-Nipomo Dunes NWR as presented in the Draft Comprehensive Conservation Plan (CCP). The purpose of the CCP (also referred to as the Plan) is to provide a 15-year management plan for the Refuge and long-term guidance in relation to management decisions, as directed by the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act). Both direction and guidance are described in detail through a set of goals, objectives, and strategies in the CCP.

### **Plan Area**

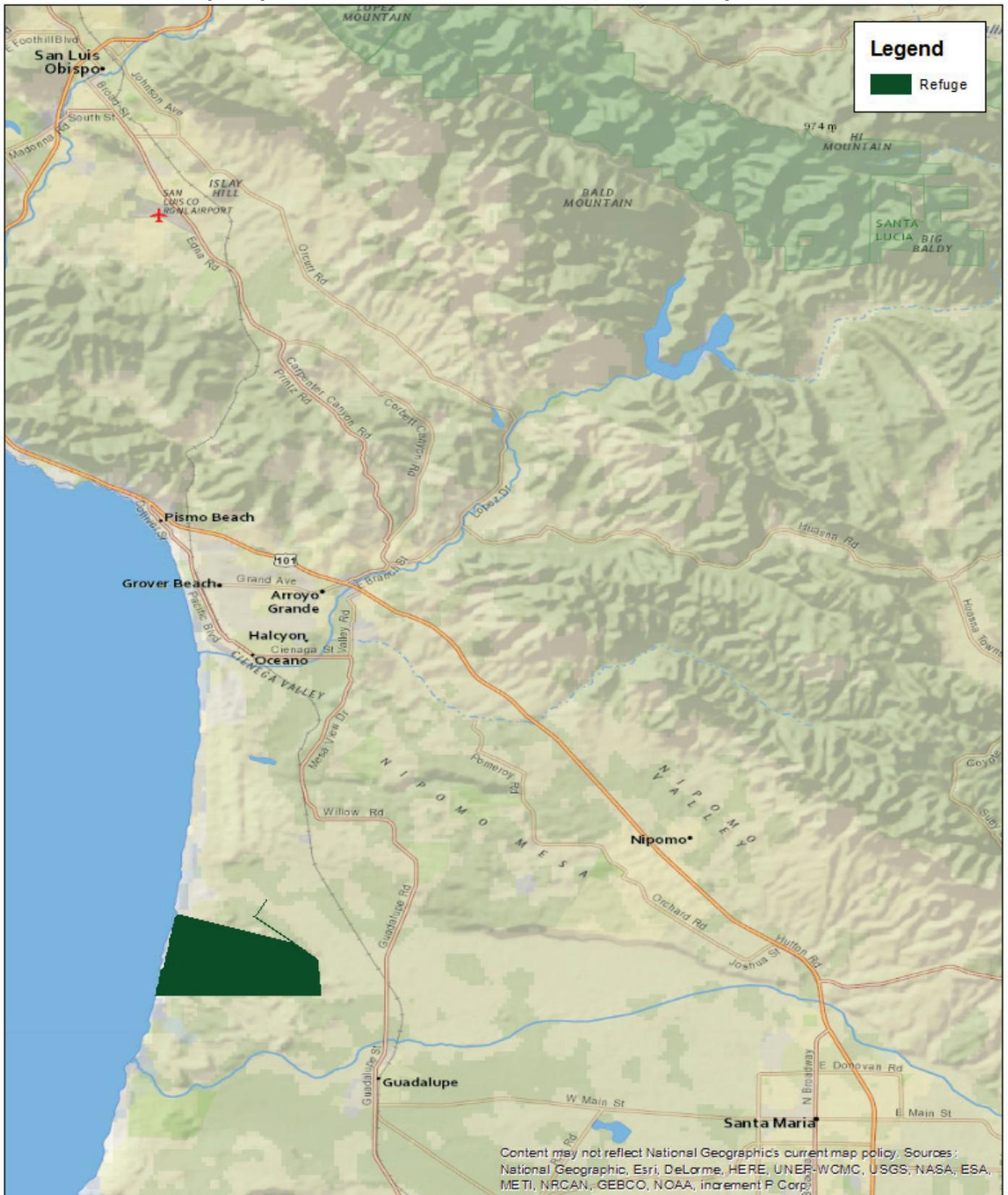
Located in the southwest corner of coastal San Luis Obispo County, California, the Refuge is approximately 10 miles west of Santa Maria, 18 miles south of San Luis Obispo, and 65 miles northwest of Santa Barbara (Figure 1). The southeast corner of the Refuge is located about two miles northwest of the incorporated city of Guadalupe, which is located in Santa Barbara County. The northeast corner of the Refuge is located about seven miles west of the unincorporated community of Nipomo, which is located in San Luis Obispo County (Figure 2).

The Refuge occupies one contiguous area of 2,553 acres to the west of the Santa Maria River Valley, to the east of the Pacific Ocean, to the north of the Guadalupe Restoration Project (former Guadalupe Oil Field), and to the south of the Oso Flaco Lake Natural Area (a management unit of the Oceano Dunes State Vehicular Recreation Area). The Refuge western boundary exists as the mean high tide line, along 1.8 miles of the Pacific Ocean coastline. Refuge boundaries extend from the mean high tide line about three miles inland (Figure 2).

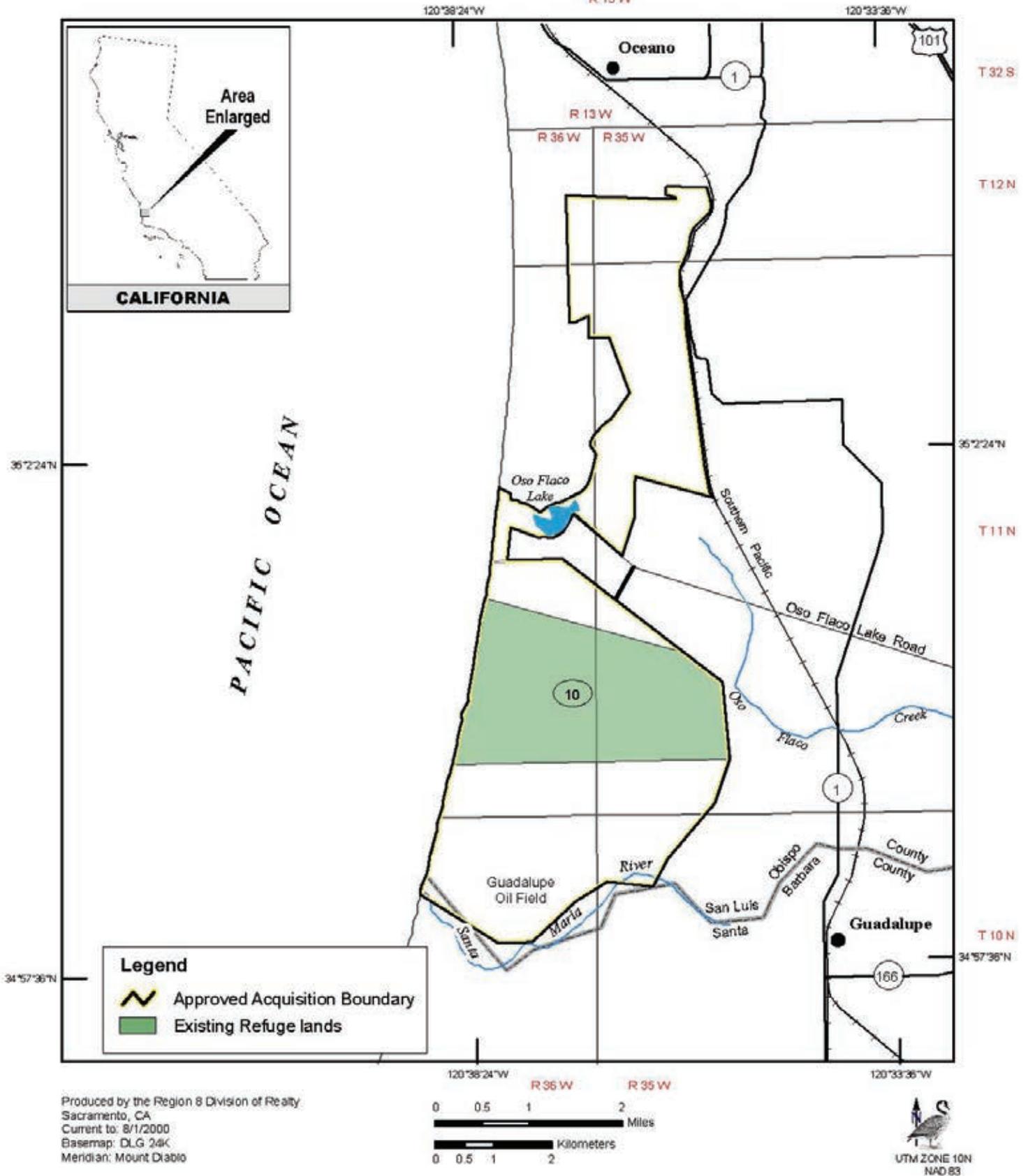
### **Refuge Management Alternatives**

The Service examined a range of management alternatives for the Refuge. These alternatives are described in Chapter 2 of this EA. The Refuge System defines alternatives as “different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues” (602 FW 1). The alternatives addressed in the EA include: making no changes to current management practices (Alternative A -No Action); moderately increasing current wildlife and habitat management practices and incrementally increasing visitor services and environmental education programs (Alternative B); and to address forecasted budget declines within the Refuge System, closing the Refuge to all public uses and reducing current wildlife and habitat management actions to the minimum necessary to meet our statutory responsibilities under the Endangered Species Act of 1973, as amended, and the Improvement Act (Alternative C).

**Figure 1. Guadalupe-Nipomo Dunes National Wildlife Refuge Vicinity Map**



**Figure 2. Guadalupe-Nipomo Dunes National Wildlife Refuge Location Map.**



A preferred alternative is not identified in the draft EA. Following public review of the Draft CCP and EA, we will select an alternative for implementation. To ensure complete evaluation of the potential effects to the environment of implementing any of the three alternatives, we have included in our analysis the potential effects of the step-down plan (draft Feral Swine Control and Monitoring Plan) prepared in association with Alternative B.

The Service proposes to implement a CCP that achieves the purposes for which the Refuge was established, helps fulfill the mission of the National Wildlife Refuge System (Refuge System), is consistent with sound fish and wildlife management, ensures that the biological integrity, diversity, and environmental health of the Refuge System are maintained, and can be accomplished within current budget constraints. The alternative ultimately selected for implementation may look very similar to one of the three alternatives described in the Draft CCP, or it could include a combination of components from two or more of the alternatives presented. The final decision will be based on the analysis presented in the Draft CCP and EA, comments received from other agencies, Tribal governments, nongovernmental organizations, and/or individuals during the public comment period for the Draft CCP and EA, and forecasted budgets for the Refuge System.

### **Purpose and Need for the Proposed Action**

A CCP is needed to provide guidance for managing a Refuge consistent with the purposes for which the Refuge was established and the mandates of the Refuge System. The purpose of a CCP is to address, as appropriate, how general Refuge operations, wildlife and habitat management, habitat enhancement and restoration, cultural resource management, and visitor services will be implemented over the life of the CCP. It is also the purpose of the CCP to describe the desired future conditions of the Refuge over the next 15 years and provide guidance for achieving those conditions. The CCP accomplishes the following:

- Sets a long-term vision for the Refuge;
- Establishes management goals, objectives, and strategies for the Refuge;
- Provides the Refuge with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats;
- Defines if and how compatible public uses will be provided;
- Develops a plan that, when fully implemented, will achieve Refuge purposes, help fulfill the mission of the Refuge System, and maintain and, where appropriate, restore ecological integrity;
- Communicates the Service's management priorities for the Refuge to the public; and
- Provides a basis for budget needs to support staffing, operations, maintenance, and capital improvements.

The development of this CCP is also required to fulfill legislative obligations of the Service. The Improvement Act requires that every refuge or related complex of refuges have a CCP in place within 15 years of the Improvement Act's enactment. To comply with NEPA, an EA or Environmental Impact Statement (EIS) that evaluates the effects on the environment of implementing a range of alternatives for managing the Refuge over the next 15 years must be prepared to accompany the CCP. The Draft CCP and its appendices are herein incorporated by reference.

### **NEPA and this Document**

NEPA requires Federal agencies to consider the environmental effects of all actions<sup>1</sup> they undertake. This EA evaluates the effects of various alternative management scenarios for the Refuge. Federal agencies must consider the environmental effects of a reasonable range of alternatives, and then disclose

---

<sup>1</sup> Under NEPA and implementing regulations, *action* refers to a policy, plan, program, or project that is implemented, funded, permitted, or controlled by a Federal agency or agencies.

those effects to the public. If adverse environmental effects are identified, NEPA requires an agency to identify means to mitigate the adverse effects. An EA documents that an agency has considered and addressed all these issues. This EA has been prepared to assess the environmental effects of the action alternatives. The Service will also use this EA to solicit public involvement in the Refuge planning process.

This EA discusses the purpose and need for the Refuge CCP; it also provides an analysis of the impacts that could be expected from each of the management proposals outlined in the Plan. This analysis will help the Service make a determination regarding the effect on the human environment of implementing the various management alternatives described in the CCP.

The policies of the Service, the Improvement Act, and NEPA require the Service to actively seek public involvement in the preparation of environmental documents. NEPA also requires the Service to give serious consideration to all reasonable alternatives for managing refuges, including the no-action alternative representing continuation of current conditions and management practices. Alternative management scenarios were developed as part of the planning process described in this EA.

This EA describes the existing resources on the Refuge and the projected environmental effects of the three management alternatives. Two of the three alternatives presented in this EA are *action alternatives* that would involve a change in the current management of the Refuge. The remaining alternative is the *no-action alternative*, under which current management of the Refuge would continue, and provides a basis of comparison to the action alternatives. A Final CCP will be prepared regardless of which alternative is selected.

### **Decisions to be Made**

Based on the analysis documented in this Draft EA, the Regional Director must determine whether the selected management alternative would have a significant effect on the human environment. If a determination can be made that the selected management alternative will not have a significant effect on the human environment, a Finding of No Significant Impact can be made; however, if there is a potential for significantly affecting the quality of the human environment an EIS must be prepared before making a decision.

### **Comprehensive Conservation Planning Process**

The Service developed the CCP using a systematic decision-making approach that encouraged public involvement in management decisions throughout the planning process. A planning team was assembled (see Chapter 5 of this EA) of personnel from the Service's Hopper Mountain National Wildlife Refuge Complex. The Service contacted a range of groups to participate, including representatives of tribal groups, State agencies, local governments, local organizations, local interest groups, academics, neighboring landowners, and other members of the public. These interested participants and local residents received announcements regarding the location, date, and time for the scoping meeting. At the scoping meeting, the staff explained the Refuge's purpose, history, and laws and regulations governing management, as well as the purpose and need for the CCP and the relevant management activities and issues.

The planning team consisted primarily of Refuge staff and Service technical experts. The team developed a list of issues and concerns that included comments generated from the scoping meeting, written comments, and verbal comments from discussions with various parties. The planning team reviewed the current Refuge management actions during the planning process and ultimately presented three alternatives for future Refuge management.

Key steps in the Service's comprehensive conservation planning are:

1. Preplanning.
2. Identifying issues and developing a vision statement.
3. Gathering information.
4. Analyzing resource relationships.
5. Developing alternatives and assessing environmental effects.
6. Identifying a preferred alternative.
7. Publishing the draft plan and NEPA document.
8. Addressing public comments on the draft plan.
9. Preparing the final plan.
10. Securing approval from the Regional Director.
11. Implementing the Plan.

### ***Issues Identification***

The Service followed NEPA scoping guidelines and identified issues, concerns, and opportunities through early planning discussions and the public scoping process, which began in the spring of 2013. The planning team has identified a range of reasonable alternatives and evaluated the consequences of each alternative. This planning effort and the planning team's ongoing dialogue with various State and county agencies, interest groups, and individuals provided important direction in synthesizing the proposed goals, objectives, and strategies found in the Draft CCP. It will be necessary to further coordinate and cooperate with these entities to implement the Plan.

### ***Public Involvement***

Public involvement is an essential component of the comprehensive conservation planning and NEPA process. The Service announced the beginning of this planning effort for the Refuge through a *Federal Register* Notice of Intent on December 6, 2013. In 2013, the Refuge hosted two public meetings on December 11 and 12. Public comments were generated from the public meetings and the *Federal Register* notice. A planning update, which introduced the Refuge and the planning process, was mailed to over 200 agency and organization representatives, members of the public, media, and elected representatives of each of the counties. An average of 10 people attended each of the meetings. A number of individuals provided comments at the meetings, via email, and by postal mail.

Written public input received during the process is considered during the planning process. A summary of the comments is presented in the CCP. The original comments are maintained in planning team files at the Hopper Mountain National Wildlife Refuge Complex headquarters in Ventura, California, and are available for review.

### **U.S. Fish and Wildlife Service and National Wildlife Refuge System**

The mission of the Service is working with others to conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of the American people. The Service is the primary Federal agency responsible for migratory birds, endangered plants and animals, certain marine mammals, and interjurisdictional fish. This responsibility to conserve the Nation's fish and wildlife resources is shared with other Federal agencies, as well as with State and tribal governments.

As part of this responsibility, the Service manages the Refuge System—the only nationwide system of Federal lands managed and protected for wildlife and their habitats. The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Refuge is managed as part of the Refuge System in accordance with the Improvement Act and other relevant legislation, Executive orders (EOs), regulations, and policies.

### **Purposes of the Guadalupe-Nipomo Dunes National Wildlife Refuge**

Refuges are not only guided by the Service and Refuge System missions, but also individual purposes that form the authority for the establishment of a Refuge. These purposes are often drawn from Federal acts or EOs. Further, these purposes provided the foundation for which the Refuge vision statement and the CCP goals have been developed. Guadalupe-Nipomo Dunes NWR was established under the following authority:

“ . . . to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species . . . ” 16 USC § 1534 (Endangered Species Act of 1973).

As stated in the Conceptual Management Plan for the Proposed Guadalupe-Nipomo Dunes NWR (USFWS 2000), the Refuge was established to protect and conserve the unique central California coastal dune and associated wetland habitats and the endangered and threatened wildlife and plants that inhabit them.

### ***Vision Statement***

Propelled by relentless ocean waves and strong onshore winds, small grains of sand scour and accumulate to form the impressive migrating dunes of the Guadalupe-Nipomo Dunes National Wildlife Refuge (Refuge). Harsh, but dynamic processes create unique habitats among the dunes for imperiled plants and animals such as La Graciosa thistle, marsh sandwort, California red-legged frog, and western snowy plover.

The Refuge lies within the Guadalupe-Nipomo Dunes Complex (Dunes Complex), an 18-mile-long stretch of coastal dunes located north of Point Sal and south of Pismo Beach. To conserve the dynamic landscape and imperiled natural resources of the Refuge and the Dunes Complex, the Service works cooperatively with other agencies, non-profit organizations, local businesses, private landowners, and private citizens. Working together, we instill stewardship through activities that include habitat restoration, protection of cultural resources, recovery of threatened and endangered species, and opportunities for high-quality visitor experiences in this unique and spectacular dunes landscape. Such cooperative efforts enable all partners to share limited resources to meet common goals, thereby achieving much more together than we could alone.

Originally envisioned by conservation-minded individuals who valued solitude and the satisfaction of spending time outdoors, we protect the Dunes Complex for everyone’s enjoyment, including future generations.

Together with our partners, we coalesce like grains of sand to ensure that wildlife-dependent recreation, environmental education, interpretation, and wildlife photography opportunities exist for the public, and that these activities are balanced with our conservation goals for cultural resources, plants, and animals of this treasured landscape.

## ***Goals of the Refuge***

### **Goal 1**

*Protect, restore, and enhance native habitats to aid in the recovery of endangered, threatened, and other special status species.*

### **Goal 2**

*Protect, manage, and restore coastal dune and other natural communities to support the diverse species of the central California coast.*

### **Goal 3**

*Provide safe and high-quality opportunities for compatible wildlife-dependent educational and recreational activities to foster public appreciation of the natural heritage of the central California coast region.*

## ***Chapter 2. Alternatives***

This chapter describes three alternatives for managing the Refuge including a no action alternative (Alternative A, continue current management) and two action alternatives. The three alternatives are described here and summarized in Table 1 at the end of this chapter. The two action alternatives presented in this chapter would result in a change to the current management of the Refuge. Alternative B proposes a moderate increase in management activities and some increase in public use. Alternative C proposes to close the Refuge to all public use and minimize management actions in response to forecasted reductions in future budgets for the National Wildlife Refuge System.

### **Current Management**

The Refuge currently has an interim plan to guide the management of all its resources and uses. Current management efforts on the Refuge focus on monitoring endangered species, monitoring non-native and invasive plants, habitat restoration, interpretation, and public use.

For a complete description of the current management practices, please see Chapter 4 of the Draft CCP.

### **Alternatives Development Process**

Three alternatives were developed to manage Guadalupe-Nipomo Dunes NWR.

- Alternative A: continue current management (no action)
- Alternative B: moderate increase in wildlife and habitat management; small increase in visitor services and the environmental education program
- Alternative C: minimal wildlife and habitat management and the Refuge is closed to the public

The alternatives development process was an iterative process that began after the planning team developed the Refuge vision statement and revised the Refuge's goals. The first step in this process was to identify all the important issues related to Refuge management, including current and future costs and anticipated funding levels. Following that, the planning team identified priority species and habitats. The list of needs and issues was generated collaboratively by the core planning team and Service staff. The public also helped identify important management needs and issues through the scoping process.

Once the list of important management issues was generated, the planning team defined Alternative A, the no action. It was important to describe this alternative accurately because the no-action alternative serves as the baseline to compare against all other alternatives.

Next, the planning team listed a range of management actions that would address the issues identified and the priority species and habitats identified, and achieve one or more of the Refuge goals. These actions were refined over regular planning team meetings to address a range of issues including wildlife management, habitat enhancement, public use activities, and funding resources to support staffing and operations. Although these alternatives represent a broad range of management approaches, there are several actions that are common to more than one alternative.

### **Alternatives Considered but Eliminated from Detailed Analysis**

The alternatives development process under NEPA and the Improvement Act are designed to allow the planning team to consider the widest possible range of issues and develop feasible management solutions that respond to these issues. These management solutions are then incorporated into one or more alternatives evaluated in the EA process and considered for inclusion in the CCP.

Actions and alternatives that are not feasible or may cause substantial harm to the environment are usually not considered in an EA. Similarly, an action (and therefore, an alternative containing that action) should generally not receive further consideration if:

- It is illegal (unless it is the no-action alternative, which must be considered to provide a baseline for evaluation of other alternatives, even though it may not be capable of legal implementation).
- It does not fulfill Refuge purposes or the mission of the Refuge System.
- It does not relate to or help achieve Refuge goals.
- Its environmental impacts are already evaluated in an approved NEPA document.

However, if such actions or alternatives address a controversial issue or an issue on which many public comments were received, they may be considered within detail in a NEPA document to demonstrate clearly why they are not feasible or would cause substantial harm to the environment.

During the alternatives development process, the planning team considered a wide variety of potential actions on the Refuge. The following actions were ultimately rejected and excluded from the proposed alternatives because they did not achieve Refuge purposes or were incompatible with one or more goals.

*Horseback Riding.* One comment during the public scoping meetings requested that horseback riding be considered on the Refuge. We considered this use, but later removed it from further consideration for a number of reasons, including the potential damage to plover nests and disturbance to breeding and wintering snowy plovers; this use is not currently provided by our neighbors to the north and south, making it difficult for users to access the Refuge; and the potential use area (beach) is small.

*Off-Road Vehicles.* Off-road vehicles were considered in light of this use in the area. Similar to horseback riding, this use was removed from further consideration for the following reasons: the potential damage to plover nests and disturbance to breeding and wintering snowy plovers; and the potential use area (beach) is also small. Also, this use is offered in neighboring areas.

### **Features Common to All Alternatives**

There is one component that is common to all the alternatives and would be part of the CCP regardless of the alternative selected for implementation. All proposed alternatives involve some level of protection for endangered species, particularly for La Graciosa thistle, marsh sandwort, Gambel's watercress, and California red-legged frog.

A preferred alternative is not identified in the Draft CCP or EA. We will select a preferred management alternative for implementation following completion of the public comment period and consideration of the comments provided by agencies, tribes, nongovernmental organizations, adjacent land managers, other stakeholders, and the interested public and input from refuge staff and other Service staff, as well as consideration of future costs and anticipated available budgets.

The management alternative selected for implementation must be consistent with the following criteria:

- Forwards the mission of the Refuge System;
- Addresses the purposes for which the Refuge was established;
- Provides guidance for achieving the Refuge's vision and goals;
- Protects the sensitive native habitats and listed species present on the Refuge;
- Adheres to the scientific principles of sound fish and wildlife management and listed species recovery; and

- Complies with all applicable legal mandates.

The alternative selected for implementation in the Final CCP may look very similar to one of the three alternatives described in the EA, or could include a combination of components from two or more of the alternatives presented. The final decision will be based on the analysis presented in the draft CCP and EA, public comments, Service staff input, the need to meet our statutory requirements, and forecasted declining budgets. The three alternatives considered for managing the Refuge are summarized in Table 1 and are described here.

## **Description of Management Alternatives**

### ***Alternative A: No Action (Continue Current Management)***

Under this alternative, the Refuge would continue current management actions (as detailed in Chapter 4 of the CCP), including habitat management, wildlife management, and public use opportunities. Habitat and wildlife management activities would focus on wildlife surveys and invasive weed management. Guided interpretive walks would continue to be offered. Current staffing and funding would remain the same. The Refuge would also work actively with partners to support the goals of the Guadalupe-Nipomo Dunes Complex.

*Listed Species.* Under Alternative A, annual western snowy plover surveys during the breeding and wintering season would continue to be conducted on the Refuge. The adult breeding population and hatch rate would be recorded for the breeding season, while a one-day adult population count would occur in the winter. Use of nest enclosures, when feasible, would continue to be conducted to protect and reduce threats to the snowy plover. Outreach on the Refuge would be conducted to reduce disturbance to the snowy plover. During the breeding season, closure signage would also be installed along the snowy plover breeding habitat. Opportunistic sightings of California least tern, California red-legged frog, La Graciosa thistle, marsh sandwort, and Gambel's watercress would also be recorded. Fencing at Myrtle and Colorado Ponds reduces damage to California red-legged frog, La Graciosa thistle, marsh sandwort, and Gambel's watercress habitat from mammals, including feral swine and deer. Seed collection and outplanting of La Graciosa thistle, marsh sandwort, and Gambel's watercress would be conducted intermittently when staff time permits. Sporadic control of beach grass and other invasive weeds (by us or through partners) would be conducted to improve snowy plover and least tern habitat.

*Other Species.* Under Alternative A, opportunistic sightings of other native plants and wildlife would also be recorded. The Refuge would continue to facilitate other native wildlife and plant monitoring and research through its partners. Intermittent weed management activities would also continue to benefit wildlife resources and native plants. Abnormal frog monitoring also occurs intermittently on the Refuge. Coverboards have also been placed in different parts of the Refuge to observe reptiles and invertebrates that may be present on the Refuge.

*Habitat Management.* Under Alternative A, the Service would continue to manage the habitat on the Refuge as described in detail in Chapter 4 of the CCP. The primary habitat types managed are coastal dune and coastal dune freshwater marsh and pond. Sporadic manual weed control and monitoring post-control of these habitats would continue as funds (for contracts) and staff time permit. Jubata grass would continue to be controlled as staffing and resources allow, via hand pulling and mechanical (shovel, tree saw, and string trimmer). Beachgrass and veldt grass control would continue as resources are available; using herbicide occurs through partners. Volunteers would continue to help with manual weed removal and conducting vegetation surveys. Fencing along the southern and eastern boundaries of the Refuge would continue to be maintained to protect Refuge habitats and natural resources from damage by feral swine and deer.

*Public Access.* Under Alternative A, the Refuge would continue to provide wildlife observation, wildlife photography, and interpretation as detailed in Chapter 4 of the CCP. Guided, interpretive walks are offered to the public at least once per year, when staff time or support from partners permits. Guided, interpretive walks are also conducted for private and non-profit entities as requested. The public is permitted to access the Refuge from the beach; the beach area of the Refuge is closed to the public during the snowy plover breeding season.

*Other.* Under Alternative A, other non-wildlife-dependent recreational uses would continue, including surf fishing. Surf fishing technically occurs below mean high tide, which is considered State waters, whereas the Refuge boundary is above the mean high tide line. However, the public traverses through the Refuge to access the beach where surf fishing occurs. Staff participates in offsite outreach events when time permits, such as talks about the Refuge history and resources to local groups (e.g., local Audubon chapters).

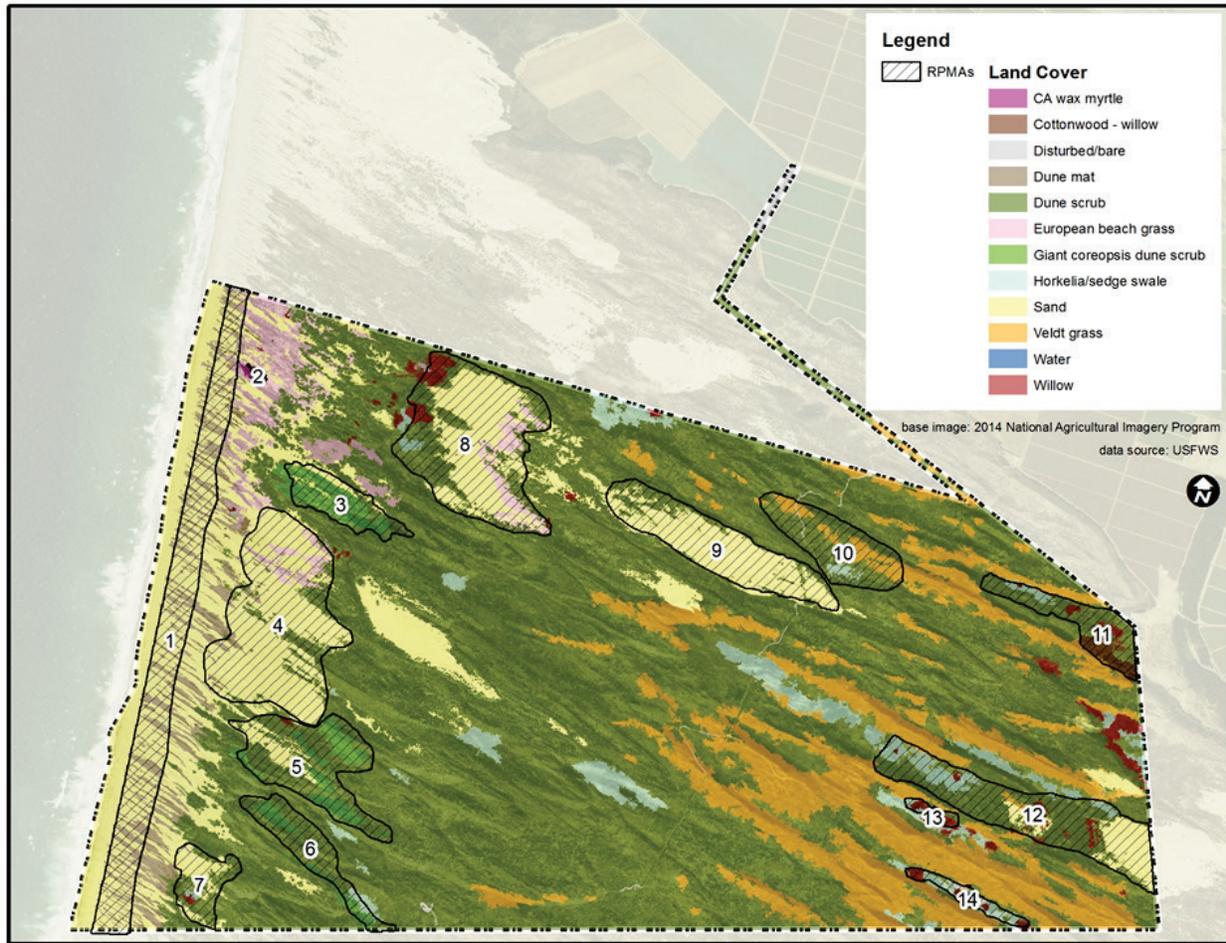
***Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education.***

Alternative B includes those actions in Alternative A; in addition, the Refuge would moderately expand wildlife and habitat management while incrementally increasing visitor service and environmental education activities. For this alternative, Refuge Priority Management Areas (RPMAs) were established that represent unique habitat types or provide habitat for listed or rare species on the Refuge that deserve conservation attention (Figure 3). Additional wildlife management activities include improving western snowy plover hatch rate by reducing invasive weeds and predation. Habitat and monitoring would be improved to support the listed La Graciosa thistle, marsh sandwort, Gambel's watercress, and California red-legged frog. Of the Service's "Big 6" public uses—wildlife observation, photography, interpretation, and environmental education—would be enhanced on the Refuge. Public access through snowy plover breeding habitat to the back dunes of the Refuge would also be limited to a marked trail corridor (five-year pilot project) to reduce human disturbance. Refuge staff would develop a dedicated volunteer crew to support Refuge management and outreach. Additional staff and funding would be needed to implement this alternative.

*Listed Species.* Under Alternative B, western snowy plover surveys would continue during the breeding season twice a week to monitor nesting and hatch success. The monitoring plan for listed species would be revised to standardize protocols. To increase hatch success by 10 percent, beachgrass would be controlled to no more than 20 percent within 90 acres of coastal strand and coastal dune habitat (RPMA 1) to provide the open, unvegetated sand environment preferred by plovers.

A feral swine control and monitoring plan, prepared in association with the CCP and available for review as Appendix J of the Draft CCP, would be implemented under Alternative B to protect the western snowy plover, California least tern, California red-legged frog, La Graciosa thistle, and other listed and sensitive species. In accordance with this step-down plan, feral swine would be controlled to reduce predation and damage to the habitat of these species. Although eradication of feral swine from the Refuge has been deemed unlikely, control of the existing population is expected to reduce the level of current impact to habitat and listed species. No more than 20 traps (e.g., corral-style, cage, drop-net, padded leg hold, box), totaling no more than 400 square feet, would be installed at one time. More information on the feral swine control and monitoring is detailed in Appendix J of the Draft CCP.

**Figure 3. Guadalupe-Nipomo Dunes Refuge Priority Management Areas**



Although California least tern are not known to nest on the Refuge, they have been observed roosting in the beach areas of the Refuge and are known to nest on neighboring lands. It is anticipated that invasive weed control and the implementation of a feral swine control and monitoring plan would benefit the least tern.

A step-down avian and mammalian predator management plan, which would require compliance with NEPA, would be developed following approval of the CCP to reduce threats to snowy plover adults, chicks, and eggs from various individual species. The recovery plan for the western snowy plover (USFWS 2007) identifies expanding predator populations as one of the primary reasons for a decline in active nesting areas and in the size of the breeding and wintering populations.

The Refuge would begin regular surveying of the listed La Graciosa thistle, marsh sandwort, Gambel's watercress, and California red-legged frog. Three occurrences of La Graciosa thistle would be established and maintained (present at least three consecutive years) at Three Pond West, Myrtle, and Colorada Ponds, totaling at least 25 plants each through seed collection, dispersal, and propagation. Barrier fencing would be installed and maintained to reduce trampling of plants by mammals. Weed control would also allow these occurrences to expand. Watering of plants from the pond may be conducted during prolonged drought. Two occurrences of marsh sandwort would be established and maintained (presence for at least

three consecutive years) at Myrtle Pond and at or near Colorado Pond (there are multiple wetland areas near Colorado Pond) through seed collection, dispersal propagation, and weed control. Barrier fencing would also be installed and maintained at all wetland areas to reduce trampling of plants by mammals. Remote cameras may be used to record damage and frequency by nuisance wildlife for both plants.

An investigation would also be conducted to determine the suitable water level and water quality regime needed to support La Graciosa thistle and marsh sandwort. The results of this investigation may identify suitable locations where additional ponds can be constructed. A pond management plan would be developed to maintain water levels and water quality requirements.

Three ponds (Myrtle, Colorado, and Icebox) would be maintained to support California red-legged frog. Site-specific monitoring protocol and an associated monitoring program that includes surveys for red-legged frogs would be developed and implemented at these ponds, including another three wetland areas where they are known to occur. Upland dispersal habitat around each pond would be enhanced, consisting of riparian vegetation (species to be determined); spaces under boulders or rocks; and organic debris, such as downed trees or logs, industrial debris, and moist leaf litter. Invasive and woody vegetation that threaten frog habitat would be removed, and the vegetation density around the periphery of the pond would be actively managed to provide shade and protection from predators. Hand removal of surface and emergent vegetation in ponds would be conducted as needed. Barrier fencing would also be installed and maintained to reduce damage of frog habitat by mammals. Remote cameras may be used to record damage and frequency of visits to ponds by nuisance wildlife.

An investigation would also be conducted to determine the suitable water level and water quality regime needed to support the California red-legged frog and whether feasible locations exist on the Refuge. The results of this investigation may identify suitable locations where additional ponds can be constructed. A pond management plan would be developed to maintain water levels and water quality requirements.

To understand effects on climate change on the snowy plover, La Graciosa thistle, marsh sandwort, and red-legged frog, long-term survey information (e.g., nest locations, phenology, population size) would be compared to local climate data trends—such as temperature, precipitation, sea-level rise, frequency of storm events, and beach erosion data—to determine adaptive and mitigating actions. A climate vulnerability assessment would also be conducted on the western snowy plover, La Graciosa thistle, marsh sandwort, and California red-legged frog. The results of the assessment would inform monitoring and management actions.

During the snowy plover breeding season, access through the beach inland to the interior of the Refuge would be limited to a corridor marked with fencing to limit trampling of nests and disturbance to birds (see *Public Uses* for more details). Also, the Refuge staff would work with partners to conduct outreach and education on the Refuge, at Oso Flaco Lake parking lot, at Rancho Guadalupe Dunes Preserve parking lot, and other locations as appropriate to reduce human disturbance and inform the public of sensitivity of the breeding birds and listed plants. This outreach would be particularly important during high use holiday weekends.

*Other Species.* Additional survey efforts would be conducted to obtain a baseline understanding of the bird, mammal, herpetological, and plant communities on the Refuge. One occurrence of Nipomo lupine would be established in RPMA 10 or other appropriate location on the Refuge, if suitable habitat exists. There are existing occurrences of beach spectaclepod in approximately 60 acres of coastal dune scrub habitat in RPMAs 5 and 7. These occurrences would be maintained and enhance through seed collection, dispersal, and invasive weed control.

*Habitat Management.* Habitat management would consist primarily of invasive weed control and enhancement of native plant communities. The unique coreopsis dune scrub in RPMA 3, 5, and 6 would be conserved. Some 200 acres of naturally shifting, primarily unvegetated open sand cover in RPMA 4, 5, 7, and 9 would be maintained by invasive weed encroachment. Priority weeds would be controlled using a variety of mechanical, manual, and chemical methods.

Besides beachgrass, veldt grass is another pressing invasive weed requiring control. The cover of perennial veldt grass would be reduced by 50 percent in three or more RPMA to protect high-quality sand sheet, willow forest, wetland pond, dune swale, and coastal dune scrub habitat. Over the life of the CCP, the cover of perennial veldt grass would be reduced by 75 percent in those RPMA.

Following completion of the Final CCP, an Integrated Pest Management (IPM) Plan would be prepared as a step-down plan and made available for public review and comment. The IPM Plan would address the control of veldt grass, beachgrass, jubata grass, purple ragwort, iceplant, and other known highly invasive plant species to at least 50 percent of baseline survey occurrences on all RPMA. Also, an early detection and rapid response program would be created and implemented to address the introduction of new invasive weeds on the Refuge.

Another habitat management tool proposed under Alternative B is the use of prescribed burns and pile burning on the Refuge, particularly for use in association with invasive weed control. Prior to implementing these fire-related management activities, it will be necessary to revise the Refuge's Fire Management Plan and complete the associated NEPA documentation.

*Public Uses.* Under Alternative B, there would be a small increase in visitor opportunities. Because access to the Refuge requires—at a minimum—a one-mile hike on the beach to the Refuge boundary, it is not anticipated that visitation would significantly increase with the added opportunities. Four interpretive walks would be conducted annually, with no more than 20 participants. Two special events such as a hike to Oso Flaco Peak for coreopsis blooming, trash removal, or weed-pulling would be conducted annually in honor of Earth Day or National Wildlife Refuge Week. Some of these walks may take place through the Beagle Road entrance, but the majority of walks are expected to start from the Oso Flaco Lake parking lot. Self-guided opportunities would include an undeveloped loop trail (five-year pilot) starting on the beach roughly 200 yards from the northern boundary to Myrtle Pond, Hidden Willow Valley, and Oso Flaco Peak to provide public access during the breeding season and to protect plover nesting habitat (proposed trail also open during the plover non-breeding season). Other times of the year, visitors could continue to use the trail or decide to hike through the Refuge using a path of their choosing. Interpretive signage would be updated or created at Myrtle Pond, Hidden Willow Valley, and Oso Flaco Peak to enhance the visitor experience.

While fishing does not actually occur on the Refuge (land below the mean high tide line is State waters), staff would conduct fishing regulation education to ensure compliance.

*Environmental Education.* Under Alternative B, environmental education opportunities would be provided on and off the Refuge, depending on the age group. Because the Refuge may be difficult to access for young children, elementary school-age environmental education programs would be conducted off-site (at least two per year) in collaboration with a non-profit education organization such as Dunes Center. On-Refuge environmental education opportunities would be directed at high school age and older. At least one research or Citizen Science partnership would be established annually with local university and high school science classes or clubs to support research or monitoring of Refuge priority species and habitats, while teaching technical field biology skills. Where possible, program materials would be translated into Spanish, as the local community is largely bilingual.

*Other.* Currently, there is no permanent office facility for the Refuge. Under Alternative B, an office and/or contact station would be established at or near the Refuge in the Guadalupe area. Because all lands within the approved acquisition boundary have not been acquired, the Refuge would actively work with partners and willing sellers to acquire remaining lands within the approved acquisition boundary. Located on the coast, the Refuge is at continual risk for oil spills and other contaminants. The Refuge would work with neighboring partners to respond to oiled, injured, or distressed wildlife along the coast of the Dunes Complex. The Refuge would also establish and maintain a relationship with local law enforcement to increase presence on the Refuge.

A volunteer group of at least six dedicated individuals would be established, trained, and maintained to support habitat restoration, natural resource monitoring, and general surveillance, as well as to lead tours, and conduct environmental education programs. There is a history of Native American presence on the lands of what is now the Refuge. To honor this history, the Refuge would coordinate at least three gatherings or projects within the life of the CCP with appropriate local Native American groups to protect, preserve, share, record, or interpret the cultural heritage and resources of the Refuge.

The existing Refuge website would be updated and maintained to share history, current management activities, and visitor opportunities with the public.

***Alternative C: Minimal wildlife and habitat management, and the Refuge is closed to public.***

Under Alternative C, the types and extent of wildlife and habitat management actions that are currently being implemented on the Refuge would be reduced or discontinued in light of forecasted declining Refuge System budgets. Since 2010, the Refuge System budget nationally has declined by over \$20 million while costs have continued to increase. Over the same period, staffing has been reduced by about 12 percent. Uncertainty about future budget appropriations will continue to influence the range of management actions that can be implemented on refuges.

Management activities related to monitoring, invasive species control, and habitat enhancement and restoration would no longer be implemented under Alternative C. Instead, management actions would be limited to installing and maintaining permanent refuge closure signs at the beach and any other potential access entry points; maintaining existing perimeter fencing and fencing installed to protect listed species; and inspecting site conditions and implementing sign and fence maintenance three times per year (i.e., spring, summer, fall). A Feral Swine Control and Monitoring Plan would not be implemented under this alternative, and no future step-down predator management plan or IPM Plan is proposed. In addition, no visitor services, including environmental education programs, would be provided and the Refuge would be closed to all public access. Some signage on and off the Refuge may also need to be removed or modified to inform the public that the Refuge would no longer be open for public access.

*Listed Species.* Under Alternative C, contributions to the recovery of listed species would include closing the Refuge to all public access to minimize human disturbance to plover nesting habitat; maintaining existing perimeter fencing; and maintaining fencing that has been installed around much of the Refuge's La Graciosa thistle population and around a number of ponds and wetland areas that support California red-legged frog and have the potential to support marsh sandwort and Gambel's watercress.

*Other Species.* Due to the forecasted declining budgets, no management of other sensitive plant or animal species would be conducted under this alternative.

*Habitat Management.* Due to the forecasted declining budgets, Alternative C does not include any proposals for habitat management or enhancement of native plant communities. No control of non-native, invasive plants in wetland or dune habitat is proposed. No habitat restoration, pond management, or

monitoring of habitat quality (e.g., extent of encroachment by invasive plants, impacts to habitat due to feral swine activity) would be conducted.

*Public Uses.* Due to the forecasted declining budgets, the Refuge would be closed and no public use activities would be conducted.

*Environmental Education.* Due to the forecasted declining budgets, no environmental education activities would be conducted on or off the Refuge.

**Table 1. Summary of Alternatives**

Issue Area	Alternative A: No Action (Continue Current Management)	Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education	Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public
GOAL 1: Protect, restore, and enhance native habitats to aid in the recovery of endangered, threatened, and other special status species.			
<b>Western snowy plover</b>			
Low productivity	Monitor adult breeding population and hatch rate on the Refuge; survey during the breeding season, two days per week; one-day wintering survey.	Over the life of the CCP, increase long-term average hatch rate by 10 percent; take measures to improve hatch success when productivity drops below the long-term average.	Close the Refuge to public access and install and maintain signage on the beach indicating that the Refuge is closed.
Invasive grasses (beachgrass and iceplant)	Conduct invasive European beachgrass and other species control via herbicide, mechanical, and hand removal; vegetation monitoring post-invasive weed control.	Using a full range of invasive weed control methods, achieve and maintain 90 acres of coastal strand and coastal dune habitat (RPMA 1) with no more than 20 percent occurrence of invasive plant species (e.g., beachgrass, veldt grass, iceplant) to support western snowy plover.	No action is proposed to address this issue.
Predation of western snowy plover	Reduce predation of plover nests and disturbance using nest exclosures and seasonal closure of nesting habitat.	Develop and implement a predator management plan which includes control of avian and mammalian species.	No predator management, including the use of exclosures, is proposed.
Human disturbance (from recreation activities, presence of pets, noise pollution, and aircraft disturbance)	Close Refuge to mean high tide line during breeding season. Conduct outreach to visitors when staff are present on the Refuge, and document all known trespass occurrences in closed area.	Beginning in 2016, work with partners to conduct outreach and education annually on the Refuge, at Oso Flaco Lake parking lot and Rancho Guadalupe Dunes Preserve parking lot, and at other locations as appropriate during the plover breeding season to reduce human disturbance and inform the public of sensitivity of the breeding birds.	Close the Refuge to all public access.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Impacts to nesting birds from existing access route	Not currently addressed.	Upon completion of the CCP, conduct a five-year pilot project to provide an undeveloped loop trail roughly 200 yards from the northern boundary to Myrtle Pond, Hidden Willow Valley, and Oso Flaco Peak to provide public access during the breeding season and to protect plover nesting habitat (proposed trail also open during the plover non-breeding season).	The Refuge would be closed to all public access.
Climate change	Not currently addressed.	Throughout the life of the CCP, compare snowy plover nest locations to local climate data (e.g., sea-level rise, frequency of storm events, beach erosion data) to determine how and where to enhance or modify inland dune habitat to support nesting habitat as needed.	No action is proposed to address this issue.
<b>La Graciosa thistle</b>			
Incomplete data regarding species presence and distribution on the Refuge	Opportunistic sightings and recording of species presence.	Conduct regular monitoring /inventory/ survey at all wetland areas for presence and extent (e.g., map distribution, number of plants, and/or density).	No monitoring, inventories, or surveys are proposed.
Loss of reproductive vigor in small populations	Maintain two new ponds.	In 15 years, establish and maintain three occurrences (present at least three consecutive years) of La Graciosa thistle at Three Pond West, Myrtle, and Colorada, Ponds, totaling at least 25 plants each through seed collection, dispersal, and propagation.	No action is proposed to address this issue.
Feral swine predation, as well as destruction of habitat	Continue to maintain and fence wetland and riparian areas.	Implement the feral swine control and monitoring plan and install and maintain barrier fencing around ponds.	Continue to maintain existing fencing on the Refuge.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Animal disturbance	Continue to maintain and fence wetland and riparian areas.	Within the life of the CCP, measure and establish a reduction rate to reduce animal disturbance at three occurrences (present at least three consecutive years) of La Graciosa thistle at Three Pond West, Myrtle, and Colorada Ponds.	Continue to maintain existing fencing on the Refuge.
Human disturbance	Continue to maintain fencing around wetland areas.	Beginning in 2016, conduct outreach and education annually on the Refuge, at Oso Flaco Lake parking lot and Rancho Guadalupe Dunes Preserve parking lot, and at other locations as appropriate to reduce damage from trampling.	Close the Refuge to all public access.
Declining water levels	Not currently addressed.	Within five years, determine through investigation the suitable water level and water quality regime needed to support La Graciosa thistle and whether feasible locations exist on the Refuge.	No action is proposed to address this issue.
Climate change	Not currently addressed.	Within three years of the CCP's approval, begin conducting annual surveys at the three ponds to monitor responses of La Graciosa thistle to climate change.	No action is proposed to address this issue.
<b>Marsh sandwort</b>			
Incomplete data regarding species presence and distribution on the Refuge	Opportunistic sightings and recording of species presence.	Conduct regular monitoring / inventory / survey at all wetland areas for presence and extent (e.g., map distribution, number of plants, and/or density).	No action is proposed.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Habitat modification by conversion of marsh habitat to mesic upland habitats that support grass and shrub dominated plant communities; alteration of the hydrological regime; water quality issues (e.g., excessive nitrogen)	Maintain two new ponds; outplant seedlings.	In 10 years, establish and maintain two occurrences (presence for at least three consecutive years) at Myrtle Pond and at or near Colorada Pond (there are multiple wetland areas near Colorada Pond).	No action is proposed to address this issue.
Human disturbance resulting in damage or destruction of plants	Exclosure fencing installed around perimeter of known population; fencing installed on Refuge southern and eastern boundaries.	Beginning in 2016, conduct outreach and education annually on the Refuge, at Oso Flaco Lake parking lot, at Rancho Guadalupe Dunes Preserve parking lot, and at other locations as appropriate to reduce damage from trampling and install and maintain barrier fencing around ponds.	Close the Refuge to all public access.
Feral swine predation, as well as destruction of native habitats.	Continue to maintain and fence wetland and riparian areas.	Implement the feral swine control and monitoring plan to control feral swine, and install and maintain fencing around ponds.	Continue to maintain existing fencing on the Refuge.
Animal disturbance	Continue to maintain and fence wetland and riparian areas.	Within the life of the CCP, measure and establish a target rate to reduce disturbance at two occurrences (present at least three consecutive years) of marsh sandwort at Myrtle and Colorada Ponds.	Continue to maintain existing fencing on the Refuge.
Declining water levels	Not currently addressed.	Within five years, determine through investigation the suitable water level and water quality regime needed to support marsh sandwort and whether feasible locations exist on the Refuge.	No action is proposed to address this issue.
Climate change	Not currently addressed.	Within three years of the Plan's approval, conduct annual surveys in the two occurrences to monitor responses of marsh sandwort to climate change.	No action is proposed to address this issue.

**Table 1. Summary of Alternatives**

Issue Area	Alternative A: No Action (Continue Current Management)	Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education	Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public
<b>California least tern</b>			
Habitat loss and fragmentation	Contracted invasive European beachgrass and other species control via herbicide, mechanical, and hand removal; vegetation monitoring post-invasive weed control.	Using a full range of invasive weed control methods, achieve and maintain 90 acres of coastal strand and coastal dune habitat (RPMA 1) with no more than 20 percent occurrence of invasive plant species (e.g., beachgrass, veldt grass, iceplant) to support western snowy plover.	No action is proposed to address this issue.
Human disturbance (from recreation activities (and their pets), noise pollution, aircraft disturbance)	Close Refuge to mean high tide line during breeding season.	Beginning in 2016, work with partners to conduct outreach and education annually on the Refuge, at Oso Flaco Lake parking lot, at Rancho Guadalupe Dunes Preserve parking lot, and at other locations as appropriate during the least tern breeding season to reduce human disturbance and inform the public of sensitivity of the breeding birds.	. Close the Refuge to all public access.
<b>California red-legged frog</b>			
Incomplete data regarding species presence and distribution on the Refuge	Opportunistic sightings and recording of species presence.	Conduct regular monitoring / inventory / survey at all wetland areas for presence/absence.	No action is proposed to address this issue.
Habitat loss, alteration, and fragmentation (general); specific to Refuge: drought, fluctuating ground water levels and trophic enrichment	Construct two new ponds.	Over the life of the CCP, maintain three ponds (Myrtle, Colorada, and Icebox) for presence of California red-legged frog.	No action is proposed to address this issue.
Declining water levels	Not currently addressed.	Within five years, determine through investigation the suitable water level and water quality regime needed to support red-legged frog and whether feasible locations exist on the Refuge.	No action is proposed to address this issue.
Feral swine predation of red-legged frog, as well as destruction of native habitats.	Continue to maintain and fence wetland and riparian areas.	Implement the feral swine control and monitoring plan to control feral swine, and install and maintain fencing around ponds	Continue to maintain existing fencing on the Refuge.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Animal disturbance	Continue to maintain and fence wetland and riparian areas.	Within the life of the CCP, measure and establish a reduction rate to reduce disturbance at Myrtle, Colorado, and Icebox Ponds where red-legged frog are present or recently known to occur.	Continue to maintain existing fencing on the Refuge.
Climate change	Not currently addressed.	Within three years of the Plan's approval, conduct annual surveys in the three ponds to monitor responses of red-legged frogs to climate change.	No action is proposed to address this issue.
<b>GOAL 2: Protect, manage, and restore coastal dune and other natural communities to support the diverse species of the central California coast.</b>			
<b>Beach spectaclepod</b>	Not currently addressed.	Over the life of the CCP, protect, maintain, and enhance approximately 60 acres of coastal dune scrub habitat in RPMAs 5 and 7 to support beach spectaclepod; at a minimum, maintain population or cover of beach spectaclepod as surveyed within three years of the CCP.	No action is proposed to address this issue.
<b>Native coastal dune and wetland ecosystem species</b>			
Invasive vegetation	Sporadic manual weed control and monitoring post-control of coastal dune, freshwater marsh, and pond areas would continue as funds (for contracts) and staff time permit.	Maintain the existing 200 acre spatial extent of naturally shifting, primarily unvegetated open sand cover (define as an open sand percentage through initial baseline survey) in RPMAs 4, 5, 7, and 9.	No action is proposed to address this issue.
Conservation of unique coreopsis plants	Not currently addressed.	Maintain representative examples of coreopsis dune scrub in RPMAs 3, 5, and 6.	No action is proposed to address this issue.
Lack of baseline information on natural resources	Ongoing opportunistic inventory.	Within the life of the CCP, obtain a baseline understanding of the bird, mammal, herpetological, and plant communities on the Refuge.	No action is proposed to address this issue.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Priority invasive weeds (veldt grass, iceplant, jubata grass, and purple ragwort)	Intermittent and experimental weed control using herbicide, mechanical, and handpulling methods.	Within 5 years, reduce cover of perennial veldt grass by 50 percent (of 2016 baseline survey) in three or more RPMA's to protect high-quality sand sheet, willow forest, wetland pond, dune swale, and coastal dune scrub habitat. Within 15 years, reduce cover of perennial veldt grass by 75 percent in those RPMA's.	No action is proposed to address this issue.
Invasive jubata grass	Jubata grass control via hand pulling and mechanical (e.g., shovel, tree saw, string trimmer).	Within five years, create and implement an IPM step-down plan to control veldt grass, beachgrass, jubata grass, purple ragwort, iceplant, and other known highly invasive plant species to at least 50 percent of baseline survey occurrences on all RPMA's within life of the CCP.	No action is proposed to address this issue.
Need for rapid response to newly introduced invasive species and highly invasive ones in the region	Continue sporadic manual weed control in coastal dune, freshwater marsh, and pond habitat areas as funding and staff time permits.	Within 10 years, develop and implement an early detection and rapid response program to address the introduction of new invasive weeds on the Refuge.	No action is proposed to address this issue.
<b>Nipomo lupine</b>			
Establish Nipomo lupine on the Refuge	Continue the Nipomo lupine viability study.	Within life of the CCP, work with University of California at Santa Barbara or another local university to establish one occurrence of Nipomo lupine in RPMA 10 or other appropriate location on the Refuge, if appropriate habitat exists.	No action is proposed to address this issue.
<b>Administration</b>			
Limited staff presence on the Refuge	Continue to manage the Refuge through the Hopper Mountain NWR Complex and work with partners.	Increase staff support and work with partners; within the life of the CCP, establish an office or contact station at or near the Refuge (Guadalupe area).	Reduce management to minimize staffing needs, continue to manage the Refuge through the Hopper Mountain NWR Complex.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Remaining lands to be acquired	Not currently addressed.	Over the life of the CCP, actively work with partners and willing sellers to acquire remaining lands within the approved acquisition boundary of the Refuge.	No acquisition is proposed.
<b>Oil spill/contaminants</b>			
Improve ability to respond to oil spill and other contaminants concerns	Not currently addressed.	Over the life of the CCP, coordinate oil spill response with other neighboring partners and respond to oiled, injured, or distressed wildlife on the Refuge (per the Service’s regional Oil and Hazardous Material Spill Preparedness and Response Plan).	No action is proposed to address this issue.
GOAL 3: Provide safe and high-quality opportunities for compatible wildlife-dependent educational and recreational activities to foster public appreciation of the natural heritage of the central California coast region.			
<b>Safe public access</b>			
Improve public access on the Refuge	Not currently addressed.	Upon completion of the CCP, conduct a five-year pilot project to provide a loop trail roughly 200 yards from the northern boundary to Myrtle Pond, Hidden Willow Valley, and Oso Flaco Peak to provide public access during the breeding season and to protect plover nesting habitat (proposed trail also open during the plover non-breeding season).	The Refuge would be closed to all public access.
<b>Wildlife observation, interpretation, photography, and environmental education</b>			
Provide opportunities for wildlife observation, interpretation, photography, and environmental education	Continue to provide off-refuge interpretation and outreach opportunities on a case-by-case basis.	Lead four interpretive walks per year.	No wildlife-dependent recreational uses are proposed and the Refuge would be closed to all public access.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
Stewardship	Continue current occasional volunteer events through partnerships	Conduct at least two special event walks (e.g., to Lunar Crater, Oso Flaco Peak for coreopsis blooming, Myrtle Pond) for Earth Day or Refuge Week, cleanup or weed-pulling events.	No volunteer projects are proposed.
Outreach	Continue current outreach efforts.	Within three years, establish a website with regularly updates.	No public outreach other than informing the public that the Refuge would be closed indefinitely to all public access.
<b>Environmental education</b>			
Opportunities for increasing understanding of priority species and habitats	Continue current education-related partnerships.	Establish at least one research or Citizen Science partnership annually with local university and high school science classes or clubs to support Refuge priority species and habitats, while teaching technical skills.	None proposed.
Engage elementary school-age students in environmental education	Continue current environmental education-related partnerships.	Annually conduct at least two offsite elementary school-age environmental education programs in collaboration with a non-profit education organization such as Dunes Center.	No opportunities for environmental education would be provided.
<b>Research</b>			
Encourage research on the Refuge that can assist in the conservation of listed and other special status species and native habitats	Continue current research partnerships.	Continue current research partnerships and encourage the creation of additional partnerships to benefit Refuge resources.	No research projects would be implemented on the Refuge under this alternative.

**Table 1. Summary of Alternatives**

<b>Issue Area</b>	<b>Alternative A: No Action (Continue Current Management)</b>	<b>Alternative B: Moderate increase in wildlife and habitat management, and an incremental increase in visitor services and environmental education</b>	<b>Alternative C: Minimal wildlife and habitat management, and Refuge is closed to public</b>
<b>Volunteers</b>			
Engage volunteers in assisting with management needs	Continue current efforts to work with volunteers through existing partnerships.	Within five years, establish, train, and maintain a volunteer group of at least six dedicated individuals for habitat restoration, weed control, monitoring, general surveillance, leading tours, conducting environmental education programs.	No volunteer projects are proposed.
<b>Conservation Outreach</b>			
Fishing (not regulated or occurring on the Refuge, but anglers do access the Refuge to conduct this use)	Not currently addressed.	Over the life of the CCP, conduct fishing regulation education and compliance.	No action is proposed to address this issue.
<b>Law Enforcement/Safety</b>			
Ensure the safety of the Refuge visitors and the protection of Refuge resources	Continue current periodic patrols of the Refuge.	Establish and maintain a relationship with local LE to increase law enforcement presence on the Refuge	Refuge closed to the public, staff site visits will occur three times a year.
<b>Cultural resources</b>			
Protect cultural resources	Continue to adhere to all applicable policies and regulations related to the cultural resources and coordination with Tribes.	Alternative A and within the life of the CCP, coordinate at least three gatherings or projects with appropriate, local Native American groups to protect, preserve, share, record, or interpret the cultural heritage and resources of the Refuge.	Same as Alternative A.

### ***Chapter 3. Affected Environment***

This chapter is intended to describe the physical, biological, and cultural resources, as well as the social and economic environment that would most likely be affected by the alternatives. The CCP provides a detailed description of each of these components.

## ***Chapter 4. Environmental Consequences***

Chapter 4 analyzes the environmental impacts expected to result from implementation of the alternatives. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative impacts for each alternative where applicable. Direct impacts are generally caused by the proposed actions and occur at the same time and place as the action, such as flushing of wildlife from wildlife observation activities. Indirect impacts are defined as reasonably foreseeable effects caused by the proposed action but occurring later in time or farther away from the source of impact than direct effects. An example of an indirect impact is habitat modification that results in a change in abundance, breeding success, or prey availability. Cumulative effects would occur when incremental direct or indirect impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them. The analysis is organized by each aspect of the environment described in Chapter 3 of the CCP, including physical, biological, cultural, social, and economic resources. The purpose of the analysis is to provide the context and intensity of any effects that would be expected to occur in association with the implementation of each alternative such that a determination of significance can be made by the decision-makers.

NEPA requires the development of mitigation measures when Federal activities are likely to result in adverse impacts on the human environment. As currently drafted, Alternative C may result in adverse impacts that could be avoided through the incorporation of additional management strategies. Alternative A (no action) is a continuation of current management practices that are currently in place and serves as a baseline against which Alternatives B and C are compared.

### **Physical Resources**

#### ***Water***

##### Alternative A

Because the Refuge is located along the coast, much of the Refuge is affected by tidal changes and storm events. Over time, tidal changes and storm events are expected to change the shape and amount of sediment along the coastal foredune.

Under Alternative A, weed management activities, particularly manual removal of weeds by hand pulling, cutting, digging, chopping, uprooting (weed wrenching), and weed-whacking may expose soil and make it vulnerable to erosion. However, the coastal dune environment consists of shifting open sand dunes, and sand movement is a constant. Controlled sites would be replaced by native plants through seeding or planting seedlings to prevent long-term soil loss, where appropriate, such as surrounding wetland areas.

Weed control activities in the form of chemical removal could also cause soil disturbance and would introduce chemicals into the environment. However, only approved herbicides appropriate for the Refuge's coastal dune and wetland environments would be used and all herbicide applications would be implemented according to label directions. Manual removal of invasive weeds would be the preferred method in wetland areas. In situations where herbicide application is used near wetland areas, only the use of herbicides labeled for aquatic environments would be permitted. The use of herbicides would not be permitted during inclement weather to reduce impacts to coastal and wetland water quality. All herbicides approved by the Service through the Pesticide Use Proposal (PUP) process would be applied at label rates, and all label recommendations would be followed (e.g., measures to preclude herbicide application on windy days).

The Refuge would continue to periodically use Service-approved herbicides, including Fusilade DX (fluzifop-p-butyl), Habitat (Imazapyr), Aquanet (glyphosate), POAST (BASF) (sethoxydim), and Arrow 2EC (clethodim) to control invasive vegetation on the Refuge. New herbicides may be added throughout the life of the CCP but must be Service-approved.

Because it binds strongly with soils, fluzifop-p-butyl is not highly mobile and is not likely to contaminate ground water or surface water through surface or subsurface runoff. In water, fluzifop-p-butyl is rapidly hydrolyzed to fluzifop acid, which is stable in water. (Tu et al. 2001) Fluzifop-p-butyl is reported to be of low mobility in soils and does not present an appreciable risk of groundwater contamination (EXTOXNET 1996a, WSSA 1994).

Imazapyr is the active ingredient found in herbicides such as Habitat® or Polaris®. It is highly soluble in water. The half-life of Imazapyr in water is 3-5 days with photodegradation being the primary form of degradation. Due to its rapid photodegradation by sunlight, water contamination by Imazapyr is generally not of concern. (Leson and Associates 2005)

Glyphosate is considered nonmobile in soils and sediments because it rapidly and strongly adheres to soil particles and degrades in the soil. Glyphosate is moderately persistent in the soil. Glyphosate is highly adsorbed on most soils, especially those with high organic content. Therefore, because glyphosate is so tightly bound to the soil and little is transferred by rain or irrigation water, it is not expected to affect water quality. One estimate showed less than two percent of the applied chemical was lost to runoff (USFS 1984). The herbicide could move when attached to soil particles in erosion runoff. In water, glyphosate is strongly adsorbed to suspended organic and mineral matter and is broken down primarily by microorganisms. Its half-life in pond water ranges from 12 days to 10 weeks (Cornell University 1994). Because glyphosate is tightly bound to the soil and with the implementation of the Service's PUP requirements, the Service anticipates there would be no adverse effects to water quality.

Sethoxydim is readily degraded by light (Shoaf and Carlson 1992). Photodegradation occurs in less than one hour in water (WSSA 1994, EXTOXNET 1996b). Sethoxydim is water-soluble and does not bind strongly with soil particles.

Clethodim may be highly persistent in the aquatic environment. Reported half-lives for clethodim in the aquatic environment are 128 days in the aqueous phase and 214 days in the sediment (USEPA 1992). The reported hydrolysis half-life at pH 7-9 is approximately 300 days. The main pathway for degradation of clethodim in the aquatic environment is anaerobic metabolism by microorganisms (USEPA 1992). However, due to the low persistence and mobility of the compound, it is unlikely to be found in surface waters. Clethodim may be somewhat mobile in the soil environment, but it is very short-lived. The U.S. Environmental Protection Agency (EPA) has stated "under present use patterns and under most circumstances clethodim does not appear to threaten groundwater" (USEPA 1992).

Under Alternative A, management activities to benefit wildlife and habitat are not expected to impact coastal water quality. Vegetation control in the coastal dune habitat, particularly manual removal of vegetation, may result in minor changes to the hydrology of the Refuge, but because it is a coastal dune environment, the sand is already naturally shifting. Use of herbicide is not expected to affect water quality, and only those herbicides approved for the aquatic environment would be permitted for use when applications are to occur near wetland areas. Most herbicide application currently occurs via backpack sprayer, which is finely targeted at each plant with little affect to surface water sources. Herbicide application would not be conducted during inclement weather (e.g., wind, precipitation). Vegetation control in and along wetland areas may result in minor short-term negative impact to water quality from increased erosion.

Feral swine are known to occur on the on the Refuge. They can impact water quality within Refuge wetland and ponded areas. Specifically, feral swine typically feed by digging or rooting through the upper soil layer. This disturbance can be extensive and frequently occurs in riparian and other wetland areas (USDA Forest Service 2013). The result of this activity is displaced soils and vegetation, leaving large areas of bare ground vulnerable to erosion and potentially increasing turbidity in ponded and other wetland areas. The correlation between soil erosion and the presence of feral swine in a watershed is supported in the scientific literature (Browning 2008).

In addition, feral swine are a documented source of coliform bacteria in California watersheds (USDA Forest Service 2013). As already noted, foraging and wallowing behavior of swine can markedly increase water turbidity, but more importantly, feral swine can introduce infectious waterborne organisms into ponds and other wetland areas. Protozoan parasite pathogens, such as *Giardia*, *Cryptosporidium*, *Balantidium*, and *Entamoeba* are often present in the feces of feral swine. In a study conducted in California, it is suggested “that given the propensity for feral pigs to focus their activity in riparian areas, feral pigs may serve as a source of protozoal contamination for surface water” (Atwill et al. 1997).

Barrier fencing has been installed around many, but not all, of the Refuge’s wetland areas to avoid water quality and quantity impacts from nuisance wildlife (e.g., feral swine, deer). However, observations on the Refuge indicate that during the summer months, when water is scarce, swine have penetrated some fencing to gain access to the available water. Therefore, barrier fencing alone is not adequate to protect wetland areas on the Refuge from swine-related water quality impacts.

Public use activities, including fishing (occurring in State waters) do not affect water quality, and fencing would be maintained to keep visitors out of wetland areas. Self-guided public access may result in trespass into closed areas such as the wetlands.

#### Alternative B

Under Alternative B, effects to water would be similar to those described under Alternative A. However, under Alternative B, additional fencing to deter the presence of swine within wetland areas would be installed and regularly inspected and maintained to minimize the potential for impacts to water quality. In addition, a Swine Control and Monitoring Plan would be implemented to reduce the numbers of swine present on the Refuge, which would further minimize the potential for the introduction of sediment and infectious waterborne organisms into ponds and other wetland areas.

Increased vegetation control and planting around wetland areas may result in more minor short-term negative impact to water quality such as increased erosion. Areas where invasive vegetation is removed would continue to be replaced by native vegetation to provide stabilization, as appropriate. Best management practices would be implemented to reduce any potential water quality impacts, such as avoiding fencing construction activities during inclement weather and constructing temporary barriers to prevent impact to waterbodies.

Increased vegetation control in coastal dune habitat would result in larger expanses of open sand that may change the hydrology patterns on the Refuge. However, this is a shifting sand environment that ideally contains little vegetation, and change to hydrology is expected. Water sources are not expected to be impacted by feral swine control and monitoring. No trapping would occur in or near wetland areas or along the beach.

Increased visitor and environmental education opportunities are not expected to affect water quality and quantity. Visitors would not be allowed access into wetland areas; fencing would act as a barrier and buffer.

### Alternative C

Under Alternative C, no weed management activities (e.g., manual removal, use of herbicides) are proposed, therefore, no soils would be exposed that would be susceptible to erosion and although impacts to water quality from herbicide application are minimized through best management practices, there would be no potential for impacts to water quality from herbicide use.

Impacts to water quality associated with the lack of swine control would be similar to those described under Alternative A, however, under Alternative C, inspections of existing fencing would be limited to three times per year, which would delay needed maintenance to one or more fences that protect ponds and other wetland areas. Under this alternative, feral swine could have up to 4 months of unrestricted access to wetland areas before fencing is repaired.

No public access onto the Refuge would be permitted, reducing the potential for adverse effects to water quality as a result of human disturbance. Some trespass may occur, but such incidents are expected to be minimal.

### *Soils and Topography*

#### Alternative A

Weed control activities in the form of mechanical and chemical removal methods may result in varying levels of soil disturbance and would introduce herbicides into the environment. Invasive plant removal may also result in temporary soil erosion; appropriate areas (e.g., wetland areas) would be re-planted with native plants, which should reduce long-term erosion potential. As part of weed control efforts, best management practices to mitigate for soil erosion such as constructing fencing would be used to prevent soil from escaping the area.

The use of herbicides would have a minor to moderate negative effect on soil. The interaction of herbicides with soils affects the chemical's availability to interact with water, fish and wildlife. The active ingredient for each pesticide and its availability in the soil is presented here. How herbicides interact with the soil affects its availability to potentially effect wildlife and fish, as discussed under the *Wildlife* section.

The Refuge would continue to periodically use Service-approved herbicides, including Fusilade DX (fluazifop-p-butyl), Habitat (Imazapyr), Aquanet (glyphosate), POAST (BASF) (sethoxydim), and Arrow 2EC (clethodim) to control invasive vegetation on the Refuge. New herbicides may be added throughout the life of the CCP but must be Service-approved.

Fluazifop-p-butyl is not easily degraded by sunlight. The average half-life of fluazifop-p-butyl is one to two weeks (WSSA 1994). Because it binds strongly with soils, fluazifop-p-butyl is not highly mobile (Tu et al. 2001).

Imazapyr is considered highly mobile in soils with a half-life of 25-141 days, depending on water inundation. Imazapyr is relatively mobile in soils because it adsorbs to soils and sediments only weakly. Adsorption increases with decreasing pH. Above a pH of 5, Imazapyr is ionized and does not adsorb to soil. Volatilization of Imazapyr from soil is insignificant. The mobility of Imazapyr in soils is of small concern however, as it does not bioaccumulate and is considered practically non-toxic to mildly toxic to mammals, birds, fish, and aquatic invertebrates (Leson and Associates 2005).

Glyphosate is considered nonmobile in soils and sediments because it rapidly and strongly adheres to soil particles and degrades in the soil. Glyphosate is moderately persistent in the soil. Glyphosate is highly adsorbed on most soils, especially those with high organic content. More than 95 percent of the Refuge is

covered by a soil classified as dune land, which has little organic content; therefore, Glyphosate adsorption rates on the Refuge should be low. Glyphosate has no known effect on soil microorganisms. The compound is so strongly attracted to the soil that little is expected to leach from the applied area. Microbes are primarily responsible for the breakdown of the product. The time it takes for half of the product to break down (half-life) ranges from 1 to 174 days (USFS 1984). The herbicide could move when attached to soil particles in erosion runoff. With the implementation of the Service's PUP requirements, the Service anticipates there would be no adverse effects to soils or soil microorganisms.

Photodegradation occurs in less than four hours on soil (WSSA 1994; EXTOXNET 1996b). Microbial metabolism is the primary means of degradation of sethoxydim in soils. Sethoxydim is water-soluble and does not bind strongly with soil particles. Adsorption of sethoxydim to soil particles increases with increasing soil organic content (WSSA 1994).

Sethoxydim is of low soil persistence. It is degraded in soils rapidly by microbial metabolism and photolysis. The half-life of sethoxydim in soils ranges from a few hours to 25 days (Roslycky 1986, Shoaf and Carlson 1992, Koskinen et al. 1993). Roslycky (1986) also found that degradation rates are rapid during the first few weeks following application but then decrease, taking 50 days to reach 80 percent and 100 days to reach 90 percent degradation. Similarly, Koskinen et al. (1993) detected residues 38 days following application, while half-lives averaged less than one week.

Clethodim is of low persistence in most soils with a reported half-life of approximately three days (WSSA 1994). Breakdown is mainly by aerobic processes, although photolysis may make some contribution (USEPA 1992). Volatilization loss and hydrolysis are probably not important processes in the soil breakdown of clethodim (WSSA 1994). The main breakdown products in soils under aerobic conditions are sulfoxide, sulfone, and oxazole sulfone (USEPA 1992). Clethodim and these degradates are weakly bound to soils, with reported soil K<sub>d</sub> (soil-water partition coefficient unadjusted for soil organic matter) values of 0.05 and 0.23 over a range of five soils (WSSA 1994). Thus, while it may be somewhat mobile in the soil environment, it is very short-lived. EPA has stated "under present use patterns and under most circumstances clethodim does not appear to threaten groundwater" (USEPA 1992). In field studies, no vertical movement of the parent compound or residues was observed below the top 20 cm of the soil (USEPA 1992).

Wildlife monitoring is not expected to impact geology and soils. Installation of exclosures and closure signage to protect nesting snowy plovers would result in temporary sand disturbance. The areas would resume their original state after exclosures and signage are removed following the breeding season.

Minor short-term negative impact, due to manual vegetation removal to improve wildlife and habitat would expose soils to erosion and reshape the contours of the environment. However, this is a shifting sand environment, and change to topography is expected.

The coastal dune system is a wind-driven shifting soil environment. Therefore, Refuge management activities that result in localized, minor soil disturbance are expected to be beneficial to the coastal dune environment, especially when those management activities encourage further sand movement (e.g., removal of vegetation). Sand movement and disturbance discourage invasive vegetation from stabilizing. Minor short-term negative impact, due to manual vegetation removal would temporarily expose soils to erosion. Herbicide control would reduce vegetation cover and have a positive effect of exposing additional sand to its natural state. Hand pulling of invasive weeds would result in localized soil erosion and disturbance. Although there is the potential for erosion to wetland edges, care would be taken to minimize soil movement when working in proximity to wetland areas.

The foraging habits of feral swine include turning up the soil with their snouts while rooting for food. They also create wallows in wetland areas. Both activities physically disturb soils and displace vegetation (Sweitzer and Van Vuren 2002, 2008). The effects of swine on the landscape are well documented throughout California and the U.S. (Hone 1988, Vtorov 1993, Choquenot et al. 1996), and are visible on the Refuge. Under Alternative A, only minimal efforts would be taken to manage swine activity on the Refuge, therefore, adverse effects to soil related to vegetation removal and excessive grubbing are anticipated both in wetland and upland areas.

Maintenance of barrier fencing around wetland areas would temporarily expose soils to erosion. Again, this action should have a negligible effect in this shifting sand environment and would deter to some extent soil disturbance from feral swine.

Self-guided public access is not expected to affect soil and geology, as visitation is considered low (average of 1,500 visitor days annually). There may be a small potential that self-guided visitors trespass beyond barrier fencing, resulting in erosion in wetland areas.

Guided interpretive walks are not expected to affect soil and geology. These walks total no more than 20 people and only occur once or twice a year. Furthermore, they would occur outside of sensitive areas and would be supervised by trained staff or docents.

#### Alternative B

Under Alternative B, effects to soil and topography would be similar to those described in Alternative A. In addition, minor short-term negative impacts associated with increased manual and chemical vegetation removal to improve important coastal dune and wetland habitat (as identified by RPMAs), would expose soils to disturbance and reshape the contours of the environment. However, this is a shifting sand environment, and change to topography is expected.

Installation of traps (corral-style, cage, drop-nets, padded leg hold, and/or box traps) for feral swine control could result in soil disturbance in preferably ruderal non-sensitive habitat. Traps are likely to require digging into the soil to install fence T-posts and anchors. A total of 15-20 traps (not more than 20 square feet each) may be used at one time on the Refuge. However, the trap footprint is not expected to exceed a total of 400 square feet (.009 acres) at any one time, which is a negligible area considering the Refuge is 2,553 acres. Traps would be removed from an area once no additional captures occur and would be moved to a new location. Wetland and other priority habitats would be avoided. Minor superficial soil disturbance would also occur from the use of utility task vehicles (UTV) for installation and checking of traps. Although some disturbance from swine control is anticipated, any adverse effects would be outweighed by the benefits of minimizing the presence of feral swine on the Refuge.

Increased weed control around wetlands areas may cause temporary soil erosion into wetlands, but native plants would be replaced in the area to provide stabilization. Installation of additional barrier fencing to all wetland areas would temporarily expose soils to erosion. Again, this action should have a minor effect where shifting sand is expected in a coastal dune environment. Localized, temporary soil disturbance would occur during the planting of marsh sandwort and La Graciosa thistle seedlings but this limited disturbance is expected to result in reduced long-term erosion around wetland areas. Similarly, localized, temporary soil disturbance to the coastal dune habitat would occur during the planting of Nipomo lupine. Such impacts to soil would be limited.

Additional wildlife-oriented recreation, interpretation, environmental education, and volunteer opportunities under this alternative would result in additional foot traffic on the Refuge. Increased visitation may also result in soil disturbance. To reduce soil impacts, increased signage and staff training to contact visitors would be used to encourage visitors avoid sensitive habitats.

Increased soil disturbance and erosion could occur in varying degrees from improvements to existing and placement of new visitor and environmental education amenities (i.e., interpretive panels, kiosks, pergolas, and benches). Localized soil disturbance (e.g., compaction and erosion) would occur from use of hand-held equipment and foot traffic to place this infrastructure. The placement of these features would be assessed individually; infrastructure would not be placed in sensitive habitat and sites that may be at high risk for soil erosion.

#### Alternative C

The limited maintenance activities proposed under Alternative C are not expected to impact soils or topography. However, the effects of the lack of swine control on the Refuge, as described under Alternative A, would likely result in impacts to soil associated with digging and grubbing in wetland and other vegetated areas throughout the 2,000 acre Refuge. Additionally, because no invasive plant control is proposed under Alternative C, sands in the Refuge's dune habitat would become more stable over time, reducing the amount of blowing sand, and changing the natural unstable topographic character of the dune habitat.

#### *Air Quality*

##### Alternative A

The San Luis Obispo Air Pollution Control District monitors air quality in the region. It is believed that there is an existing elevated amount of blowing sand occurring on the Refuge with the use of off-highway vehicles at the neighboring Oceano Dunes State Vehicular Recreation Area. All ongoing general operation and maintenance would have a negligible increase in dust (PM<sub>10</sub>) from UTV tailpipe emissions (e.g., nitrous oxides, sulfur oxides, carbon dioxide). Operation and maintenance activities are generally limited to use of one or two UTVs and mostly require hiking. Also, the Service anticipates a minor increase in tailpipe emissions resulting from visitor opportunities since most visitors to the Refuge arrive by motorized vehicles.

The use of a UTV for wildlife monitoring and vegetation removal activities would result in carbon emissions, but is not expected to have long-term impact on local air quality. The Refuge has only two UTVs for access; passenger vehicles are not equipped to drive on the Refuge's shifting sand environment. Minor particulate emissions from UTV use for Refuge management activities and aerial spraying for invasive vegetation control are expected to be negligible. Minor localized dust may occur with manual weed-pulling. No other air quality impacts are expected from manual vegetation removal that would benefit native wildlife and resources.

Minor particulate vehicle emissions are expected from volunteer activities and limited guided tours. Few vehicles are expected of both activities. Volunteers are often no more than one or two individuals at a time. Because tours are only offered once or twice a year and tour sizes are small (less than 20 people), few vehicles are expected. Because of the sand dune terrain, no personal vehicles are allowed on the Refuge.

##### Alternatives B

Alternative B would have the same effects on air quality and climate as described under Alternative A. In addition, increased weed management to benefit native wildlife and plants species will result in increased carbon emissions and localized dust. Use of an UTV for feral swine control would also result in minor increased carbon emissions and localized dust. Additional temporary, localized dust would occur with manual weed-pulling, installation of barrier fencing, and installation of traps for feral swine control. Additional aerial spraying events would also result in minor increased carbon emissions, occurring a few days per year. Herbicide application is not likely to affect significantly air quality. Herbicide applied via backpack sprayer or truck or UTV-mounted tanks would be done in close contact to the plant to reduce

potential drift to non-target species. Aerial application would result in exposure to non-target plants but is not expected to result in a population-level effect to non-target species. Significant patches of sensitive plant species would be identified and avoided. Application of chemicals to control non-native vegetation would not occur during inclement weather such as high winds to avoid potential chemical drift.

Minor increase in carbon emissions and particulate vehicle emissions is expected from minor increased visitation and environmental education activities. The current visitor estimates are low, with an estimated 1,500 visits per year; we do not expect visitation to increase by more than 50 percent. Installation of additional public use infrastructure such as interpretive signage and benches would result in a negligible increase in localized dust and vehicle emissions from UTV use. Again, these activities are expected to be infrequent, one-time projects with air quality impacts dissipating rapidly.

#### Alternative C

Under Alternative C, there would be a negligible decrease in dust (PM<sub>10</sub>) from UTV activity, as well as a negligible decrease in tailpipe emissions (e.g., nitrous oxides, sulfur oxides, carbon dioxide) due to reduced refuge management activities. The Service also anticipates a minor decrease in tailpipe emissions resulting from the closure of the Refuge to visitor opportunities. Finally, because no invasive plant control is proposed under Alternative C, sands in the Refuge's dune habitat would become more stable over time, reducing the amount of blowing sand in the area.

#### *Noise*

##### Alternative A

Because the Refuge is relatively remote, bordered by ocean, agricultural fields, and open space, Refuge management activities are not expected to affect the human environment. Use of UTV (no more than two) to travel onto the Refuge to conduct monitoring and other habitat management activities to support listed species may have temporary localized noise increases. These levels may result of daytime flushing of wildlife but are not expected to have lasting effects. Also, management activities would only occur during daylight hours and are not expected to occur daily. When possible, existing trails would be used where wildlife in those locations may have habituated to the noise.

Maintenance of barrier fencing around wetland areas would be limited to hand tools and is not expected to result in noise impacts. Aerial spraying of invasive vegetation in listed species habitat would increase noise. These activities are expected to be limited to a few days per year and only conducted during daylight hours. Sensitive breeding seasons are expected to be avoided. Much of the weed management activities conducted on the Refuge would be conducted by hand (hand pulling) or hand-held equipment (e.g., shovel, string trimmer), so noise from these activities is expected to be low.

Minor increases in noise levels are expected from visitors when limited guided tours are offered. Vehicle noise is expected to increase in the general area, but not on the Refuge. Noise would be limited to talking since non-Service vehicles are not permitted on the Refuge. Vehicle noise to the general area (not on Refuge) would also increase as the use of volunteers on the Refuge increased, however, no more than one or two volunteers are generally present on the Refuge at any given time. Because tours are only offered once or twice a year and tour sizes are small (less than 20 people), only a small number of vehicles are expected. Although there would be an increase in the overall noise level on and adjacent to the Refuge during these events, the noise generated from this activity would be relatively low and to potential for disturbance to sensitive wildlife would be limited.

##### Alternative B

The activities proposed under Alternative B would generate noise levels similar to those described for Alternative A. However, there would be some increases in noise levels during UTV use associated with invasive vegetation and feral swine control that would not occur under Alternative A. In addition, under

Alternative B, there would be minor increases in aerial herbicide application flights, though still no more than several days of the year. .

There would also be a minor increase in noise from installation of fencing, T-posts, and anchors for traps for feral swine control. Setting traps in the afternoon or evening may also incur noise and disturbance to resting and nocturnal wildlife. Trapping would occur over two-week periods (except on the weekends). Dispatch of trapped swine using guns in the early morning would also result in a minor increase in noise disturbance. Only one person is expected to conduct the feral swine control and monitoring, therefore, noise levels would be minimal.

A minor increase in daytime noise would also be anticipated as a result of additional visitation associated with improved visitor services and new environmental education opportunities. There would also be minor increases in temporary, daytime noise created from installation of infrastructure to support visitation and environmental education programs. We do not expect total visitors to increase by more than 50 percent.

#### Alternative C

The reduction in overall management activities proposed on the Refuge under Alternative C, as well as the closure of the Refuge to all public access, would result in an overall decrease in disturbance related to noise as compared to Alternatives A and B.

#### ***Wilderness***

Because there is no designated wilderness at the Refuge, none of the alternatives would impact wilderness.

### **Biological Resources**

#### ***Vegetation and Habitat***

##### Alternative A

Under Alternative A, monitoring, survey, and research activities (e.g., listed plant surveys) would result in some trampling of vegetation, but these impacts would be limited and temporary. Weed control activities in the form of mechanical and chemical removal methods would allow native plant communities to thrive with less competition from invasive weeds. These weed control activities may also result in indirect effects to native plants. Small, discrete patches of native plants may be temporarily disturbed or trampled by foot traffic. Fencing at ponds is expected to benefit vegetation and wetland habitat by keeping out mammals (e.g., swine, deer) from rooting and trampling wetland vegetation. Incidental plant observations would yield discovery and potential protection of new native plants.

The Refuge would continue to periodically use Service-approved herbicides, including Fusilade DX (fluazifop-p-butyl), Habitat (Imazapyr), Aquanet (glyphosate), POAST (BASF) (sethoxydim), and Arrow 2EC (clethodim) to control invasive vegetation on the Refuge. New herbicides may be added throughout the life of the CCP, but must be Service-approved.

Fluazifop-p-butyl kills annual and perennial grasses but does little or no harm to broad-leaved plants (dicots). Fluazifop-p-butyl is ineffective under drought conditions. Growth regulating herbicides are only effective when plants are growing. Under drought conditions, no new plant growth occurs, and the herbicide is rendered ineffective. Some herbicides remain in the plant until new growth resumes, but fluazifop-p-butyl is metabolized rapidly by the plant and, consequently, is no longer present when growth resumes weeks or months later. (Tu et al. 2001)

Because Imazapyr kills a wide variety of plants and can be relatively persistent and remain available in soils, damage to desirable non-target plants is possible. When Imazapyr is applied in high rates, directly to soil, it can result in season-long soil activity. Plant species that are resistant to Imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner and Mallipudi 1991).

Glyphosate is a broad-spectrum, nonselective systemic herbicide that kills or suppresses many grasses, forbs, vines, shrubs, and trees (Tu et al. 2001). Glyphosate is metabolized by some but not all plants (Carlisle and Trevors 1988). It is harmless to most plants once in the soil because it is quickly adsorbed to soil particles, and even when free, it is not readily absorbed by plant roots (Hance 1976). The half-life of glyphosate on foliage has been estimated at 10.4 to 26.6 days (Newton et al. 1984). Roy et al. (1989) found 14 percent and 9 percent of applied glyphosate accumulated in the berries of treated blueberry and raspberry bushes, respectively. These residues dissipated from the fruit with a half-life of <20 days for blueberries and <13 days for raspberries (Roy et al. 1989).

Sethoxydim kills grasses by preventing the synthesis of lipids, but it has little or no impact on broadleaf herbs or woody plants (Tu et al. 2001). Clethodim is selectively toxic to plants, affecting only grass species (USEPA 1992). Clethodim is rapidly degraded on the leaf surfaces by an acid-catalyzed reaction and photolysis (WSSA 1994). Remaining clethodim would rapidly penetrate the cuticle and enter the plant (WSSA 1994). Little information is available regarding translocation and accumulation, but it is hypothesized that it may translocate and accumulate at growing points (WSSA 1994). Within soybeans, cotton, and lettuce it is rapidly metabolized (WSSA 1994).

Herbicide use by aerial spraying may impact non-target, native vegetation. Backpack spraying is not expected to affect non-target vegetation, as herbicide application would be conducted at close range. Manual control would not affect non-target vegetation as well because invasive vegetation would be clearly identified for removal. Herbicide application would not occur during inclement weather to reduce impacts to non-target vegetation. The application of herbicides would be properly calibrated to needs. Only trained applicators would apply herbicides, following label rates and other instructions per the Refuge's approved PUPs. Timing of application would take into account wind speed and moisture in the air to reduce the potential of transfer of herbicide to non-target plants. Use of herbicides would result in reduced non-native vegetation and allow for expansion of native plant communities. For any weed control activities, endangered plants would be flagged and avoided. Overall, weed control is expected to result in a net benefit to native vegetation.

Habitat restoration fulfills the Service's congressional mandate to preserve, restore, and enhance habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, interjurisdictional fish, marine mammals, resident wildlife, and plants.

The continued presence of feral swine on the Refuge is likely to result in impacts to habitat and vegetation on the Refuge as well as adjacent protected lands. Native flora could be subject to trampling and removal as feral pigs root and wallow within vegetated areas. Cushman et al. (2004) hypothesized that vegetation changes due to feral swine rooting and wallowing provide greater opportunities for non-native grass colonization. Feral swine can also transport invasive seeds in hair and feces. The presence of these invasive grasses within the dune complex is already threatening the natural processes and sensitive species associated with the area's coastal dune habitats, and ongoing disturbance by feral swine would continue to exacerbate this problem.

Although feral swine are known to eat almost anything, from grubs, weeds, and acorns to small mammals, birds and amphibians, on the Refuge, they seem to favor eating the roots from broad-leaved cattail and narrowleaf iceplant. Of particular note, wild swine can leave a crater in the ground (often two

feet in diameter by a foot or two deep) when they dig up the long taproots of narrowleaf iceplant. Wetland areas are also highly vulnerable to feral swine digging and wallowing. Without the implementation of a control plan on the Refuge, a variety of habitats and vegetation are at risk.

Barrier fencing to exclude feral swine has been installed around a number of ponded areas on the Refuge; however, observations by Refuge staff indicate that during the summer months, when water is scarce, swine have penetrated some fencing to gain access to the available water. Fenzel and Baldwin (2015) note that “wild pigs are strong enough to upturn many types of fences and simply go under them by utilizing their natural rooting instinct.” They recommend that to be effective, exclusion fencing must be monitored closely to detect signs of breaching.

Although the effects of feral swine on Refuge vegetation and habitat quality can be reduced to some extent through regular inspection and maintenance of existing fencing, as well as the installation and maintenance of fencing around those wetlands that are not currently protected, limited protection is available for other important vegetation and habitat within the Refuge.

Impacts to Refuge vegetation by current wildlife-oriented recreation opportunities (e.g., wildlife observation and photography) are expected to be insignificant. Trampling is expected to be temporary and small-scale. Also, platforms have been installed in some wetland areas to direct visitation. Interpretation and environmental education programs may have a negligible impact to vegetation. These programs are conducted in small groups and designated areas for visitors. Small, discrete vegetated areas may be temporarily trampled during programs, but they are not expected to be significant impacts. In addition, these programs would be guided or supervised to ensure that visitors remain in designated areas and avoid sensitive habitat. Public use may introduce non-native seed from visitor clothing and footwear. This activity is not expected to result in a measurable loss of plants based on the average 1,500 visits annually. Guided visitors would be advised on reducing impacts to the Refuge environment during their visit.

#### Alternative B

The effects on vegetation and habitat from current management activities, as described under Alternative A, would also occur under Alternative B. In addition, under Alternative B, invasive weed control by aerial spraying may have minor to moderate negative impacts to some native plants and habitat communities because of the wide broadcast nature of the method. The potential for such effects can however be minimized through best management practices and adherence to all label requirements. On the whole, native vegetation and habitat communities are expected to benefit positively from invasive plant control as a result of reduced competition for habitat from invasive vegetation. The results of control actions conducted on veldt grass-invaded dunes by the U.S. Air Forces indicate that compromised dune habitat can be restored to native vegetation (Pickart 2000). However, the potential for restoration depends on the continued monitoring and control of new invading veldt grass plants for several years, along with an active restoration effort.

Barrier fencing would also have a positive impact to native vegetation in wetlands areas by protecting them from being trampled or consumed by nuisance wildlife (e.g., feral swine, deer). Improved protocols on early detection of new invasive vegetation would also benefit native plants and habitats.

Alternative B proposes the implementation of feral swine control and monitoring, which would benefit plant species and habitat both on and off the Refuge by reducing the potential for serious habitat damage and plant loss associated with trampling and grubbing by feral swine. The activities associated with feral

swine control would have minimal, if any, effect on listed plant species and priority habitats (e.g., wetland areas, snowy plover habitat), because ruderal habitat and open sand areas would be targeted for trap locations.

Baseline surveys would have a positive impact of vegetation and habitat by identifying native, rare plants that warrant conservation. Establishing occurrences of Nipomo lupine and beach spectaclepod on the Refuge would also provide redundancy occurrences for these special status species.

Additional visitor opportunities would have both negative and positive impacts on vegetation. Increased activities would result in additional visitors and more pressure on the habitat. More visitors may result in increased trampling of vegetation. However, staff contact, signage, and fencing would be increased to encourage visitors to stay out of sensitive habitats. Rare or sensitive vegetation would be fenced and/or signed for protection. Increased visitation of the Refuge may increase stewardship and support for native habitats.

The placement of public infrastructure, such as interpretive panels, kiosks, pergolas, and benches would result in the loss of some vegetation. Loss of vegetation would be minimized to the small size of the construction footprint (less than 0.25 acre combined). Also, the infrastructure would not be placed in sensitive areas.

Special service events such as invasive plant control would benefit vegetation and habitat by reducing the invasive plant threat. The Citizen Science program would also benefit vegetation and habitat trends or provide new information. Sensitive wildlife areas would be avoided. The benefit may extend beyond the Refuge itself; when visitors become informed of the advantages of native vegetation, they may begin to plant natives on their own property. The volunteer program would have a beneficial impact to vegetation and habitat by reducing invasive plant threats through invasive weed control and planting of native plants.

### Alternative C

The limited management activities proposed under Alternative C would result in some trampling of vegetation, but these impacts would be minimal and temporary. Impacts to plant species and habitat from feral swine would be similar to those described under Alternative A, as no feral swine control is proposed under this alternative. However, unlike Alternative A, no monitoring of habitat quality is proposed, so impacts associated with feral swine would not be documented. In addition, visits to the Refuge would be limited; therefore, the effectiveness of existing fencing to protect wetland areas would likely be reduced. Closing the Refuge to all public use would reduce the potential for human trampling of vegetation.

Unlike Alternatives A and B, no invasive plant species control, habitat enhancement, or habitat restoration is proposed under Alternative C. In 2014, vegetation mapping of the Refuge indicated that approximately 940 acres (about 37 percent) of the 2,553-acre area of the Refuge was infested with perennial veldt grass. This highly invasive species would be expected to continue spreading into natural sand dune and central coast dune scrub habitats on the Refuge, where it likely would displace much of the native plant species. The spread of veldt grass has been described as the most serious threat to sand dunes in the central coast of California (Frey 2005). According to D. Walters, as cited by Chesnut 1999, perennial veldt grass can increase more than 100 percent in one year when untreated. At this rate, much of the dune habitat within the Refuge could be covered by this non-native invasive species well before the end of the 15-year timeframe of the CCP.

Under Alternative C, the Service would not monitor or document the continued proliferation of non-native vegetation within the Refuge boundaries. Similar impacts to those described for veldt grass would be expected elsewhere on the Refuge, where other invasive grasses (e.g., European beachgrass, jubata grass) are likely to spread unchecked under this alternative, causing existing habitat quality to degrade

over time. The lack of control of invasive plants on the Refuge also has the potential to adversely affect adjacent dune habitat through the dispersal of seed and vegetative matter from the Refuge to other properties via wind, wildlife, and feral swine.

There are also indirect effects of not controlling feral swine on the Refuge, involving impacts to adjacent protected areas. All of the surrounding conservation areas are now implementing feral swine control, including Chevron, which recently received a CDFW Depredation Permit. Without a control plan in place on the Refuge, feral swine would continue to reproduce and disperse to adjacent lands, reducing the effectiveness of control efforts on adjacent properties. According to Fenzel and Baldwin (2015), “All methods of control are only effective long-term if adjacent property owners work together cooperatively to reduce population size; otherwise, even the most efficient wild pig removal programs will suffer from frequent reinvasion from neighboring pig populations.”

## ***Wildlife***

### **Alternative A**

Under Alternative A, all Refuge management activities would occur during daylight hours only (unless pre-approved by the Refuge Manager), allowing wildlife resting periods at night. Wildlife could be temporarily flushed by UTV use and foot traffic associated with Refuge management activities. Wildlife surveys could disturb wildlife. Conservation measures would be employed, such as avoiding sensitive breeding seasons and surveying areas before activities take place. These activities would result in short-term disturbance to wildlife but are not expected to result in population-level effects and would be outweighed by the creation of additional native habitat for wildlife or outreach through environmental education and interpretation programs. Snowy plover monitoring and incidental wildlife observations have an overall positive benefit towards conservation of populations and protection of newly discovered native wildlife.

Weed control could also disturb wildlife. Foot traffic and UTV operations for these activities could temporarily flush wildlife. Aerial spraying has the potential to incur minor impacts such as temporary flushing of wildlife, which would affect large swaths. Weed control activities would only occur in daylight hours, and wildlife are expected to return to their habitat at the end of the day. Herbicides are not expected to adversely affect the health of wildlife. As a consequence of invasive vegetation control, cover would be lost and may result in increased exposure of wildlife to predators. However, wildlife here should be acclimated to the open sand dune environment.

Overall, invasive weed control benefits native wildlife that use the area. Barrier fencing maintained in wetland areas would also benefit non-listed native wildlife that use the area such as California toad. Manual and chemical removal of invasive weeds may adversely affect individuals but not negatively affect wildlife populations because weeds are generally not considered habitat for native wildlife species. The Refuge would continue to periodically use Service-approved herbicides, including Fusilade DX (fluazifop-p-butyl), Habitat (Imazapyr), Aquanet (glyphosate), POAST (BASF) (sethoxydim), and Arrow 2EC (clethodim) to control invasive vegetation on the Refuge. New herbicides may be added throughout the life of the CCP but must be Service-approved.

Fluazifop-p-butyl is of relatively low toxicity to birds and mammals but can be highly toxic to fish and aquatic invertebrates (Tu et al. 2001). Studies have shown fluazifop-p-butyl to be “slightly to practically non-toxic” to mammals and birds that ingest it and only “slightly” toxic to animal skin and eyes (EXTOXNET 1996a). Fluazifop-p-butyl can pass readily into fish tissue, and is highly toxic to fish and other aquatic species, including invertebrates (*Daphnia* 48 hr LC50 > 10 mg/L). Studies have shown “very high to high” toxicity in bluegill sunfish (96 hr LC50 = 0.53 mg/L) and rainbow trout (96 hr

LC50 = 1.37 mg/L) (EXTOXNET 1996a). Fluazifop-p-butyl is not registered for use in aquatic systems. For humans, fluazifop-p-butyl is of relatively low toxicity to mammals but can be an irritant (eye, skin, respiratory passages, and skin sensitizer) and is toxic if inhaled (Tu et al. 2001).

Based on U.S. EPA ecotoxicity criteria, Imazapyr is generally considered practically non-toxic to mammals, many birds, and bees. Toxicity rates among fish and aquatic invertebrates are considered low and within safe parameters according to standards established by the EPA. There is a lack of information on the toxic effects these herbicides have on reptiles, amphibians, raptors, and shorebirds (Leson and Associates 2005).

Glyphosate is of relatively low toxicity to birds and mammals (Evans and Batty 1986). The LD50 of glyphosate for rats is 5,600 mg/kg and for bobwhite quail, >4,640 mg/kg. EPA's Reregistration Eligibility Decision states that blood and pancreatic effects and weight gain were noted during subchronic feeding studies with rats and mice (USEPA 1993). Other studies show developmental and reproductive impacts to animals given the highest dose.

Newton et al. (1984) examined glyphosate residues in the viscera of herbivores following helicopter application of glyphosate to a forest in Oregon and found residue levels comparable to those found in litter and ground cover (<1.7 mg/kg). These residue levels declined over time and were undetectable after day 55 (Newton et al. 1984). Although carnivores and omnivores exhibited much higher viscera residue levels (5.08 mg/kg maximum), Newton et al. (1984) concluded that carnivores were at lower risk than herbivores due to the lower relative visceral weights and a proportionally lower level of food intake.

Batt et al. (1980) found no effect on chicken egg hatchability or time to hatch when an egg was submerged in a solution of five percent glyphosate. Sullivan and Sullivan (1979) found that black-tailed deer showed no aversion to treated foliage, and consumption of contaminated forage did not reduce total food intake. Significant impacts to bird and mammal populations due to large-scale habitat alterations following treatment of forest clearcuts with glyphosate have been reported (Morrison and Meslow 1984, Santillo et al. 1989a, Santillo et al. 1989b, MacKinnon and Freedman 1993).

Glyphosate itself is of moderate toxicity to fish. The 96-hour LC50 of technical grade glyphosate for bluegill sunfish and rainbow trout are 120 mg/L and 86 mg/L, respectively. Fish exposed to 5 mg/L of glyphosate for two weeks were found to have gill damage, and liver damage was observed at glyphosate concentrations of 10 mg/L (Neskovic et al. 1996). The technical grade of glyphosate is of moderate toxicity to aquatic species, and the toxicity of different glyphosate formulations can vary considerably.

Hildebrand et al. (1980) found that Roundup® treatments at concentrations up to 220 kg/ha did not significantly affect the survival of *Daphnia magna* or its food base of diatoms under laboratory conditions. It appears that under most conditions, rapid dissipation from aquatic environments of even the most toxic glyphosate formulations prevents build-up of herbicide concentrations that would be lethal to most aquatic species.

Sethoxydim is slightly toxic to birds and mammals (EXTOXNET 1996a). The LD50 for rats is 2,600-3,100 mg/kg. For bobwhite quail and mallard duck the LD50s are >5,620 and >2,510, respectively. Effects of chronic ingestion include anemia, and reproductive and teratogenic effects (EXTOXNET 1996a). Sethoxydim is moderately to slightly toxic to aquatic species (EXTOXNET 1996a). The LC50 for bluegill sunfish and rainbow trout are 100 mg/L and 32 mg/L, respectively (EXTOXNET 1996a). The LC50 for *Daphnia* is 1.5 mg/L (EXTOXNET 1996a).

Although some of the effects of chronic exposure to sethoxydim have been identified in rabbits and dogs, EXTOXNET (1996a) concluded that chronic effects in humans from expected exposure levels were

unlikely. Sethoxydim is not mutagenic or carcinogenic in humans. The U.S. EPA reports that the level of toxicity of sethoxydim to mammals is low and that sethoxydim is practically non-toxic if absorbed through the skin. It can however, cause skin and eye irritation. Sethoxydim is slightly toxic by ingestion, and inhalation can cause irritation to the throat, nose, and upper respiratory system. Symptoms of sethoxydim poisoning include loss of coordination, sedation, tears, salivation, tremors, blood in the urine, and diarrhea.

Clethodim is practically non-toxic to birds. Reported eight-day dietary LC50s are greater than 6,000 ppm in the mallard duck and bobwhite quail (Meister 1992) and greater than 5,000 ppm for the Japanese quail (Kidd and James 1991). Under likely conditions of use, it is unlikely to pose a hazard to avian species.

Clethodim is slightly toxic to fish and aquatic invertebrate species. Reported 96-hour LC50s ranged from 18 mg/L (WSSA 1994) to 56 mg/L in rainbow trout (Kidd and James 1991) and 33 mg/L in bluegill sunfish (WSSA 1994). A 48-hour LC50 of 20.2 mg/L has been reported for Daphnia species (WSSA 1994) for the formulation. No effects were seen at concentrations of 5.5 mg/L in Daphnia (USEPA 1992). No significant bioaccumulation has been observed in fish (USEPA 1992). Under likely conditions of use, it is unlikely to pose a hazard to aquatic species.

Clethodim is practically non-toxic to honeybees, with reported LD50s of greater than 100 ug/bee for both the technical product and the Select formulation (Meister 1992, WSSA 1994). EPA has stated that "available...wildlife data indicate that the proposed uses on cotton and soybeans would result in minimal hazard to non-target and endangered beneficial insect, avian and freshwater fish and mammalian species" (USEPA 1992).

Clethodim is moderately toxic by ingestion. The reported oral LD50s are 1,630 mg/kg and 1,360 mg/kg in male and female rats, respectively (Kidd and James 1991). Reported LD50s for Select 2 EC formulation are 3,610 mg/kg and 2,920 mg/kg in male and female rats, respectively (Meister 1992, WSSA 1994). Clethodim is practically non-toxic by dermal absorption. The reported dermal LD50 is greater than 5,000 mg/kg in rabbits for the technical product as well as the formulation (Meister 1992, Kidd and James 1991, WSSA 1994). The technical product did not cause skin irritation in the rabbit (WSSA 1994), but the formulation (Select) caused moderate skin as well as eye irritation in the rabbit (WSSA 1994). Eye irritation was reversible within 8-21 days (WSSA 1994). Select formulation caused no skin sensitization in guinea pigs (WSSA 1994). No data regarding skin sensitization or eye irritation were available for the technical product. Clethodim is practically non-toxic by the inhalation route as well. The reported rodent 4-hour inhalation LC50s for clethodim technical and select formulation are greater than 3.9 mg/L and 4.4 mg/L, respectively (WSSA 1994, USEPA 1992). Effects of acute exposure to clethodim or Select may include eye or skin irritation or central nervous system effects, e.g., salivation, decreased motor activity, incoordination, unsteady gait, and hyperactivity (WSSA 1994, Valent USA 1993). These latter effects may be in large measure due to the aromatic constituents of the formulation, as these effects commonly occur upon exposure to such compounds (Sullivan and Krieger 1992).

The continued presence of feral swine on the Refuge could result in the disturbance and potential loss of wildlife. Feral swine has been identified by Refuge staff and partners as a significant threat to wetland listed species and the western snowy plover.

Public access, guided and self-guided, may cause temporary disturbance and flushing of individual wildlife. However, these activities would be limited to daylight hours and sensitive habitat would be restricted. Therefore, wildlife would have opportunities to rest. It is anticipated that wildlife have habituated to the limited public access that occurs on the Refuge. Signage would continue to be used to deter the public from entering closed areas to protect sensitive habitats.

While not managed by the Refuge, surf fishing that occurs on the Refuge boundary would result in loss of individual fish. A population-level effect is not anticipated, as the participants must be compliant with State guidelines.

Alternatively, because public access has been occurring on designated trails for several decades, wildlife in the vicinity could be habituated to such activities. Some literature suggests that if animals perceive an activity as spatially predictable and nonthreatening, they may habituate to that activity (Whittaker and Knight 1998). Gabrielsen and Smith (1995) suggest that mammals and birds nesting close to human settlements seem to have built up a higher tolerance threshold toward vehicles and human presence. They also suggest that the magnitude of the response of wildlife to disturbance depends in part on the distance, the movement pattern of the disturbance, and the animal's access to cover. Most animals seem to tolerate disturbance better in woodland than in open terrain. They also seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path. Trulio and Sokale (2008) observed trails near foraging shorebird sites and found no negative effects of trail use (non-motorized activities) on the number of birds, species richness, or proportion of birds foraging, either overall or by season, when comparing trail to non-trail sites. They did find, however, that the number of birds decreased at trail sites as trail use increased on higher use over lower use days. Cooper et al. (2008) found that the alert distance of the eastern gray squirrel did not differ between the approach by a human alone and the approach by a human with a dog. Miller et al. (2001) found this same result for songbirds; however, Miller found that presence of a dog resulted in greater influence on mule deer than just approach by a human.

#### Alternative B

The effects to wildlife from the implementation of Alternative B would be similar to those described for Alternative A. In addition, Alternative B includes a variety of other activities that have both beneficial and disturbance related effects on wildlife, including baseline surveys on focal plant and wildlife species, feral swine control, and invasive weed control. Baseline surveys would have a positive impact of wildlife by identifying native, rare wildlife that may warrant conservation. The increased invasive weed control would improve native wildlife habitat. Installation of additional barrier fencing in wetland areas would also benefit non-listed native wildlife that use the area, such as California toad.

The proposed increase in refuge management activities has the potential to temporarily disturb and flush wildlife during the daytime, particularly aerial spraying, which would affect large swaths. These activities would only occur in daylight hours, and wildlife is expected to return to their habitat at the end of the day. These activities would occur outside of sensitive breeding periods. Also, there would be sufficient habitat for wildlife to move into while activities are being conducted. As described in Alternative A previously, herbicides are not expected to adversely affect the health of wildlife. In the long term, native wildlife is expected to benefit from having high quality native habitat. The activities would cumulatively support the goals of the Refuge and the region in restoring and conserving wildlife resources.

The feral swine control and monitoring plan would result in loss of feral swine, with the goal of achieving a population-level effect on the species. A reduction in the number of feral swine on the Refuge would benefit wetland listed species and the western snowy plover. While no other wildlife would be lethally harmed, feral swine control may also indirectly disturb other wildlife with the presence of Wildlife Services on the Refuge in the early morning or evening. These predator management activities may flush or disturb non-target wildlife from their habitat. These activities are expected to be temporary and/or minimal in nature. Nonetheless, feral swine control is expected to result in positive, long-term Refuge populations of the snowy plover, California red-legged frog, and associated native wildlife. Installation of predator barriers around wetland areas may impede access for non-target species from entering or exiting their feeding and roosting areas.

More active efforts to acquire lands (from willing sellers) within the approved acquisition boundary would be beneficial to wildlife, particularly those most vulnerable to habitat loss (e.g., coastal foredune habitat) as a result of sea-level rise from climate change.

Under Alternative B, limiting access to the Refuge interior through a designated beach corridor to protect snowy plovers during the breeding season would also benefit other coastal shorebirds in the area (e.g., sanderlings). Refuge staff believes trespassing through the beach to the Refuge interior occurs despite closure through signage and symbolic fencing of the entire beach area during snowy plover breeding season. Increased staff, volunteer, and partner outreach and education with the public would reduce public disturbance to wildlife.

Visitors and environmental education program may result in the temporary, daytime disturbance of wildlife. Wildlife would be able to return to their roosting or nesting areas once visitors leave the area. Sensitive habitats would be signed or fenced from visitors. No visitors are permitted on the Refuge after sunset; evening disturbance is not anticipated. Overall, programs would be beneficial to wildlife because of their stewardship message. Special service events such as invasive plant control and trash clean-up would reduce the invasive plant threat and trash in wildlife habitat. The Citizen Science program would also benefit wildlife trends or provide new species information. The volunteer program would have a beneficial impact to wildlife by improving habitat through participation in surveys, invasive weed control, and planting of native plants.

The installation of signage, pergolas, benches, and other associated features to facilitate wildlife observation and environmental education would cause minor, temporary wildlife disturbance and flushing. The footprint of these features would be small and have minor impact on wildlife habitat. They would be constructed in sparsely vegetated areas or other low-quality wildlife habitat. Increased visitor use in the form of wildlife observation, photography, recreation, and environmental education would result in more traffic in habitat areas and may cause wildlife to temporarily flush from the area. However, messaging to visitors would also promote stewardship of habitat and wildlife. Additional signage and fencing would be installed as needed to deter the public from entering sensitive wildlife habitats. These activities are not expected to result in a population-level effect on wildlife.

#### Alternative C

Refuge management activities under Alternative C would be limited and would occur during daylight hours only (unless pre-approved by the Refuge Manager), allowing wildlife resting periods at night. Wildlife could be temporarily flushed by UTV use and foot traffic associated with fencing inspection and maintenance. Conservation measures would be employed, such as avoiding sensitive breeding seasons and surveying areas before activities take place. These activities would result in short-term disturbance to wildlife but are not expected to result in population-level effects. Barrier fencing maintained in wetland areas would also benefit non-listed native wildlife, such as California toad, that use these wetland areas.

No improvements to wildlife habitat or control of invasive plant species would be implemented under Alternative C. The quality and quantity of native wildlife habitat is therefore expected to decrease. This is of particular concern in vegetated coastal dune scrub and active, unvegetated interior dune habitat, where habitat loss and degradation has been attributed to invasive beachgrass and other nonnative grasses.

The effects to wildlife of not implementing a feral swine control and monitoring plan, as described under Alternative A, would be similar under Alternative C. However, Alternative C proposes a significantly reduced staff presence on the Refuge, therefore, the effectiveness of fencing around wetlands to protect California toad and other wildlife is expected to be diminished. Fencing would be inspected and

maintained only three times each year which could allow feral swine unrestricted access to wetland areas for up to four months at a time.

Because the Refuge would be closed under Alternative C, there is the potential of decreased human disturbance. Paradoxically, reduced ability to management presence on the Refuge may also increase trespassing and human disturbance.

### ***Listed and other Special Status Species***

In considering the context and intensity of potential impacts to listed species, the Service considered its obligations under sections 2c and 7a(1) of the Endangered Species Act (ESA) of 1973, as amended. Section 2c of the ESA states that “It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.” Section 7a(1) of the ESA states that “The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.” The effects of conservation actions (or lack thereof) are described under each Alternative.

### **Alternative A**

Under Alternative A, short-term disturbance to listed species may occur from operation and maintenance activities, but would result in long-term benefits to listed and other special status species due to surveying, monitoring, invasive plant species control, and habitat protection and restoration. Use of herbicides, mechanical removal, cultural methods (e.g., salinization), and hand-pulling of non-native plants under Alternatives A would have the potential to impact wildlife. The effects of herbicide application to listed and other special status species are the same as those discussed previously in the *Wildlife* sections.

Alternative A may result in short-term minor disturbance to listed and other special status species from the various opportunities available for public use on the Refuge. Generally, however, for the most vulnerable listed and sensitive species, their habitat is fenced or signed to minimize human disturbance. Also, outreach and education (through staff engagement and signage) would help alleviate visitor disturbance.

Monitoring and invasive weed control would have an overall positive impact to listed and special status species. While these activities may result in temporary daytime disturbance, they would provide overall habitat improvement. Invasive weed control would occur outside the breeding season; however, wintering plovers and other birds of conservation concern may be disturbed during invasive weed control on the beach. These minor disturbances would be offset by the overall improvement and expansion of available nesting and foraging habitat following the removal of beachgrass. Barrier fencing and vegetation control in and around wetland ponds is expected to support a range of listed and special status plant species and two amphibian species.

Public access, guided and self-guided, may cause temporary disturbance and flushing of individual wildlife. These disturbances are only expected to occur during daylight hours, when access is permitted. Therefore, wildlife would have opportunities to rest. It is anticipated that wildlife have habituated to the limited public access since it occurred even prior to the Refuge’s establishment. Some literature suggests that if animals perceive an activity as spatially predictable and nonthreatening, they may habituate to that activity (Whittaker and Knight 1998).

While not managed by the Refuge, surf fishing may result in disturbance to roosting western snowy plover, California least tern, or other birds of conservation concern in the same area as the anglers. This area is closed during the breeding season, so disturbance by anglers at that time should be little to none.

**Western snowy plover (federally listed as Threatened)** –The Refuge, which includes designated critical habitat for the western snowy plover, is located within Recovery Unit 5, which supports the greatest number of western snowy plovers (approximately half of the U.S. population), and has the greatest amount of available suitable habitat to support this listed species (USFWS 2007). The Recovery Plan for the western snowy plover identifies three objectives for achieving recovery goals: 1) increase population numbers distributed across the range of the Pacific coast population of the western snowy plover; 2) conduct intensive ongoing management for the species and its habitat and develop mechanisms to ensure management in perpetuity; and 3) monitor western snowy plover populations and threats to determine success of recovery actions and refine management actions (USFWS 2007).

Actions proposed under Alternative A that would contribute to achieving the recovery objectives for the western snowy plover include: monitoring on the Refuge during the western snowy plover breeding season, as described in Chapter 4 of the draft CCP; installing nest enclosures to minimize the loss of eggs to predation and accidental trampling by humans; restricting public access on the Refuge during the nesting season; and opportunistically working with partners to control European beachgrass, sea fig, and other invasive plants in nesting areas. Additional actions taken by the Refuge to reduce the potential for predation of plover eggs, chicks, and adults include reducing the presence of potential avian predator perches within and surrounding plover nesting areas (including the use of triangular “Closed Area” signs rather than standard rectangular signs) and removing carcasses and trash from the beach that could attract avian and/or mammalian predators into the nesting area.

The continued presence of feral swine and avian and mammalian predators on the Refuge is expected to result in some loss of western snowy plover eggs, chicks, and adults. In addition, predators from the Refuge could have similar effects on plovers nesting on adjacent conserved lands. From 2001-2013, the Refuge has lost between 11% and 62% of the known nests due to predation, with an average of 31%. Predation of nests and chicks has been identified as an important cause of population decline (Page et al 1983, Clowell et al 2005). Predators may impact plovers directly by depredating eggs, chicks, juveniles, or adults. Secondary predation, or indirect predator impacts, such as disturbance, can increase time spent by adults in vigilance or avoidance behavior, adults may select secondary habitats and adults may limit incubating and brooding behavior. Depredation of plover may result in egg abandonment or loss of dependent chicks. Predation can occur quickly, leaving little or no evidence, and it is likely that only a small percentage of events are documented during a season.

**La Graciosa thistle (federally listed as endangered)** – The majority of the Refuge is designated critical habitat for the La Graciosa thistle. Recovery objectives for this species, which are currently in draft form, include: 1) expand the species current range to its historical range; 2) increase the number of populations to maintain viable metapopulations; 3) reduce threats from habitat alteration, competition with non-native species, and other threats to the point that populations are self-sustaining; and 4) maintain habitat of sufficient quality and configuration to support all life history stages, including germination, growth, reproduction, and seed dispersal (USFWS 2011). Habitat fragmentation appears to increase the risk of extirpation and extinction events for this species, therefore, the best way to conserve this species is to increase the total size of available habitat and connect remaining available habitat with habitat linkages. Implementing these strategies is likely to ameliorate the threats associated with small population sizes by promoting dispersal and gene flow.

The 5-year review for this species recommends the following actions: work with partners to reestablish this species at historical locations and establish new populations throughout its historical range in the near future to reduce the risk of extinction; conduct seed collections and propagate seed for introduction and re-introduction efforts; conduct updated surveys throughout the historical range for the species (USFWS 2011).

Actions proposed to continue under Alternative A to benefit the recovery of La Graciosa thistle include periodic surveying the Refuge for additional populations of this species and monitoring current populations to determine population trends, identify threats, and manage La Graciosa thistle occurrences proactively; working with partners to plant La Graciosa thistle seeds obtained from the Refuge in wetland areas that support appropriate habitat, such as near Myrtle Pond and Colorado Pond; maintaining perimeter fencing along Refuge boundaries to exclude cattle; maintaining exclusion fencing around known La Graciosa thistle occurrences on the Refuge to prevent trampling and herbivory in wetland areas and minimize the potential for human disturbance; and working opportunistically with partners to control invasive grasses and other invasive plants that threatened habitat quality for this species. These actions are expected to benefit the populations of La Graciosa thistle on the Refuge. However, feral swine on the Refuge have the potential to adversely affect habitat quality for this species, as well as the potential for direct loss of plants due to digging and grubbing.

**Marsh sandwort (federally listed as endangered)** – In 2007, there was only one known extant, wild population of this critically endangered species (USFWS 2008). To assist in the prevention of the species extinction, it is assumed that under Alternative A, current partnerships that enable the outplanting of marsh sandwort propagules in existing ponds on the Refuge, as was done in October 2008 and August 2013, would continue. Maintenance of existing exclusion fencing needed to minimize the threat of herbivory by mammals would also continue under Alternative A. Although these actions provide benefits to the species, threats exist that would not be addressed under Alternative A, including potential damage and loss from feral swine activity, impacts to habitat quality from invasive species encroachment, and the lack of routine monitoring to determine the status of the species on the Refuge and to gather information regarding potential threats to surviving plants.

**Gambel's watercress (federally listed as endangered)** – The only known remaining wild population of genetically pure Gambel's watercress was discovered in 1996 on Vandenberg Air Force Base (VAFB) in Santa Barbara County, California. In October 2008 (USFWS 2008) and August 2013, propagules from the Vandenberg population were outplanted on the Refuge. It is assumed that under Alternative A, current partnerships that enable the outplanting of Gambel's watercress propagules on the Refuge would continue. Maintenance of existing exclusion fencing needed to minimize the threat of herbivory by mammals would also continue under Alternative A. Although these actions provide benefits to the species, threats exist that would not be addressed under Alternative A, including potential damage and loss from feral swine activity and impacts to habitat quality from invasive species encroachment.

**California red-legged frog (federally listed as Threatened)** - The Recovery Plan for the California red-legged frog addresses the following recovery strategies: 1) protect existing populations by reducing threats; 2) restore and create habitat that will be protected and managed in perpetuity; 3) survey and monitor populations and conduct research on the biology of and threats to the subspecies; and 4) reestablish populations within its historic range (USFWS 2002). On the Refuge, California red-legged frogs are found in natural dune swale ponds, old agricultural ponds, and recently created ponds constructed for the purpose of supporting the red-legged frog and listed wetland plant species.

Under Alternative A, periodic manual removal of large portions of the surface and emergent vegetation within occupied ponds would continue on the Refuge as needed to ensure adequate habitat quality to support the successful reproduction of red-legged frogs within Refuge wetland areas. To avoid adverse effects to the existing populations, this activity would be scheduled to occur after all California red-legged frog tadpoles are likely to have metamorphosed, but before new California red-legged frog egg masses are deposited. Depending on weather conditions, this period typically occurs from late October to mid-December. Existing enclosure fences would continue to be maintained around occupied ponds to protect the frogs from trampling and predation. Although these actions provide benefits to the frog, threats exist that would not be addressed under Alternative A, including impacts from feral swine (direct losses of frogs, indirect impacts related to decreased water and habitat quality).

**Other Special Status Species** – A total of 60 special status species (see Appendix F for a complete listing) have been documented on the Refuge. In addition to the federally listed species addressed above, two State listed plant species, the threatened beach spectaclepod and surf thistle, occur on the Refuge and an addition 21 plant species and 39 animal species are present that are considered special status species. The installation and maintenance of fencing to protect listed species also provides protection for several of the Refuge's other species status species, and invasive plant control assists in reducing adverse effects to special status species occurring outside of wetland areas. Impacts associated with the presence of feral swine pose a threat to sensitive plant populations, host plants for sensitive butterfly species, and habitat for badgers, birds, and reptiles.

#### Alternatives B

Alternative B proposes to expand management actions over those proposed under Alternative A. The potential adverse effects to listed and special status species of these increases as they relate to disturbance from monitoring, maintenance, and habitat and wildlife management activities would be generally the same as those described under Alternative A. Additional monitoring, maintenance, and management activities would occur outside of the breeding season, with the exception of plover monitoring, to minimize the effects of disturbance on listed and sensitive species, and measures to ensure minimal intrusion or trampling within existing native vegetation and wetland habitats would be implemented to avoid direct impacts to listed and sensitive plants and wildlife.

Invasive species control has the potential to incur minor impacts such as temporary flushing of sensitive wildlife, particularly during aerial application of herbicides which would affect large swaths of the Refuge, albeit for a limited period of time. These activities would occur outside of sensitive breeding periods, and would only occur during daylight hours. In addition, the products to be applied would be reviewed and approved through PUPS, which would evaluate any potential for adverse effects from the selected herbicide to listed and special status species and incorporate required setbacks and other restrictions for how the aerial application would proceed. No long term adverse effects are anticipated, and short-term impacts, related primarily to disturbance, are outweighed by the long-term benefit of higher quality habitat to support listed and special status species. The activities would cumulatively support the goals of the Refuge and the region in restoring and conserving wildlife resources.

Increased wildlife observation and environmental education opportunities are expected to have minor to no impact on listed and special status wildlife and plants. Sensitive wildlife areas would be closed entirely (e.g., wetland areas) or seasonally (e.g., snowy plover breeding season along the beach) to public access to minimize the potential for disturbance and trampling of nests and sensitive vegetation. Signage and/or fencing would be installed to protect listed and special status species. Though few in number, wintering snowy plover may be flushed from the beach when visitors are present during the winter after fencing and signage restricting access to nesting areas have been removed.

The volunteer program proposed under Alternative B would have a beneficial impact to listed and special status species, as this program is proposed to improve habitat quality through participation in surveys, invasive weed control, and planting of native plants.

Monitoring and analysis of listed species survey data against long-term climate change trends under this alternative would have a positive benefit. Through this analysis, staff would identify adaptive changes or acquisition needs that may be required to support wildlife in a changing climate. The process would help staff identify which wildlife are most at risk for climate change effects and prioritize management actions to protect them.

Feral swine control and monitoring that is proposed under Alternative B is expected to result in improved listed and special status species breeding success, recruitment, and total population size on the Refuge. Implementing a feral swine control and monitoring plan on the Refuge would also benefit adjacent habitat areas and the efforts of the neighboring landowners to control feral swine on their own properties. There are no expected detrimental effects of this activity on listed or special status species. The proposal to prepare and implement a step-down predator management plan is also expected upon its implementation to provide benefits to listed species, particularly the western snowy plover and California least tern, as predation is identified as a known threat to these species.

**Western snowy plover (federally listed as Threatened)** – Management actions to protect western snowy plovers on the Refuge under Alternative B would include those actions described under Alternative A, as well as the following additional actions: monitoring of wintering plovers on the Refuge; additional control of beachgrass to expand the areas available for nesting near the beach and in the foredunes; implementing a feral swine control and monitoring to reduce the population of swine on the Refuge and minimize the potential for egg loss and nest disturbance on the beach; and the proposal to prepare and implement a step-down predator management plan to address reduce predation of plover eggs, chicks, and adults from mammalian and avian predators.

Alternative B also proposes to provide a new public access route from the beach to the interior of the Refuge, as a pilot project, that would direct the public away from plover nesting areas to avoid disturbance and potential trampling of nests. This action is expected to reduce the potential for trespass and disturbance during the snowy plover breeding season. Evidence in the field indicates that trespassing through the beach to the Refuge interior currently occurs despite closure through signage and symbolic fencing of the entire beach area during snowy plover breeding season. It is believed that by providing an appropriate access route to the interior of the Refuge rather than prohibiting access, illegal trespassing would be reduced, providing increased protection for nesting plovers. Following designation of an appropriate access route, monitoring would be conducted to determine the extent, if any, of non-compliance. Increased staff, volunteer, and partner outreach and education with the public would also be implemented to improve compliance and reduce overall public disturbance to wildlife.

As proposed, the actions to be implemented under Alternative B would result in benefits to the plover and assist in achieving the recovery goals for this species.

**La Graciosa thistle (federally listed as endangered)** – Alternative B would include all of the actions proposed under Alternative A to benefit the recovery of La Graciosa thistle, as well as increased invasive weed control that could be implemented with partners and/or a designated volunteer program; installing additional fencing around wetland areas supporting this species;

implementing a feral swine control and monitoring plan to minimize the potential for impacts to wetland areas that support this species; and conducting regular surveys this species on the Refuge

using standardized monitoring protocols. These actions would have a beneficial impact on conservation of the Refuge's population of this species.

**Marsh sandwort (federally listed as endangered)** – Alternative B would include all of the actions proposed under Alternative A to benefit marsh sandwort, as well as an increase in invasive weed control by working with partners and/or a designated volunteer program; installing additional fencing around wetland areas; implementing a feral swine control and monitoring plan to minimize the potential for impacts to wetland areas; and conducting regular surveys for this species on the Refuge using standardized monitoring protocols. These actions are expected to benefit not only any existing marsh sandwort plants on the Refuge, but also provide the opportunity to continue past efforts to establish this species in other areas of the Refuge.

**Gambel's watercress (federally listed as endangered)** – In addition to the actions proposed under Alternative A to manage Gambel's watercress, Alternative B would also include an increase in invasive weed control by working with partners and/or a designated volunteer program; installing additional fencing around wetland areas; implementing a feral swine control and monitoring plan to minimize the potential for impacts to wetland areas; and conducting regular surveys for this species on the Refuge using standardized monitoring protocols. These actions are expected to benefit not only any existing Gambel's watercress plants on the Refuge, but also provide the opportunity to continue past efforts to establish this species in other areas of the Refuge.

**California red-legged frog (federally listed as Threatened)** – Management actions to protect the population of California red-legged frog on the Refuge under Alternative B would include those actions described under Alternative A, as well as the following additional actions: 1) begin conducting regular surveys for California red-legged frog on the Refuge using standardized monitoring protocols; 2) increase invasive weed control by working with partners and/or a designated volunteer program; 3) install additional fencing around wetland areas; and 4) implement a feral swine control and monitoring plan to minimize the potential for impacts to wetland areas. As proposed, the actions to be implemented under Alternative B would result in benefits to the California red-legged frog plover and assist in achieving the recovery goals for this species.

**Special Status Species** – In addition to the actions proposed under Alternative A to manage sensitive species, Alternative B would also include an increase in invasive weed control by working with partners and/or a designated volunteer program; installing additional fencing around wetland areas; implementing a feral swine control and monitoring plan to minimize the potential for impacts to wetland areas; and conducting regular surveys to document the status of sensitive species on the Refuge and identify potential threats. These actions are expected to benefit the range of sensitive status species on the Refuge.

### Alternative C

Under Alternative C, the types and extent of wildlife and habitat management actions that are currently being implemented on the Refuge to support listed and special status species, as described under Alternative A, would be reduced or discontinued. Refuge management activities would be limited to three times per year, when sign installation, replacement, and/or repair, fence repair, sign maintenance, and general inspection of site conditions would be implemented. These activities would have limited potential to result in disturbance to listed and special status species.

The Refuge would be closed to all public access, with the intent of minimizing the potential for disturbance to habitat and wildlife, including listed and special status species. Paradoxically, control of authorized access and monitoring of its effects would be greatly reduced due to the lack of a management presence on the Refuge. As a result, there is the potential for adverse effects to listed and special status species due to trespassing and associated human disturbance.

While not managed by the Refuge, surf fishing that occurs on the beach may result in disturbance to roosting western snowy plover, California least tern, or other birds of conservation concern that occupy the same area as the anglers. Although the area would be posted as closed during the breeding season, without more frequent visits to the Refuge, staff cannot assure that signage and fencing would remain in place during the higher high tides. Loss of signage and/or fencing could lead to disturbance in plover nesting areas by anglers.

Although adverse effects to listed and special status species from the implementation of the management actions proposed under Alternative C would be limited, discontinuing or reducing existing management actions on the Refuge would likely result in adverse effects to one or more of the listed species on the Refuge. For example, the unchecked spread of European beachgrass on the Refuge is likely to result in a reduction in available nesting habitat for the western snowy plover over time, as well as an increase in shelter for mammals that prey on plover eggs, chicks, and adults. Unchecked, the spread of European beachgrass on the Refuge could be substantial, with reinvasion of previously control areas as well as the invasion of new areas of the Refuge. The invasive nature of this beachgrass is evident by the results of a study conducted by Chesnut (1997) between 1969 and 1997, in which he documented an increase in beachgrass from approximately 8 to 109 hectares (20 to 270 acres).

Listed and rare plants present within the Refuge's dune habitat would also be adversely affected by the lack of invasive species control as the dynamic nature of the dunes would further stabilize reducing the availability of suitable sites for germination and growth (Damschen 2008).

**Western snowy plover (federally listed as Threatened)** – Management actions to protect western snowy plovers on the Refuge under Alternative C would be limited to closing the Refuge to all public access. No swine control and monitoring or predator management, including the use of exclosures, is proposed. No invasive species control, including the control of beachgrass and other invasive plant species within plover nesting area, is proposed. No monitoring of nesting plovers or wintering plovers would be implemented; therefore, no documentation of the effects of not implementing the various management actions presented in the Recovery Plan for western snowy plover, as described in Alternatives A and B, would be available. Impacts to the western snowy plover under Alternative C would include a reduction in available nesting habitat due to expanding invasive grasses and the continued loss of eggs, chicks, and adults from feral swine and avian and mammalian predation.

The Recovery Plan (USFWS 2007) identifies habitat degradation caused by human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations as the primary cause for the decline in active nesting areas and the size of plover's breeding and wintering populations. Closing the Refuge to public use would minimize human disturbance, but the lack of management actions to address invasive beachgrass would likely lead to the continued stabilization of the dunes, a reduction in the amount of unvegetated area above the tideline, a decrease in the width of the beach, and an increase in beach slope (Wiedemann 1987). These changes would reduce the amount of potential western snowy plover nesting habitat on the Refuge and could hamper brood movements.

There is also the potential for adverse effects to plovers on adjacent conserved lands as a result of feral swine and avian and mammalian predation, as described under Alternative A.

**La Graciosa thistle (federally listed as endangered)** – Closing the Refuge to public access would minimize the potential for human disturbance and maintaining existing fencing to protect La Graciosa thistle would provide benefits to this species. However, the lack of any invasive plant control on the Refuge is likely to lead to the alteration of the existing dune structure and a reduction in habitat quality adequate to support all life history stages of the species. Without a monitoring program in place, it would be difficult to identify the extent of continuing threats and/or new threats to the species, as well as to track any changes in population size or distribution of the species on the Refuge.

The effect of the lack of swine control on this species is addressed under Alternative A.

**Marsh sandwort and Gambel’s watercress (both federally listed as endangered)** – The status of these two species on the Refuge is currently unknown, although both were outplanted as seedlings within various wetland areas on the Refuge. Under Alternative C, the status of these species on the Refuge would remain in question as no monitoring of listed species is proposed. Under this alternative, the Refuge would be closed to public access and existing fencing around wetland areas would be periodically inspected and maintained in an effort to protect habitat that has the potential to support marsh sandwort and Gambel’s watercress. However, during dry periods, existing fences could be breached by feral swine searching for water. The likely result would be substantial damage to wetland vegetation and impacts to habitat and water quality. Without a monitoring program in place, these and other threats to these species would be difficult to identify, and potential adverse effects to the species are likely.

**California red-legged frog (federally listed as Threatened)** – Management actions to protect this species on the Refuge under Alternative C would be limited to closing the Refuge to all public access and maintaining the existing fencing that has been installed around some wetland areas. No swine control and monitoring is proposed, so wetland fencing is subject to breaching, as described previously. No invasive species control or other vegetation management is proposed so wetlands have the potential to become overgrown, impacting habitat to support the red-legged frog.

**Special Status Species** – Management actions to protect sensitive status species on the Refuge under Alternative C would be limited to closing the Refuge to all public access and maintaining the existing fencing that has been installed around some wetland areas. No swine control and monitoring is proposed, subjecting sensitive plant and animal species throughout the Refuge to direct and indirect impacts from feral swine activities, including foraging and grubbing. No invasive species control or other vegetation management is proposed, which could adversely affect habitat quality and displace some plant and animal species.

### **Social and Economic Environment**

The implementation of Alternative A or B is not expected to adversely affect the social and economic environment of San Luis Obispo County. Minor tourism revenue may be generated through the self-guided and guided opportunities at the Refuge. If an increase in visits to the Refuge occurs or there is a net increase in visitors to the area, this could benefit the local economy and employment if visitors utilize local businesses such as gas stations, markets, and restaurants. However, increased visitation can lead to more traffic in the local area as well. Increased visitation also provides an opportunity for public education, which can foster stewardship for these native habitats. Minor local revenue may be generated through contracting of invasive weed control through aerial application since the Refuge does not have equipment to conduct this activity.

The management actions proposed under Alternatives B include feral swine control. Implementation of this alternative could have beneficial economic effects on adjacent land owners. Currently, all of the conserved lands surrounding the Refuge are implementing feral swine control. With control of feral swine on the Refuge, control costs for adjacent land managers could be reduced as a result of reduced swine populations on the Refuge. Additionally, reduced potential movement of feral swine from the Refuge onto adjacent agricultural areas could result in decreased crop damage and reduced concerns regarding *Escherichia coli* O157 contamination and associated losses in revenues (Jay-Russell 2012, Seward et al. 2004).

Under Alternative C, the Refuge would be closed to all public access; therefore, the minor tourism revenue that may be generated by public use opportunities under Alternatives A and B would not be realized.

### ***Public Use***

#### **Alternative A**

Under Alternative A, the recreational opportunities offered at the Refuge provide some social benefits to nearby communities by providing access to open space and solitude. Closure of snowy plover breeding habitat along the coast would reduce available area for public access for several months. Weed control through aerial spraying may temporarily available area for public access; these closures would be limited to several days and during daylight hours only.

Guided tours would enhance visitor experience, while self-guided access would give visitors flexibility to explore at their own pace. Viewpoints at newly established wetland ponds enhance the visitor experience. While not managed by the Refuge, access to surf fishing is permitted along the Refuge and State waters boundary.

#### **Alternatives B**

Alternative B would have the same effects on public as described under Alternative A. In addition, there would be increased wildlife observation, photography, interpretation and environmental education opportunities. Official closure of beach except for the designated trail from the beach to the Refuge interior would limit public access along the beach. There also may be temporary daytime closures of all or part of the Refuge a few times a year for aerial spraying of herbicide.

Feral swine control activities would avoid public areas as much as possible. However, public use areas may be temporarily closed for several weeks in the event such areas attract feral swine.

Overall, the wildlife observation, interpretation, and environmental education opportunities prescribed in Alternative B would have a positive effect on the public's ability to experiences the Refuge. The experience would further be enhanced with features such as interpretive panels, kiosks, benches, and pergolas for visitor enjoyment. The volunteer program would have a beneficial impact to public use by facilitating the guided tours and conducting outreach through partners.

#### **Alternative C**

The Refuge would not be open to any public uses; therefore, no social benefits to nearby communities would be realized.

### ***Economy***

#### **Alternative A**

Weed control activities may involve hiring local contractors, providing a benefit in the form of income to local business. Public access and guided tours may result in spending in the local area (e.g., restaurants,

gas, shops) that normally would not occur. While not managed by the Refuge, access to surf fishing through the Refuge could also result in local area spending (e.g., restaurants, gas, shops) that would not normally occur. Surf fishing could also provide subsistence for local residents.

#### Alternative B

Like Alternative A, no significant effect is expected on the economy under Alternative B. Expanded weed control activities, including aerial applications, as proposed under Alternative B, would likely provide additional short-term income to local business. Feral swine control and monitoring could require the addition of one (part-time) contracted personnel. Potential savings associated with feral swine control on the Refuge, as discussed previously, could benefit adjacent property owners. Increased visitor opportunities may result in increased tourism spending in the areas at local restaurants, gas stations, and lodging. The establishment of an office in the Guadalupe area may result in rental income to a local company and local tax benefits.

#### Alternative C

Alternative C would provide limited potential for any increases in income to the surrounding community. Similar to Alternative A, potential costs associated with an uncontrolled feral swine population on the Refuge could adversely affect adjacent property owners.

#### ***Cultural Resources***

Under Federal ownership, archaeological and historical resources within the Refuge receive protection under Federal laws mandating the management of cultural resources, including but not limited to the Archaeological Resources Protection Act, the Archaeological and Historic Preservation Act, the Native American Graves Protection and Repatriation Act, and the National Historic Preservation Act. There are some identified historic and cultural elements on the Refuge, but the Refuge has not been thoroughly surveyed. These known elements are protected from Refuge activities.

#### Alternative A

Invasive weed control activities, particularly hand-pulling of weeds could also disturb and uncover unknown cultural resources. Any known cultural resource locations would be avoided. Maintenance of barrier fencing (e.g., re-installation of posts, digging to embed fencing) at Myrtle and Colorado Ponds are not expected to affect cultural resources. These areas were assessed for the cultural resources when the pond locations were sited and none identified. Any future impacts would be minimized through cultural resources reviews and surveys, as appropriate.

To preserve Refuge historic resources, all undertakings, including but not limited to construction activities, would continue to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, as outlined in the existing Programmatic Agreement between the Service and the California State Historic Preservation Officer. Staff would also coordinate with the Service's Regional Archaeologist to comply with Federal laws relating to cultural resources.

The continued presence of feral swine on the Refuge has the potential to impact previously recorded and unrecorded cultural resources. The ground disturbing activities of swine, including rooting and grubbing in wetland and dune areas, may cause minor to moderate impacts to cultural resources, depending on the type and characteristics of the resource at risk. Potential impacts include the unearthing and scattering of subsurface artifacts and mixing of soil and artifact layers resulting in the loss of context for the archaeological site.

#### Alternatives B

Increased invasive weed control activities and feral swine control in both alternatives, particularly hand-pulling of weeds and installation of traps and fencing, have the potential to increase disturbance and

exposure of unknown cultural resources. In addition, the installation of signage and other elements/facilities required to accommodate proposed public uses have the potential to disturb and expose cultural resources. Therefore, prior to any ground-disturbing activities, the Refuge would coordinate with the Service's Regional Archaeologist to comply with Federal laws relating to cultural resources as described under Alternative A and any known cultural resource locations would be avoided. Measures to minimize impacts to cultural resources would be employed, including pre-design and/or pre-installation surveys and exploratory excavation by a qualified archaeologist, as deemed necessary by the Regional Archaeologist.

Under Alternative B, a feral swine control and monitoring plan would be implemented on the Refuge, which would reduce the Refuge's overall swine population. A reduction in the number of swine would also reduce the extent to which cultural resources could be adversely affected by swine activity. Some ground disturbance would occur in association with the installation of traps, protective fencing, and other equipment needed to implement swine control. These activities would be coordinated with the Service's Regional Archaeologist to avoid any potential adverse effects to cultural resources and to comply with Federal laws related to cultural resources as described under Alternative A.

Increased visitors in both alternatives would result in minor additional foot traffic. Hiking through the sandy environment has a very low likelihood soil disturbance that may expose cultural resources. Information panels would inform visitors that take of any materials, natural or cultural, from the Refuge is strictly prohibited.

### Alternatives C

Ground disturbing activities would be limited under Alternative C to installation of closed signs and repair of existing fencing. Prior to the installation of any new fencing, the Refuge would coordinate with the Service's Regional Archaeologist to comply with Federal laws relating to cultural resources as described under Alternative A. Potential impacts to cultural resources as a result of the presence of feral swine populations on the Refuge would be the same as described under Alternative A.

## ***Climate Change***

### Common to All Alternatives

Climate change is expected to have a moderate to major long-term impact to the Refuge and its resources. Climate change could have a profound effect on the Refuge because of its location along the coast. Sea-level rise as a consequence of climate change could reduce the total land area of the Refuge, while reducing certain habitat types and expanding others.

Sea level has risen nearly eight inches along the California coast over the past century. Climate models project further increases of 3.3–4.6 feet by the year 2100 (Cayan et al. 2009). The primary threats associated with sea level rise include flooding, erosion, and loss of valuable coastal land and unique habitats.

Heberger et al. (2009) conducted a simplistic geospatial analysis that identified some areas of potential high risk from sea level rise along the entire California coast. Based on this analysis (which has not been ground-truthed), San Luis Obispo County supports 6.1 mi<sup>2</sup> of existing coastal wetlands. As sea level rises, these wetlands are expected to migrate inland, potentially covering 1.1 mi<sup>2</sup> of new terrain. The analysis further assessed where wetlands are expected to migrate, and determined that 69 percent of the area is viable for migrating wetlands and should be protected to allow for such shifts (Heberger et al. 2009). An additional seven percent of the area where wetlands might migrate is viable but would experience loss of other functions, such as pasture, parks, or open space. The remaining 24 percent of the area has infrastructure making it unfeasible for wetlands to migrate. This analysis suggests that the wetland areas of the Refuge are at risk of sea-level rise and may be lost or forced to migrate inland.

A sea-level rise modeling exercise was conducted for the Refuge lands in 2008 using the Sea Level Affecting Marshes Model (SLAMM 5.0) to determine changes in tidal marsh area and habitat type in response to sea-level rise (Clough and Larson 2008). The primary set of eustatic (worldwide change) sea-level rise scenarios used within the SLAMM was derived from the work of the Intergovernmental Panel on Climate Change (IPCC 2001). SLAMM 5.0 was run using IPCC and fixed-rate scenarios based on varying ranges of fossil fuel use.

Based on the SLAMM results, upland, freshwater marsh, and riparian woodlands—the three most common land cover classifications used by Clough and Larson (2008) on the Refuge—are predicted to be resilient to sea level rise, even under the 1.5-meter scenario (the highest sea-level rise scenario). The high elevation of dry land and fresh marsh for this site suggests that the majority of this Refuge is not subject to the pressures of increased sea level rise. The oceanic beach fringe west of the Refuge is subject to more effects, losing a minimum of 38 percent of its mass due to erosion and inundation. The small fringes of saltmarsh and brackish marsh south of the Refuge are also predicted to be vulnerable (Clough and Larson 2008).

A study of the effects of sea-level rise on special status plant species<sup>2</sup> on the Central California Coast was also conducted by the Bren School of Environmental Management, University of California, Santa Barbara (Berlin et al. 2012). For in-depth analysis, they chose nine rare plant species that represent a diverse range of life histories, habitats, elevation, level of endemism, and listing status within the tri-county area (San Luis Obispo, Santa Barbara, and Ventura Counties). The exposure of these plant species to three physical processes that are exacerbated by seas level rise was assessed: inundation, flooding, and erosion.

Results from this study suggest that plant species at the lowest elevations above sea level would generally be most affected by sea level rise. Four of the nine analyzed species would be exposed to at least one of the sea level rise-related threats by the end of this century. Two of these four plant species predicted to be threatened by sea level rise are found on the Refuge: La Graciosa thistle and beach spectaclepod.

Climate change could also result changing temperature and precipitation, which would affect wildlife and plant communities on the Refuge. Not only could habitats shift, but also the timing of when birds migrate and leaves begin to bud (IPCC 2007). Climate change could magnify impacts on wildlife habitat, reduce native vegetation, and increase occurrence of non-native (plant and animal) species on the Refuge. Climate change can result in physiological changes, phenological (lifecycle) changes, range shifts, community changes, ecosystem process shifts, and multiple stressor conditions (Parmesan and Galbraith 2004). Climate change may require organisms to migrate at much higher rates than they have done in the recorded past (Malcolm and Pitelka 2000).

Native plants may not thrive in the Refuge boundaries due to changing temperatures. Moreover, climate change could result in changes to local food web dynamics, altering prey resources in the bay waters adjacent to the Refuge. The potential changes to food availability near the Refuge could deter or attract wildlife, therefore affecting productivity.

Over time, climate change could result in significant ramifications for wildlife and vegetation. Tidally influenced habitat for wildlife at the shoreline could disappear, forcing wildlife to move onto higher

---

<sup>2</sup> Species are considered to be of special status when they have been listed by a government agency (such as California Department of Fish and Wildlife or the Service) or a conservation organization (such as the International Union for Conservation of Nature or California Native Plant Society) as endangered, threatened, rare, and/or of limited geographic distribution.

ground and possibly competing with other wildlife for habitat. Plant communities at the shore could be inundated or be forced to migrate to higher ground, competing with other vegetation (Smerling et al. 2005).

Refuge management activities that could contribute to climate change include the use of vehicles to travel to the Refuge and the use of UTVs to travel on the Refuge. Vehicle use is expected to contribute negligibly to carbon emissions that exacerbate climate change since staffing is small (currently only one position) and the Refuge has no more than 2 UTVs.

#### Alternative A

Alternative A would have the same effects on climate change as described under Common to All Alternatives. Refuge visitor services could also contribute to carbon emissions because there is no public transit to the Refuge, requiring visitors to drive. Use is relatively low, with an average of 1,500 visits annually. Therefore, vehicle numbers should be low and emission increases are expected to be negligible.

Changes along the shoreline as a related to sea level rise would likely be documented as part of the snowy plover monitoring activities to be implemented under Alternative A.

#### Alternative B

Under Alternative B, there would be a negligible increase in carbon emissions due to an increase in Refuge management activities, including wildlife monitoring, invasive species control, feral swine control, and planting. The use of helicopters for aerial spraying of herbicide would also contribute carbon emissions. This is expected to occur only a few times a year and contribute negligibly to carbon emissions. Increased visitation would also result in a negligible impact on increasing climate change effects. However, increases are not expected to exceed 50 percent of the current estimated visits (1,500 annually).

The effects of sea level rise and climate change on Refuge resources would be documented as part of the habitat and species monitoring that would be conducted under Alternative B.

#### Alternative C

Compared to Alternative B, there would be a negligible decrease in carbon emissions due to reduced Refuge management activities and the closure of the Refuge to the public. No monitoring is proposed, therefore, the effects to Refuge resources as a result of sea level rise and climate change would not be documented.

### **Environmental Justice**

#### Alternative A

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires all Federal agencies to achieve environmental justice by “identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” Environmental justice is defined as the “fair treatment for peoples of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies.”

The mission of the Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The developing environmental justice strategy of the Service extends this mission by seeking to ensure that all segments of the human population have equal access to America’s fish and wildlife resources, as well as equal access to information that would enable them to meaningfully participate in activities and policy shaping.

No minority and low-income populations or communities would be disproportionately affected by any of the alternatives. Outreach and environmental education opportunities would be directed to encourage more participation by local minority and low-income populations. The Service has concluded that none of the alternatives would disproportionately affect any one population or community.

While not managed by the Refuge, access to surf fishing through the Refuge may provide subsistence alternative for low-income residents.

#### Alternative B

Under Alternative B, the environmental education program would reach out to the local community, predominantly minority, who are not known visitors to the Refuge. Programs would also be translated into Spanish or other common languages in the local community, when possible, to facilitate this outreach. The website would offer materials translated into Spanish when possible.

#### Alternative C

Under Alternative C, the Refuge would be closed to all public uses and no on or offsite environmental education programs would be offered. Therefore, no benefits to the local community, including minority and low-income populations would be provided under this alternative.

### **Cumulative Effects**

Cumulative effects are those effects on the environment resulting from incremental consequences of the Service's proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes those actions. Cumulative effects can be the result of individually minor impacts that can become significant when added over a period of time. It is difficult to accurately analyze cumulative effects because one action may increase or improve a resource in one area, while other unrelated actions may decrease or degrade that resource in another area. Moreover, CCP actions may be inhibited or accelerated by other activities or management plans occurring in the same area. This section assesses how these other activities in addition to the CCP actions would affect the physical, biological, cultural, and social and economic environment.

#### ***Cumulative Effects on the Physical Environment***

Alternatives A and B are anticipated to enhance or restore the natural physical environment of the Refuge to provide long-term benefits to native wildlife and vegetation. Under Alternative C, the natural physical processes related to dunes on the Refuge are likely to decrease. The Refuge is surrounded by several agricultural growers and other private lands, which could result in profound cumulative effects to the physical environment of the area. These neighbors have the potential to introduce or attract invasive vegetation, nuisance wildlife, trash, and contaminants. The Refuge has little control over these external impacts, but has worked and would continue to work with partners during their planning processes to protect and encourage the restoration of important native habitat.

The ongoing use of fertilizers, herbicides, and pesticides by neighboring growers may introduce contaminants onto the Refuge through groundwater that feeds wetlands areas. The Refuge is researching contaminants issues in Refuge wetland ponds to inform future management actions.

The ongoing environmental remediation of the former Guadalupe Oil Field immediately south of the Refuge would have a regional benefit of improving soil and groundwater sources that have the potential to migrate onto Refuge property. The invasive plant control activities, habitat restoration, revegetation with native plant species, and development of a native plant nursery also occurring as part of the

remediation work would benefit the Refuge and surrounding lands by reducing the spread of invasive plants.

The work of the Dunes Collaborative is in concert with the management actions prescribed by the Refuge. The Collaborative is a partnership between Federal, State, private, and non-profit organizations committed to restoration of the Dunes Complex (the 18-mile long coastal dunes landscape along southwestern San Luis Obispo County and northwestern Santa Barbara County, which includes the Refuge). The Collaborative advises on projects that would restore or enhance the Dunes Complex, and their work would have a positive effect on the physical resources of the Refuge and the larger coastal dune area. These projects include controlling the spread of non-native invasive plant species, recovering rare plant populations, and improving and protecting sensitive coastal habitats and listed species.

### ***Cumulative Effects on Biological Resources***

Alternatives A and B would have long-term benefits for native wildlife species and habitats within the area. The alternatives integrate habitat and wildlife conservation activities with compatible wildlife-dependent opportunities that would represent a cumulative benefit for local wildlife, native plant communities, and human communities. Alternative C could have long-term adverse effects on native plant species, as well as listed and special status species, due to the lack of an invasive plant control plan, a swine control and monitoring plan, and the integration of conservation activities with compatible wildlife-dependent recreational activities.

The activities proposed under Alternatives A and B would cumulatively support the goals of the Refuge and the region in restoring and conserving wildlife resources, while Alternative C could contribute to cumulative impacts to the western snowy plover and a number of special status plant species.

Visitor activities prescribed in Alternatives A and B in conjunction with other public access opportunities along the Guadalupe-Nipomo Dunes Complex would result in increased visitation to the area. The increased visitor uses of hiking, off-road recreational vehicles, guided tours, and environmental education programs combined would add more visits to the Refuge, which could result in increased disturbance to wildlife and degradation of habitat. The Refuge would work with other partners within the Dunes Complex to mitigate any potential disturbance and avoid sensitive habitat areas on the Refuge. Because Alternative C would close the Refuge to all public uses, this alternative would not contribute to disturbance associated with visitation to the area.

Under Alternative A and B, signage, closure of sensitive areas, and public outreach would be required elements to provide prior to increased visitor access to prevent or reduce disturbance and degradation. Installation and/or maintenance of fencing as needed would be provided near sensitive sites to deter visitors from disturbing sensitive plants and wildlife.

The ongoing environmental remediation of the former Guadalupe Oil Field immediately south of the Refuge would also have regional benefits to biological resources within the Refuge and Dunes Complex. Under Alternatives A and B, habitat restoration through invasive plant control, native planting, and site-wide ecological monitoring would benefit sensitive wildlife species such as California red-legged frog, La Graciosa thistle, and western snowy plover. The limited management actions proposed under Alternative C would not be adequate to contribute to the recovery of the listed species present within the Refuge. In addition, the lack of a swine control plan under Alternatives A and C would reduce the cumulative benefits of swine control occurring on adjacent conserved lands.

The work of the Dunes Collaborative is also expected to have a positive impact on biological resources on the Refuge and in the Dunes Complex, particularly sensitive species. The Collaborative advises on

projects such as control of non-native invasive plant species, recovery of rare plant populations, and improving and protecting sensitive coastal habitats and listed species.

The Dunes Center was established to conserve the Dunes Complex through education, research, and the support of cooperative stewardship. Their work also has a beneficial impact to biological resource on the Refuge and in the Dunes Complex by educating local school children and adults on the sensitive habitats and wildlife within the Dunes Complex. This work seeks to instill stewardship and conservation in those who visit the coastal dunes.

### ***Cumulative Effects on Cultural Resources***

The Service adheres to the policies and regulations pertaining to the protection of cultural resources to avoid or mitigate for any significant adverse effects resulting from management activities. The actions in the CCP would continue to adhere to those policies and regulations. There is the potential for adverse effects to cultural resources under Alternatives A and C due to the lack of plan to control feral swine on the Refuge. Alternative B, which does include swine control, would benefit the efforts of the surrounding land owners in controlling feral swine and reducing potential impacts to cultural resources.

### ***Cumulative Effects on the Social and Economic Environment***

Activities involving the expansion of wildlife-dependent recreation, interpretation, and environmental education, as proposed under Alternatives A and B, would provide benefits to local residents. In addition, the environmental education and outreach programs would attempt to reach a diverse audience. These benefits would not be realized under Alternative C.

A negligible amount of tourism dollars could be generated from the increased recreation opportunities. Local restaurants, stores, lodging, and gas stations could benefit under Alternatives A and B, but not under Alternative C. Contract work for invasive weed control may benefit a local company under Alternatives A and B.

The work of the Collaborative is also in concert with the visitor opportunities prescribed under Alternatives A and B. The Dunes Collaborative advises on projects that enhance visitor experiences through education, interpretation, and visitor services.

The work of Dunes Center would also benefit local residents by providing opportunities for environmental education and interpretation. The Dunes Center and Service have worked together on educational programs, outreach events, classroom and field training of docents, preparation of docent training guides, and preparation of western snowy plover outreach educational materials. Further, the Dunes Center provides information to the inquiring public about Refuge access, regulations, and special events.

**Table 2. Summary Impacts of Alternatives.**

	<b>Alternative A</b>	<b>Alternative B</b>	<b>Alternative C</b>
	<b>No-Action Alternative (Continue Current Management)</b>	<b>Moderate increase in wildlife and habitat management and small increase in visitor services and the environmental education program</b>	<b>Minimal wildlife and habitat management, and Refuge is closed to public</b>
<i>Physical Environment</i>			
<b>Soils and Topography</b>	Minor, temporary sand disturbance and minor erosion due to outplanting of listed plants, vegetation removal, installation of exclosures and closure signage, and maintenance of barrier fencing to protect native wildlife and plants. These activities are expected to result in reduced long-term erosion around wetland areas. Sand movement and disturbance discourage invasive vegetation from stabilizing.	Minor temporary negative impact due to increased manual and chemical vegetation removal, planting, installation of additional barrier fencing, installation of feral swine traps, installation of additional public use infrastructure, and increased public use. Beneficial impact from planting of native plants to provide stabilization where necessary.	Minor temporary negative impact due to installation of closure signs and fencing repairs. The lack of control of invasive plant species would impact that natural topographic character of the Refuge's dune habitat.
<b>Air Quality</b>	Minor increase in carbon and particulate emissions due to use of vehicles and helicopters (aerial spraying), visitors, and volunteers. Localized dust may occur from manual weed-pulling.	Minor increased carbon and particulate emissions from increased use of vehicles and helicopters (aerial spraying) for weed management, feral swine control, visitors, and volunteers. Increased localized dust may occur with additional manual weed-pulling.	Reduced carbon and particulate emissions from decreased management activities and lack of public access.
<b>Noise</b>	Minor daytime, localized noise increases from vehicle use, aerial spraying, maintenance activities, and visitors.	Minor daytime, localized noise increases from increases in vehicle use, aerial spraying, maintenance activities, installation of additional public use infrastructure, and visitors. Minor early morning and evening localized noise increases from feral swine control.	Reduced daytime, localized noise from reduced management activities and lack of public access.

	<b>Alternative A</b>	<b>Alternative B</b>	<b>Alternative C</b>
<b>Water (hydrology, water quality)</b>	Minor short-term negative impact may occur from vegetation control in and along wetland areas. Minor positive impact to wetland areas due to barrier fencing.	Minor short-term negative impact may occur from increased vegetation control. Minor positive impact from additional installation of fencing of wetland areas and control of feral swine.	Feral swine on the Refuge may continue to impact water quality.
<i>Biological Environment</i>			
<b>Vegetation and Habitat</b>	Minor positive impact from barrier fencing and control of invasive vegetation. Feral swine would continue to remove and disturb vegetation and wetland habitats. Minor trampling of native vegetation and habitat could occur from management and visitor activities. Herbicide use by aerial spraying may result in minor negative impact to non-target, native vegetation. Non-native seeds may be introduced by visitor footwear and clothing.	Moderate positive impact from additional barrier fencing, baseline surveys, early detection for invasive vegetation, planting of native species, control of invasive vegetation and feral swine, volunteer program, and the Citizen Science research program. Minor negative impact from trampling of native vegetation from increased management and visitor activities. Minor negative impact to non-target, native vegetation from increased herbicide use by aerial spraying. Additional non-native seeds may be introduced by visitor footwear and clothing.	Long-term decrease of native habitat by invasive plants due to no habitat and vegetation management. Effects of feral swine on Refuge vegetation could increase due to reduced monitoring and repair of barrier fencing.
<b>Wildlife</b>	Minor positive impact from invasive weed control, barrier fencing in wetland areas, and surveys. Surf fishing (not managed by the Refuge) would result in minor loss of individual fish. Minor daytime disturbance and flushing of wildlife from management activities, including invasive weed control and surveys. Minor daytime disturbance and flushing of wildlife from visitors.	Minor daytime disturbance and flushing of wildlife from increased invasive weed control, additional wildlife surveys, and increased visitor services. Moderate negative impact from control of feral swine that threaten listed species or their habitat. Minor early morning and evening disturbance to non-target species from feral swine control.  Minor positive impact from increased invasive weed and feral swine control, installation of additional barrier fencing in wetland	Long term impacts to wildlife due to the lack of control of invasive species.

	<b>Alternative A</b>	<b>Alternative B</b>	<b>Alternative C</b>
		areas, surveys, volunteers, and Citizen Science research program.	
<b>Listed and Special Status Species</b>	Moderate positive impact from monitoring, barrier fencing, and invasive weed control. Minor daytime disturbance and flushing of wildlife from Refuge management activities and visitors. Surf fishing may result in minor disturbance to roosting snowy plover and least tern.	Moderate positive impact from monitoring, installation of additional barrier fencing, feral swine control, volunteer support, and invasive weed control. Minor daytime disturbance and flushing of wildlife from Refuge management activities and increased visitor services. Surf fishing may result in minor disturbance to roosting snowy plover and least tern.	Projected spread of invasive species would adversely impact western snowy plover, La Graciosa thistle, California red-legged frog, marsh sandwort, Gambel's watercress, and various special status species and the habitats that support them.
<i>Socioeconomic Environment</i>			
<b>Economy</b>	Weed control activities may involve contracts, which may provide income to local business. Public access, guided tours, and surf fishing may result in spending in the local area (e.g., restaurants, gas, shops). Surf fishing could also provide subsistence for local residents.	No significant effect on economy. Feral swine control and increased weed control activities may involve additional contracts, which may provide income to local business or individual. Increased public access, guided tours, and surf fishing may result in minor increased spending in the local area (e.g., restaurants, gas, shops). Surf fishing could also provide subsistence for local residents. Office establishment may result in a minor positive impact. Feral swine control could also result in beneficial effects on the economy due to reduce	Closing the Refuge to public access would also provide no benefits to the local economy.

	<b>Alternative A</b>	<b>Alternative B</b>	<b>Alternative C</b>
		potential for contamination of crops.	
<b>Public Use</b>	Minor negative impact from closures for weed control through aerial spraying and snowy plover breeding season. Minor positive benefit from limited guided tours, self-guided access, and surf fishing.	Minor negative impact from closures for increased weed control through aerial spraying and snowy plover breeding season. Potential temporary closure of public use areas for feral swine control in the area is required. Minor positive benefit from increased guided tours, self-guided access, volunteer support, and surf fishing.	No benefits related to the availability of wildlife dependent recreational uses would be realized.
<b>Cultural Resources</b>	Minor negative impact to yet unidentified sites due to Refuge management and visitation, resulting in potential for disturbance of unknown cultural resources. Any future impacts would be minimized through cultural resources reviews and surveys, as required. Feral swine populations could impact cultural resources.	Minor negative impact to yet unidentified sites due to increased Refuge management (e.g., installing infrastructure, manually pulling invasive weeds) and visitation, resulting in potential for disturbance of unknown cultural resources. Any future impacts would be minimized through cultural resources reviews and surveys, as required.	Installation of fences could have negative impacts to yet unidentified cultural resource sites. Cultural resource reviews and surveys would be conducted as required. Feral swine populations could impact cultural resources.
<b>Environmental Justice</b>	No effect.	Minor positive impact from the environmental education program and translation of materials into Spanish when possible.	No benefits to the local community would be realized as the Refuge would be closed to public access.
<b>Climate Change</b>	Minor increase in carbon emissions due to use of vehicles and helicopters (aerial spraying), visitors, and volunteers.	Minor increase in carbon emissions due to increased use of vehicles and helicopters (aerial spraying), additional visitor opportunities, and volunteers.	Decrease in carbon emissions due to reduced management and lack of public uses.

***Chapter 5. Planning Team Members Responsible for Preparing this Document***

Michael Brady	Project Leader, Hopper Mountain NWR Complex
Ken Convery	Deputy Project Leader, Hopper Mountain NWR Complex
Winnie Chan	Refuge Planner, San Francisco Bay NWR Complex
Jason Storlie	Wildlife Biologist, Hopper Mountain NWR Complex

## ***Chapter 6. Coordination, Consultation, and Compliance***

### **Agency Coordination and Public Involvement**

The Draft CCP and EA were prepared with the involvement of technical experts, community groups, and private citizens. The Service has invited and continues to encourage public participation through planning updates and public comment periods.

### **Notice of Intent**

A Notice of Intent to prepare a CCP and EA for Guadalupe-Nipomo Dunes NWR was published in the *Federal Register* on December 6, 2013.

### **Environmental Review and Consultation**

As a Federal agency, the Service must comply with provisions of NEPA. An EA was developed to evaluate reasonable alternatives and assess the potential effects of their implementation on the human environment. This EA serves as the basis for evaluating whether any of the alternatives would result in a Federal action significantly affecting the quality of the environment. The EA also acts as a vehicle for coordination with other government agencies and an interface with the public in the decision-making process.

### **Other Federal Laws, Regulations, and Executive Orders**

Implementation of the CCP would comply with the following Federal laws, EOs, and legislative acts:

- Intergovernmental Review of Federal Programs (EO 12372);
- Archaeological Resources Protection Act of 1979, as amended;
- Fish and Wildlife Act of 1956;
- Fish and Wildlife Conservation Act of 1980 (16 USC 661-667e);
- Fish and Wildlife Improvement Act of 1978;
- Endangered Species Act of 1973 (16 USC 1531 *et seq.*);
- National Environmental Policy Act of 1969;
- Federal Noxious Weed Act of 1990;
- Floodplain Management (EO 11988);
- Protection of Wetlands (11990);
- National Historic Preservation Act of 1966, as amended;
- National Wildlife Refuge System Improvement Act of 1997;
- Antiquities Act of 1906;
- Protection and Enhancement of the Cultural Environment (EO 11593);
- Archaeological and Historic Preservation Act of 1974 (PL 93-291; 88 STAT 174; 16 USC 469);
- Environmental Justice (EO 12898);
- Management and General Public Use of the National Wildlife Refuge System (EO 12996);
- Refuge Recreation Act of 1962, as amended;
- Invasive Species (EO 13112);
- Migratory Bird Treaty Act of 1918, as amended; and
- Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186)

### **Distribution and Availability**

The Draft CCP and EA have been sent to various agencies, organizations, community groups, and individuals for review and comment. Copies of these documents are available from the Hopper Mountain NWR Complex, 2493 Portola Road, Suite A, Ventura, CA 93003 (phone 805/644 5185).

## References Cited

- Atwill, E.R., R.A. Sweitzer, M.G. Pereira, I.A. Gardner, D Van Vuren, and W.M. Boyce. 1997. Prevalence of and associated risk factors for shedding *Cryptosporidium parvum* oocysts and *Giardia* Cysts within feral pig populations in California. *Applied and Environmental Microbiology* 63(10):3946-3949.
- Batt, B.D., J.A. Black and W.F. Cowan. 1980. The effects of glyphosate herbicide on chicken egg hatchability. *Canadian Journal of Zoology* 58:1940-1942.
- Berlin, J., M. Chang, R. Freed, M. Fulda, K. Garner, M. Soo-Hoo. 2012. Impact of sea level rise on plant species: A threat assessment for the Central California Coast. Prepared by Bren School of Environmental Science and Management, University of California, Santa Barbara, CA. Prepared by U.S. Fish and Wildlife Service, Ventura fish and Wildlife Office. May 22, 2012. 93 pp.
- Browning, C.A. 2008. A preliminary examination of the effects of feral pigs on water quality and soil loss within a Hawaiian watershed. Hilo, HI: University of Hawai'i. M.S. thesis.
- Carlisle, S. M., and J. T. Trevors. 1988. Glyphosate in the environment. *Water Air Soil Pollution* 39:409-420.
- Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham, and R. Flick. 2009. Climate Change Scenarios and Sea Level Rise Estimates for California 2008 Climate Change Scenarios Assessment. California Climate Change Center. CEC 500-2009-014-F.
- Chesnut J.W. 1999. A review of weed threats to the Nipomo Dunes. Prepared for Land Conservancy of San Luis Obispo, CA.
- Choquenot, D., J. McIlroy, and T. Korn. 1996. Managing Vertebrate Pests: feral pigs. Bureau of Resource Sciences. Canberra, Australia.
- Clough, J.S. and E.C. Larson. 2008. Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to Guadalupe-Nipomo Dunes NWR. Warren Pinnacle Consulting, Warren, VT.
- Cooper, C.A., A.J. Neff, D.P. Poon, G.R. Smith. 2008. Behavioral Responses of Eastern Gray Squirrels in Suburban Habitats Differing in Human Activity Levels. *Northeastern Naturalist*, Vol. 15, No. 4: 619-625.
- Cornell University. 1994. Cooperative Extension Offices of Cornell University Michigan State University, Oregon State University, and University of California at Davis. Pesticide Information Project, Exttoxnet-Extension Toxicology Network. May 1994. Accessed on July 16, 2010, at: <http://pmep.cce.cornell.edu/profiles/exttoxnet/dienochlor-glyphosate/glyphosate-ext.html>.
- Damschen, E.I., L.A. Brudvig, N.M. Haddad, D.J. Levey, J.L. Orrock, and J.J. Tewksbury. 2008. The movement of ecology and dynamics of plant communities in fragmented landscapes. *Proceedings of the National Academy of Sciences of the United States of America*, 105, 19078-19083.
- Evans, D.D. and M.J. Batty. 1986. Effects of high dietary concentrations of glyphosate on a species of bird, marsupial and rodent indigenous to Australia. *Environmental toxicology and chemistry* 5:399-401.

- EXTOXNET. 1996a. Fluazifop-p-butyl. Pesticide Information Profiles. Extension Toxicology Network. <http://ace.orst.edu/info/extoxnet/>.
- EXTOXNET. 1996b. Sethoxydim. Pesticide Information Profiles. Extension Toxicology Network. <http://ace.orst.edu/info/extoxnet/>.
- Finzel, J.A. and R A. Baldwin. 2015. Wild Pigs. Integrated Pest Management for Home Gardeners and Landscape Professionals. Pest Notes, University of California, Agriculture and Natural Resources, Statewide Integrated Pest Management Program. Publication 74170. July 2015.
- Fry, M. 2005. Element Stewardship Abstract for *Ehrharta spp. Thunb.* Including *Ehrharta erecta* Lam., *Ehrharta calycina* Sm., and *Ehrharta longiflora* Sm.) (Ehrharta, perennial veldtgrass, longflowered veldtgrass). The Nature Conservancy's Invasive Species Initiative. <http://tncweeds.ucdavis.edu>
- Gabrielsen, G.W., and E.N. Smith. 1995. Physiological responses of wildlife to disturbance. Pages 95-107 in R.L. Knight and K.J. Gutzwiller, ed. *Wildlife and Recreationists: coexistence through management and research*. Island Press, Washington, DC. 372 pp.
- Hance, R.J. 1976. Adsorption of glyphosate by soils. *Pesticide Science* 7:363-366.
- Heberger, M., H. Cooley, P. Herrera, P. H. Gleick, and E. Moore. 2009. The Impacts of Sea Level Rise on the California Coast. California Climate Change Center. CEC-500- 2009-024-F.
- Hildebrand, L. D., D. S. Sullivan, and T. P. Sullivan. 1980. Effects of Roundup herbicide on populations of *Daphnia magna* in a forest pond. *Bulletin of Environmental Contamination and Toxicology* 25:353-357.
- Hone, J. 1988. Evaluation of methods for ground survey of feral pigs and their sign. *Acta Theriologica* 33:451-465.
- [IPCC] Intergovernmental Panel on Climate Change. 2001. *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.
- [IPCC]. 2007. Intergovernmental Panel on Climate Change. "Summary for Policymakers." In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson. Cambridge, UK and New York, NY: University of Cambridge Press, 2007.
- Jay-Russell, M. T., A. Bates, L. Harden, W. G. Miller, and R. E. Mandrell. 2012. Isolation of campylobacter from feral swine (*Sus scrofa*) on the ranch associated with the 2006 *Escherichia coli* O157:H7 spinach outbreak investigation in California. *Zoonoses and Public Health* 59:314-319.
- Kidd, H., and James, D. R., Eds. 1991. *The Agrochemicals Handbook, Third Edition*. Royal Society of Chemistry Information Services, Cambridge, UK, 1991 (As Updated).10-2

- Koskinen, W.C., K.M. Reynolds, D.D. Buhler, D.L. Wyse, B.L. Barber, and L.J. Jarvis. 1993. Persistence and movement of sethoxydim residues in three Minnesota soils. *Weed Sci.* 41(4):634-640.
- Leson and Associates. 2005. Use of Imazapyr Herbicide to Control Invasive Cordgrass (*Spartina spp.*) in the San Francisco Estuary. San Francisco Estuary Invasive *Spartina* Project. Berkeley, CA.
- MacKinnon, D.S., and B. Freedman. 1993. Effects of silvicultural use of the herbicide glyphosate on breeding birds of regenerating clearcuts in Nova Scotia, Canada. *Journal of Applied Ecology* 30:395-406.
- Malcolm, J.R., and L.F. Pitelka. 2000. Ecosystems and Global Climate Change: A Review of Potential Impacts on U.S. Terrestrial Ecosystems and Biodiversity. Prepared for the Pew Center on Global Climate Change. Arlington, VA.
- Meister, R.T. (ed.). 1992. Farm Chemicals Handbook '92, Meister Publishing Co., Willoughby, OH.
- Miller, S.G., R.L. Knight, and C.K. Miller. 2001. Wildlife Responses to Pedestrians and Dogs. *Wildlife Society Bulletin*, Vol. 29, No. 1: 124-132.
- Morrison, M.L., and E.C. Meslow. 1984. Effects of the herbicide glyphosate on bird community structure, western Oregon. *Forest Science* 30(1):95-106.
- Neskovic, N.K. V. Poleksic, I. Elezovic, V. Karan, and M. Budimir. 1996. Biochemical and histopathological effects of glyphosate on carp, *Cyprinus carpio*. *Bulletin of Environmental Contamination and Toxicology* 56:295-302.
- Newton, M., K.M. Howard, B.R. Kelpsas, R. Danhaus, C.M. Lottman, S. Dubelman. 1984. Fate of glyphosate in an Oregon forest ecosystem. 32:1144-1151.
- Parmesan, C. and H. Galbraith. 2004. Observed Impacts of Global Climate Change in the U.S. Pew Center for Global Climate Change. Arlington, VA.
- Pickart, A.J. 2000. *Ehrharta calycina*, *Ehrharta erecta*, and *Ehrharta longiflora* in: Bossard CC, JM Randall, and MC Hoshovsky (eds.) 2000. Invasive Plants of California's Wildlands. University of California Press Berkeley, CA. Pp. 164-170.
- Roslycky, E.B. 1986. Microbial response to sethoxydim and its degradation in soil. *Canadian Journal of Soil Science* 66:411-419.
- Roy, D.N., S.K. Konar, S. Banerjee, D.A. Charles, D.G. Thompson, and R. Prasad. 1989. Uptake and persistence of the herbicide glyphosate in fruit of wild blueberry and red raspberry. *Canadian Journal of Forest Research* 19:842-847.
- Santillo, D.J., D. M. Leslie Jr., and P. W. Brown. 1989a. Response of small mammals and habitat to glyphosate application on clearcuts. *Journal of Wildlife Management* 53(1):164-172.
- Santillo, D.J., P. W. Brown, and D. M. Leslie, Jr. 1989b. Response of songbirds to glyphosate-induced habitat changes on clearcuts. *Journal of Wildlife Management* 53(1):64-71.

- Seward, N.W., K. VerCauteren, G. Witmer, and R. Engeman. 2004. Feral Swine Impacts on Agriculture and the Environment. Sheep & Goat Research Journal, Volume 19, Paper 12. USDA/Wildlife Services, National Wildlife Research Center, Fort Collins, CO.  
<http://digitalcommons.unl.edu/icwdmsheepgoat/12>
- Shaner, D.L., and N. M. Mallipudi. 1991. Mechanisms of selectivity of the imidazolinone herbicides. Chpt 7 in The Imidazolinone Herbicides, D.L. Shaner and S. L. O'Connor, eds. CRC Press. Boca Raton, FL. 290 pgs.
- Shoaf, A.R., and W.C. Carlson. 1992. Stability of sethoxydim and its degradation products in solution, in soil, and on surfaces. Weed Sci. 40:384-389.
- Smerling, T., M. Steil, B. Stygar, and M.H. Surridge. 2005. Predicting the Impact of Sea Level Rise on National Wildlife Refuges. Problem Solving Workshop at University of Maryland, College Park, MD.
- Sullivan, J.B., and Krieger, G.R. 1992. Hazardous Materials Toxicology, Clinical Principles of Environmental Health. Williams & Wilkins, Baltimore, MD.
- Sullivan, T.P., and D.S. Sullivan. 1979. The effects of glyphosate herbicide on food preference and consumption in black-tailed deer. Can. J. Zool. 57:1406-1412.
- Sweitzer, R.A. and D.H. Van Vuren. 2002. Rooting and Foraging Effects of Wild Pigs on Tree Regeneration and Acorn Survival in California's Oak Woodland Ecosystems. USDA Forest Service General Technical Report. PSW-GTR-184. pp. 219-231.
- Trulio, L., and J. Sokale. 2008. Foraging Shorebird Response to Trail Use Around San Francisco Bay. Journal of Wildlife Management 72(8): 1775-1780.
- Tu, M., Hurd, C. and J.M. Randall. 2001. Weed Control Methods Handbook, The Nature Conservancy, version: April 2001.
- [USEPA] U.S. Environmental Protection Agency. 1992. Office of Pesticides and Toxic Substances, Fact Sheet Number 230: Clethodim. Washington, DC.
- [USEPA] U.S. Environmental Protection Agency. 1993. Glyphosate. R.E.D. Facts. Prevention, Pesticides and Toxic Substances. EPA-738-F-93-011.
- [USFS] U.S. Forest Service. 1984. Pesticide Background Statements, Vol. I Herbicides. United States Dept. of Agriculture, Agriculture Handbook No. 633.
- [USFS] U.S. Forest Service. 2013. Environmental Assessment Feral Pig Damage Control Project on Cleveland National Forest and Bureau of Land Management Lands.
- [USFWS] U.S. Fish and Wildlife Service. 1998. Recovery Plan for Marsh Sandwort (*Arenaria paludicola*) and Gambel's Watercress (*Rorippa gambellii*). Portland, Oregon
- [USFWS] U.S. Fish and Wildlife Service. 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). Region 1, Portland, Oregon.

- [USFWS] U.S. Fish and Wildlife Service. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). California /Nevada Operations Office, Sacramento, CA.
- [USFWS] U.S. Fish and Wildlife Service. 2008. *Arenaria paludicola* (Marsh Sandwort) 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office, Ventura, CA. June 2008.
- [USFWS] U.S. Fish and Wildlife Service. 2011a. *Cirsium loncholepis* [*Cirsium scariosum* var. *loncholepis*](La Graciosa thistle) 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office, Ventura, CA. March 2011.
- [USFWS] U.S. Fish and Wildlife Service. 2011b. (*Rorippa gambellii*) [*Nasturtium gambellii*] Gambel's Watercress 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office, Ventura, CA. September 2011.
- Valent USA. 1993. Material Safety Data Sheet for Valent Select 2 EC Herbicide. Valent USA Corporation. Walnut Creek, CA.
- Vtorov, I. P. 1993. "Feral pig removal: effects on soil microarthropods in a Hawaiian rain forest." *Journal of Wildlife Management* 57(4): 875-880. (Soil Compaction)
- [WSSA] Weed Science Society of America. 1994. Herbicide handbook. Weed Society of America. Champaign, Illinois. 352 pp.
- Whittaker, D. and R.L. Knight. 1998. Understanding wildlife responses to humans. *Wildlife Society Bulletin* 26: 312-317.
- Wiedemann, A.M. 1987. The ecology of European beachgrass (*Ammophila arenaria* (L.) Link) a review of the literature. Technical Report # 87-1-01. Oregon Department of Fish and Wildlife, Nongame Wildlife Program.